COUNTY OF SAN MATEO EMERGENCY MANAGEMENT

Local Hazard Mitigation Plan

San Mateo County, California

Volume 1: Countywide Planning Elements

2026

DRAFT

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CHAPTER 1. INTRODUCTION

The San Mateo County Local Hazard Mitigation Plan (LHMP or the Plan) was developed to guide the County and its jurisdictions (i.e., municipalities and special districts) in a risk-based approach to become more resilient to the impacts of natural hazards through mitigation planning. The Plan documents historical disasters, assesses the probability of future disasters using Hazus and GIS analyses, and outlines specific strategies to mitigate their potential impacts.

This five (5) year update was a collaborative effort among the Hazard Mitigation Core Planning Team, the Steering Committee, and the 35 plan participants (comprising the County, 20 municipalities, and 14 special districts). The Plan accomplishes the following:

- Identifies areas of risk and assesses the probability, extent, vulnerability, and impacts for each natural hazard.
- Establishes strategies and priorities to mitigate risk from natural hazards.
- Identifies specific mitigation projects to pursue for each identified natural hazard.
- Guides the communities in their risk management activities and minimizes conflicts among agencies.
- Establishes eligibility for future mitigation program funds.

1.1. Purpose of the Plan

In response to the requirements of the Federal Disaster Mitigation Act of 2000, San Mateo County developed this LHMP, which represents a regulatory update to the 2021 San Mateo County LHMP. The Federal Disaster Mitigation Act of 2000 requires jurisdictions to develop and maintain a hazard mitigation plan to remain eligible for certain Federal disaster assistance and hazard mitigation funding programs (e.g., the Hazard Mitigation Grant Program, the Building Resilient Infrastructure and Communities, and the Flood Mitigation Assistance). Renewal of the Plan every five (5) years is required to encourage continual awareness of mitigation strategies. Additionally, communities that participate in the Federal Emergency Management Agency (FEMA) Community Rating System (CRS), a voluntary program that reduces National Flood Insurance Program (NFIP) premiums, and are designated as a Category C repetitive loss community must prepare a Floodplain Management Plan (FMP) or a Repetitive Loss Area Analysis (RLAA). However, the CRS Program allows multi-hazard and multi-jurisdictional mitigation plans to fulfill this requirement.

FEMA defines a hazard mitigation plan as the documentation of a state or local government's evaluation of natural hazards and the strategies to mitigate these hazards. Furthermore, FEMA issues and updates guidelines for these plans (last updated in 2025). The California Office of Emergency Services (Cal OES) also supports plan development for jurisdictions across the State.

This Plan fulfills the federal requirements for mitigation funding outlined in 44 Code of Federal Regulations (CFR), Section 201.6 (44 CFR § 201.6) and United States Code (USC) 42, Section 5165 (42 USC § 5165), the CRS Program, and provides the jurisdiction with a blueprint for reducing the impacts of natural hazards.

1.2. Hazard Mitigation Program

Hazard mitigation is defined as any sustainable action taken to reduce or eliminate long-term risk to people and property from future disasters. Mitigation focuses on building (or rebuilding) in ways that reduce risk more permanently. It is an activity that can occur at any point in the emergency management cycle. For example, communities can undertake mitigation actions before a disaster (i.e., the preparedness phase) or during rebuilding after a disaster (i.e., the recovery phase).

A core responsibility of local governments is to protect health, safety, and public welfare, and investing in mitigation supports this responsibility. Studies show that hazard mitigation can save up to $6 for every $1 invested.[1] Mitigation can accomplish the following:

- Protect public safety and prevent loss of life and injury.
- Build resilience to current and future disaster risks.
- Prevent damage to a community's economic, cultural, and environmental assets.
- Reduce operational downtime and speed up the recovery of government and business after disasters.
- Reduce the costs of disaster response and recovery, as well as the exposure to risk for first responders.
- Help achieve other community goals (e.g., protecting infrastructure, preserving open space, and boosting economic resilience).

1.3. Planning Area

The planning area was defined as Unincorporated San Mateo County, 20 municipal jurisdictions (i.e., cities and towns), and 14 special districts within San Mateo County's geographical boundary. All partners to this Plan have jurisdictional authority within this planning area.

San Mateo County and the participating jurisdictions intend to implement this Plan with full coordination and participation from county and local departments, organizations, and groups, as well as relevant state and federal entities. Coordination helps ensure that stakeholders have established communication channels and relationships necessary to support mitigation planning and the mitigation actions included in each jurisdictional annex.

1.4. Participating Jurisdictions

In September 2025, San Mateo County notified all municipalities and the special districts, as appropriate, within the County of the pending planning process and invited them to formally participate in the 2026 LHMP update. Jurisdictions were asked to formally inform the County of their intent to participate (via a Participation Letter) and to identify two (2) planning points of contact to facilitate municipal participation and represent the interests of their respective communities.

[1] National Institute of Building Sciences. (2019). Natural Hazard Mitigation Saves (2019 Report). Retrieved from https://www.nibs.org/files/pdfs/NIBS_MMC_MitigationSaves_2019.pdf.

All participating jurisdictions (i.e., cities, towns, and special districts) listed in **Table 1-1** were represented by one (1) or more representatives. Responsibilities for each of the participating jurisdiction's representatives included the following:

- Represent their jurisdiction throughout the entire planning process.
- Assure participation of all departments and functions within their jurisdiction that have a role in hazard mitigation (e.g., planning, engineering, code enforcement, police and emergency services, public works).
- Assist with gathering information for inclusion in the Plan update, including the use of previously developed reports and data.
- Support and promote public engagement throughout the planning process.
- Report on progress of mitigation actions identified in the previous LHMP updates, as applicable.
- Identify, develop, and prioritize appropriate mitigation actions.
- Report on progress of integration of the prior LHMP into other planning processes and municipal or district operations.
- Support and develop or update the jurisdiction's annex.
- Review, amend, and approve all sections of the Plan update.
- Adopt, implement, and maintain the Plan.

Point of contact information for each representative and documentation of participation in the Plan update are included in each jurisdictional annex. The County also invited key organizations to assist and review the plan update process; supporting documentation is available in **Appendix A**.

Table 1-1. Participating Jurisdictions

San Mateo County, Cities, Towns		
Unincorporated San Mateo County	City of East Palo Alto	Town of Portola Valley
Town of Atherton	City of Foster City	City of Redwood City
City of Belmont	City of Half Moon Bay	City of San Bruno
City of Brisbane	Town of Hillsborough	City of San Carlos
City of Burlingame	City of Menlo Park	City of San Mateo
Town of Colma	City of Millbrae	City of South San Francisco
City of Daly City	City of Pacifica	Town of Woodside

Special Districts		
Coastside County Water District	North Coast County Water District	San Mateo Resource Conservation District
Menlo Park Fire Protection District	OneShoreline	Silicon Valley Clean Water
Midpeninsula Regional Open Space District	San Mateo County Harbor District	Westborough Water District
Mid-Peninsula Water District	San Mateo Community College District	Woodside Fire Protection District
Montara Water and Sanitary District	San Mateo County Office of Education	

1.5. Plan Participation

Updating this Plan involved assistance in identifying and evaluating hazards and mitigation actions from five (5) main groups – the Core Planning Team, the Steering Committee, representatives from County jurisdictions, members of the public, and other stakeholders.

1.5.1. Core Planning Team

The Core Planning Team consisted of key members from the San Mateo County Department of Emergency Management and staff from Integrated Solutions Consulting (ISC). The Core Planning Team also served on the Steering Committee and helped guide the planning process. **Table 1-2** lists the Core Planning Team members from the San Mateo County Department of Emergency Management.

Table 1-2. Core Planning Team Members

Name	Title	Jurisdiction/Organization
Alina Haddad	Emergency Management Coordinator	San Mateo County Department of Emergency Management
David Passey	Program Services Manager	San Mateo County Department of Emergency Management

1.5.2. Steering Committee

Hazard mitigation planning enhances collaboration and support among diverse parties whose interests can be affected by hazard losses. A Hazard Mitigation Steering Committee (the Steering Committee) was formed to oversee all phases of the planning process.

Throughout this Plan update, the Steering Committee agreed to meet three (3) times throughout the planning process. The Core Planning Team facilitated each meeting, which addressed objectives set by the established work plan. All members of the Steering Committee were actively involved in attending meetings and were responsible for the following:

- Providing guidance and oversight of the planning process on behalf of the general planning partnership.
- Attending and participating in Steering Committee meetings.
- Assisting with the development and completion of certain planning elements, including:

  - Reviewing, identifying, and prioritizing natural hazards that impact San Mateo County.
  - Coordinating and conducting outreach activities with stakeholders, plan participants, and the public.
  - Assuring the data and information in the Plan update are based on the best available data.
  - Reviewing, updating, and identifying the Plan's goals and objectives.
  - Reviewing, identifying, and prioritizing mitigation actions and projects.
  - Defining and identifying critical facilities.
  - Reviewing and updating the planning area's capability assessment and consideration of mitigation alternatives.
- Reviewing and providing feedback on the draft Plan during the public comment period, before submitting to Cal OES and FEMA Region 9.

The Steering Committee members are listed in **Table 1-3**, and the Steering Committee Meetings sign-in sheets are available in **Appendix A**.

Table 1-3. Hazard Mitigation Steering Committee Members

Name	Title	Jurisdiction/Organization
Alina Haddad	Emergency Management Coordinator	San Mateo County Department of Emergency Management
David Passey	Program Services Manager	San Mateo County Department of Emergency Management
Travis Kusman	Administration	San Mateo County Emergency Medical Services
Koren Widdel	Director	San Mateo County Agriculture / Weights and Measures
Michael Donovan	Commission Member	San Mateo County Health, Commission on Disabilities
Matthew Cadigan Hearn	Commission Member	San Mateo County Health, Commission on Disabilities
Kismet Baldwin-Santana	Health Officer	San Mateo County Health, Public Health, Policy and Planning
Ken Anderson	Emergency Services Captain	City of South San Francisco, Fire Department
Brandon Bond	Emergency Preparedness Coordinator	City of Menlo Park
Kat Wuelfing	General Manager	Mid-Peninsula Water District
Omar Brown	Acting Deputy Director of Safety	San Mateo County Transit District
Mark Lorenzen	Fire Chief	Menlo Park Fire Protection District
Rita Mancera	Executive Director	Puente
Violet Saena	Executive Director	Climate Resilience Communities
Sandi Winters	Executive Director	Senior Coastsiders

Name	Title	Jurisdiction/Organization
Connie Santilli	Secretary, Co-Lead, Board Member	Midcoast Community Council, Age Friendly Half Moon Bay Coastside, and Senior Coastsiders
Caline Salame	Equity and Belonging Associate	County's Executive Office
Carly Bock	Program Services Manager I	San Mateo County Health

1.5.3. Local Planning Teams

Each participating jurisdiction identified representatives to serve on its Local Planning Team. The Local Planning Teams were instrumental in identifying community-specific risks and hazards and prioritizing mitigation actions to reduce disaster response and recovery costs, protect people and infrastructure, and minimize overall disruption to their respective communities in the event of a disaster. The members of each Local Planning Team are listed in the corresponding jurisdictional annex.

1.5.4. Supporting Organizations

Throughout the planning process, key stakeholders, departments, and community organizations, including local community organizations that provide support to underserved communities, were involved in providing key input, data, disseminating information about the Plan, survey, meetings, and reviewing the draft of the Plan (i.e., public comment period). Details on stakeholder engagement throughout the planning process, along with a list of stakeholders, are in **Appendix A**.

1.6. Plan Approval and Adoption

The Plan presents a comprehensive description of San Mateo County's commitment to significantly reduce or eliminate the potential impacts of disasters through planning and mitigation. Adoption by the local governing body within the State of California legitimizes the Plan and authorizes San Mateo County and its jurisdictions to implement mitigation responsibilities and activities.

A hazard mitigation plan must document that it has been formally adopted by the governing bodies of the jurisdictions requesting federal approval of the Plan (44 CFR Section 201.6(c)(5)). For multi-jurisdictional plans, such as this, each jurisdiction requesting approval must formally adopt the Plan. This Plan will be submitted to Cal OES and FEMA Region 9 for a pre-adoption review before adoption. Once pre-adoption approval (i.e., approvable pending adoption or APA) has been provided, all participating jurisdictions will formally adopt the Plan. Federal Disaster Mitigation Act of 2000 compliance and its benefits cannot be achieved until the Plan is adopted.

Following adoption of the Plan, the jurisdiction must submit a copy of the resolution or other legal document showing formal adoption (acceptance) of the Plan to the San Mateo County Hazard Mitigation Coordinator (i.e., San Mateo County Department of Emergency Management staff). San Mateo County will forward the executed resolutions to Cal OES, after which Cal OES will submit them to FEMA for recordkeeping. The jurisdictions understand that FEMA will transmit an acknowledgment of verification of formal plan adoption and the official approval of the Plan to the San Mateo County Hazard Mitigation Coordinator.

Copies of the resolutions for each plan participant are available under each jurisdictional annex.

CHAPTER 2. PLANNING PROCESS

The San Mateo County LHMP was developed to provide a basis for identifying and managing natural hazards and to meet federal, state, and local requirements for hazard mitigation and FEMA mitigation grant funding.

Updating this Plan began with an initial kick-off meeting with the San Mateo County Department of Emergency Management on September 22, 2025. Following this meeting, the Kick-Off Meeting with the plan participants and stakeholders was held, in person, on October 23, 2025. This meeting allowed the Core Planning Team to provide information on FEMA's Hazard Mitigation Program directive and how participating in this Plan will make jurisdictions (i.e., cities, towns, and special districts) eligible for FEMA hazard mitigation grant programs. Furthermore, the planning process involved the following:

- Review of the existing LHMP.
- Updating San Mateo County's hazard history.
- Gathering information on local hazards from individual communities.
- Gathering input on hazard priorities.
- Identifying specific vulnerabilities and desired mitigation strategies.
- Evaluating the previous Plan goals, objectives, and mitigation strategies.
- Determining the status of previous mitigation strategies and action plans.
- Identifying Repetitive Loss and Severe Repetitive Loss properties.
- Facilitating the activities of the Steering Committee.
- Conducting multiple public engagement and outreach activities.

Information regarding San Mateo County's hazards and applicable mitigation strategies was obtained through two (2) Stakeholder Workshops held in the San Mateo County Department of Emergency Management (Regional Operations Center) on February 11 and 12, 2026. Additionally, a comprehensive public survey reached 297 residents, of whom 212 provided complete responses.

The San Mateo County 2026 Community Resilience Survey, available in English and Spanish, was conducted as a community input survey in support of the LHMP update. This survey was designed to gather public input on disaster preparedness, hazard risk perceptions, and community resilience. It is not a statistically representative probability sample; it is a self-selected convenience sample of registered voters who chose to participate online. The information gathered from this survey was used to inform the hazard risk prioritization process and to ensure the Plan adequately addressed the public's concerns and priorities. The survey was open between January 8 and February 5, 2026. Additionally, a draft of the Plan was made available on the San Mateo County Hazard Mitigation website for public review and comment from May 15, 2026, through June 15, 2026.

The purpose of the two (2) Stakeholder Workshops was to ensure that plan participants had the opportunity to identify/update their community's risks, vulnerabilities, and impacts, as well as their mitigation strategies and priorities. These Workshops included local planning team members from each participating city, town, and special district. Participants validated the County's risk assessment findings, described specific hazard risks and concerns for their communities, updated existing mitigation actions/strategies from the 2021 Plan, and worked with their local planning teams to identify new mitigation actions. Through a combination of ranking exercises, worksheets, and discussions, workshop participants evaluated hazard risk results, action plans, and rankings; and selected options for mitigating specific hazards to be included in the 2026 LHMP update.

In summary, the planning process consisted of the following key tasks.

Task 1: Organize the Planning Effort

This task was meant to establish the overall foundation of the hazard mitigation planning process. The San Mateo County Department of Emergency Management created a Core Planning Team to attend meetings, gather data and historical information, review drafts, and participate in mitigation brainstorming sessions. Additionally, a Steering Committee was formed to provide overall guidance and direction throughout the mitigation planning process. Participating jurisdictions were invited to form Local Planning Teams to ensure their jurisdiction's mitigation needs and priorities were addressed. *Refer to Section 1.4 of this Plan for a list of Core Planning Team and Steering Committee members, and to each annex for the respective Local Planning Team members.*

The Project Kick-Off Meeting with plan participants and stakeholders was held on October 23, 2025, to provide information about the FEMA Hazard Mitigation Program directive and demonstrate how participation in the LHMP supports each jurisdiction's eligibility for FEMA Hazard Mitigation Assistance grant programs. To confirm jurisdictional participation, each participating jurisdiction (i.e., plan participant) was required to execute a Participation Letter. This agreement formally informed the County of the jurisdiction's intent to participate and established the plan participant's commitment and a cooperative working relationship with the County in developing and implementing the 2026 LHMP.

An inclusive and engaging outreach strategy to solicit meaningful input from stakeholders and the public throughout the planning process was developed. Outreach methods included, but were not limited to, presentational meetings, interactive interviews for data collection and information sharing, workshops, public surveys, and engagement on social media platforms, county and municipal websites, and via email. Furthermore, the Core Planning Team conducted an initial identification and gathering of the diverse data and resources necessary to complete the subsequent tasks. The data collection effort included a clear timeline.

Task 2: Review and Update Community Profiles and Existing Conditions

To provide better context for the planning area, a review and update of the County's community profile and the existing conditions for each plan participant were completed. The community profile served as the foundation for a deeper understanding of the community and provided essential context for the hazard risk assessment. Details and analyses of each jurisdiction's demographic characteristics (including underserved populations), the built environment (including land use), critical infrastructure and facilities, the natural environment, and the local economy were presented and evaluated as distinct yet interrelated topics for understanding risk and resilience in each participating jurisdiction.

Task 3: Hazard Identification and Risk Assessment

The Steering Committee reviewed and identified the hazards to include in this Plan. Hazard profiles were reviewed and updated to address the location, extent/severity, probability, frequency, past events, vulnerabilities, and impacts. The hazard profiles included vulnerability and impact analyses of population and property exposure; changes in development; population and life safety; underserved populations, property, facilities, and critical infrastructure; the economy; the environment; continuity of operations/delivery of services; future development; and climate change. Secondary impacts for each hazard were also identified. The Team leveraged the hazard profiles from the previous Plan and the California State Hazard Mitigation Plan for foundational hazard information, and used local resources to inventory San Mateo County's assets and estimate losses. The Core Planning Team, Steering Committee, and plan participants provided input and subject matter expertise throughout this process. Furthermore, each plan participant assessed and documented the vulnerability and impacts to people, property, the environment, and critical infrastructure for each hazard of concern.

Task 4: Review Capabilities and Integrate Resources

A capability assessment for each community was completed to outline the unique set of capabilities, including planning, regulatory, administrative, technical, fiscal, and education and outreach available to accomplish hazard mitigation and reduce long-term vulnerability. This assessment may identify specific actions that expand jurisdictional capabilities to achieve hazard mitigation goals and objectives. Additionally, it provided an opportunity to coordinate the objectives and resources of existing local planning mechanisms that can support the implementation of this Plan. The Plan also documents each participant's ability to expand and improve the identified capabilities. An assessment of each jurisdiction's participation in the NFIP was also included.

Task 5: Review and Update the Mitigation Strategy

The mitigation strategy includes a five (5) year blueprint to reduce the risk posed by and the impacts of the hazards outlined in this Plan, along with the mitigation goals, objectives, and actions. Mitigation goals were reviewed and updated as broad statements that serve as general guidelines for what San Mateo County aims to achieve with the Plan. The mitigation objectives were also reviewed and updated to connect goals with implementable mitigation actions. To help achieve the goals outlined in this Plan, existing mitigation actions were updated, and each plan participant identified new mitigation actions. Mitigation actions are specific projects, activities, or processes that should be implemented to reduce or eliminate long-term risks to people, property, and the environment posed by hazards and their impacts. Additionally, the implementation action plan was updated to clarify how the mitigation actions will be prioritized, implemented, and integrated into the community's existing planning mechanisms.

The Core Planning Team met with plan participants, via stakeholder workshops and one-on-one meetings, to develop and prioritize mitigation strategies and actions that would reduce the costs of disaster response and recovery, protect people, property, the environment, and infrastructure, and minimize overall disruption to the County and its municipalities in the event of a disaster. The mitigation actions for each plan participant can be found in the corresponding annexes.

Task 6: Review and Update the Plan Maintenance Process

The plan maintenance process outlines the monitoring, evaluating, and updating of the Plan in the next five (5) years. The LHMP is a living document that guides actions over time, and major revisions to the document are unlikely to be needed during the five (5) year life of the Plan. However, new risk information may become available, which may require minor changes to the Plan. This includes, but is not limited to, amendments to the risk assessment, reviews of existing mitigation actions, and the implementation of new mitigation actions. Keeping the Plan current will assist with implementation.

Task 7: Draft and Submit Plan

The Core Planning Team compiled all relevant sections of the Plan to produce a draft for review (i.e., the public comment period). During the public comment period, all plan participants, stakeholders, and the public were given the opportunity to review and provide feedback on the entire Plan (**Volume 1** and annexes). The feedback was reviewed and, as applicable, incorporated by the Core Planning Team for **Volume 1** and by the Local Planning Teams for the annexes. Once the Plan was finalized, it was submitted to Cal OES and FEMA Region 9 for review and approval.

Task 8: Adopt the Plan

Each jurisdiction that is included in this Plan must have its governing body formally adopt the LHMP within one (1) year of FEMA's designation of Approval Pending Adoption (APA). San Mateo County Department of Emergency Management coordinated the effort to ensure the APA was formally adopted by each participating jurisdiction (i.e., city, towns, and special districts) and that at least one (1) jurisdiction adopted the Plan within one (1) year of the APA notification from FEMA.

The San Mateo County Board of Supervisors adopted the 2026 LHMP on [TBD]. Adoption supporting documentation for San Mateo County is available in **Appendix C**, and supporting documentation for each jurisdiction is available in the corresponding jurisdictional annex.

Public Involvement and Participation

Public involvement and participation occurred throughout the entire planning process outlined in this chapter.

The public was given an opportunity to be involved throughout the planning process via a public survey, in-person public meeting, and public engagement activities to review the Plan draft. A comprehensive public survey, with 212 completed responses, was also conducted, and it was available in English and Spanish. The survey results were used to inform the hazard risk prioritization process and to ensure the Plan adequately addresses the public's concerns and priorities. The complete survey and a summary of its findings are in **Appendix B**. Once the draft Plan was completed, the public was given an opportunity to review and provide feedback on **Volume 1** and each jurisdiction annex. The public comment period began on May 15, 2026. The Plan was made available on the San Mateo County hazard mitigation website, where the public was invited to review and provide feedback. The County announced this opportunity through social media advertisements (i.e., Facebook, Instagram) and the San Mateo County Public Libraries. Additional outreach was conducted by the plan participants, who promoted the public review process on their respective social media, websites, and newsletters, on bulletin boards, and through in-person engagement. *Further details on public engagement and participation, along with supporting documentation, are available in **Appendix B** and in the jurisdictional annexes.*

To further facilitate continued public involvement in the planning process, the public will have an opportunity to provide continual feedback and input. As future needs and concerns arise, or if the public would like to provide feedback on the latest version of the LHMP, they are invited to use the form on the County's website to submit comments.

2.1. Review of Existing Programs and Plans

The LHMP update strives to use the best available technical information, plans, studies, and reports throughout the planning process to support hazard profiling, risk and vulnerability assessment, review and evaluation of mitigation capabilities, and the identification, development, and prioritization of county- and local-level mitigation strategies.

Plans, reports, and other technical information were identified and provided directly by the County, participating jurisdictions, and numerous stakeholders involved in the planning process, as well as through independent research by the planning consultant. The County and participating jurisdictions were tasked with updating the inventory of their respective capability assessments and, as applicable, providing relevant planning and regulatory documents. Relevant documents, including plans, reports, and ordinances, were reviewed to identify the following:

- Existing municipal capabilities.
- Needs to improve and/or expand capabilities, which may be identified within the County or local mitigation strategies.
- Mitigation goals and objectives outlined in Chapter 5 of this Plan.
- Updates to existing mitigation actions (i.e., mitigation actions identified in previous Plan updates) to be incorporated into the updated County and local mitigation strategies.

The following local regulations, codes, ordinances, and plans were reviewed during this process to develop mitigation planning goals, objectives, and strategies that are consistent across local and regional planning and regulatory mechanisms, thereby enabling complementary, mutually supportive strategies. Many of these were referenced in the capability assessment available for each participating jurisdiction.

- Local General Plans
    - Safety Element
    - Housing Element
- Emergency Management and Response Plans
- Local Capital Improvement Plans
- Local Climate Action/Adaptation Plans
- Local Coastal Program Policies

- San Mateo County Community Action Plan
- San Mateo County Sea Level Rise Vulnerability Assessment
- State, Municipal, and County Codes (building, fire, zoning, subdivisions, flood damage prevention)
- California State Hazard Mitigation Plan

An assessment of each jurisdiction's capabilities to reduce long-term vulnerabilities to hazards is provided in its respective annex. It should be noted that this LHMP does not replace any existing plans or programs, but is intended to provide a reference on hazard mitigation for use in planning and program development.

Primary responsibility for the development and implementation of mitigation strategies and policies lies with local governments (i.e., each plan participant). However, various regional, state, and federal partners and resources are available to assist communities in developing and implementing mitigation strategies. In the State of California, Cal OES is the lead agency providing hazard mitigation planning assistance to local jurisdictions. Cal OES provides guidance to support mitigation planning. In addition, FEMA provides grants, tools, guidance, and training to support mitigation planning.

Additional input and support for this planning effort were obtained from a range of agencies and through public engagement. The San Mateo County Department of Emergency Management and the Steering Committee provided project management and oversight of the planning process. While participating jurisdictions were asked to identify primary and alternate local points of contact, broad participation by representatives from jurisdictions was encouraged and supported throughout the planning process. A list of municipal and Steering Committee members is provided in **Table 1-1** (under Section 1.3) and **Table 1-3** (under Section 1.4), respectively.

The Plan was prepared in accordance with the following regulations and guidance:

- FEMA Hazard Local Planning Policy Guide (effective April 2025)
- FEMA Local Mitigation Planning Handbook (June 2025)
- FEMA Integrating Hazard Mitigation into Local Planning (April 2022)
- FEMA Plan Integration: Linking Local Planning Efforts (July 2015)
- Federal Disaster Mitigation Act of 2000 (Public Law 106-390, October 30, 2000)
- 44 Code of Federal Regulations (CFR) Parts 201 and 206
- FEMA Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (January 2013)

2.2. Equity Considerations for the Underserved Population

Some disasters occur on larger scales, are more influenced by built environments, and are most likely to continue impacting those most at risk because of existing health conditions, limited resources, past underrepresentation in mitigation planning, historical disinvestment in their communities, or other factors. In this case, people in widely different locations can be the most harmed by recurring disaster cycles, so mitigation strategies should also aim to break cycles of loss driven by social and economic disparities. Hazard mitigation strategies can reduce existing risk, for example, by relocating a building out of a frequently flooded area. In each case, an attempt has been made to reduce the harm that a future flood would cause before it occurs. Strategies may also aim to reduce future development's vulnerability to hazards during construction. Examples include requiring new structures to be elevated above predicted flood levels or to be built to better withstand future hazards. Hazard mitigation plans are designed to involve stakeholders from different perspectives to ensure plans use the best available data, align with the needs of the entire community, and align with other plans, such as general plans, capital improvement plans, and climate action plans.

San Mateo County recognizes that not all members of the community are impacted in the same way by natural, human-caused, and technological disasters. Some community members are at more risk for a number of possible reasons. A mitigation strategy that uses a 'one size fits all' approach and fails to recognize different levels of risk will not adequately or efficiently support historically underserved populations and may even worsen inequalities after a disaster.

This LHMP highlights equity as a key component of the Plan's overall vision and seeks to continue developing a shared understanding among participants of how hazard mitigation can be made more inclusive and to proactively create strategies that reduce existing disparities in risk and hazard recovery. Addressing the whole community requires recognizing that, while a single solution for all may seem fair, it does not address historical inequalities or current differences in age, financial resources, housing stability, neighborhood investment, health or ability, and access to government services. In mitigation planning, this means that successfully reducing risk in the most meaningful and efficient way requires understanding how the distribution of resources will actually reduce risk and for whom.

Equitable mitigation success should be measured by assessing who was most impacted in loss of life or financial harm by past and future disasters, quantifiable reductions of vulnerability to those most at risk, and increasing engagement with historically underserved populations and community organizations to better understand how plans and processes and natural hazard events are affecting different communities. The following highlights how this Plan addresses this priority.

Chapter 3 (Community Profile): This chapter describes different demographic and economic factors in San Mateo County. Additionally, data from the Centers for Disease Control and Prevention (CDC) Social Vulnerability Index (SVI) for equity, developed by the United States Census Bureau, were included. Additionally, data on at-risk populations in the County and their vulnerability to climate change impacts are provided.

Chapter 4 (Hazard Identification and Risk Assessment): This chapter includes FEMA's National Risk Index scores for the County for social vulnerability and community resilience. Social vulnerability is defined as the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood.[2] Community resilience is defined as the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and

[2] Federal Emergency Management Agency. (2023). Social Vulnerability. Retrieved from https://hazards.fema.gov/nri/social-vulnerability.

withstand and recover rapidly from disruptions.[3] Additionally, it includes a hazard ranking methodology that specifically assesses the impact of the hazard on underserved populations. Furthermore, each hazard profile includes a narrative of the vulnerability and impacts for underserved populations, FEMA's Expected Annual Loss analysis, and the County's National Risk Index score. The Risk Index score is based on the following components: Social Vulnerability, Community Resilience, and Expected Annual Loss (which is based on Exposure, Annualized Frequency, and Historic Loss Ratio (HLR)), for a total of five (5) risk factors.[4]

Mitigation goals were updated to encourage greater participation and engagement from underserved populations and groups, and align with San Mateo County's General Plan (and its elements), Community Climate Action Plan (CCAP), and the 2024 Equity Ordinance. This ensures diversity, inclusion, and equity are institutionalized across all mitigation strategies and initiatives. During Stakeholder Workshops, where new and ongoing mitigation strategies were discussed, jurisdiction representatives were encouraged to consider how mitigation actions, directly and/or indirectly, led to equitable outcomes.

During this Plan update process, a comprehensive community preparedness questionnaire was developed and disseminated. The questionnaire was designed to focus on understanding the challenges and concerns related to access and functional needs, access to information, recovery ability, and the services needed, especially for those who may be underserved or lack access to key resources.

The County and participating jurisdictions have a responsibility to ensure equitable outcomes in implementing this Plan and to take action to reduce vulnerabilities to disasters that disproportionately affect marginalized populations. When conducting community engagement related to the implementation or update of this LHMP, San Mateo County ensured that the entire community had an opportunity to participate in the process and discussion. FEMA defines the *whole community* as the groups and organizations that should share the responsibility for emergency preparedness and mitigation, including:[5]

- Individuals and families, including those with access and functional needs
- Businesses
- Faith-based and community organizations
- Nonprofit groups
- School and academia
- Media outlets
- All levels of government, including state, local, tribal, territorial, and federal partners

[3] Federal Emergency Management Agency. (2023). Community Resilience. Retrieved from https://hazards.fema.gov/nri/community-resilience.
[4] Federal Emergency Management Agency. (2023). Determining Risk. Retrieved from https://hazards.fema.gov/nri/determining-risk.
[5] Federal Emergency Management Agency. (2020). Whole Community. Retrieved from https://www.fema.gov/glossary/whole-community.

CHAPTER 3. COMMUNITY PROFILE

San Mateo County is the third smallest county in California, with 455 square miles of land, approximately 292 square miles of water, and 57.7 miles of coastline.[6] The County is characterized by a wide range of elevations, from sea level to 2,629 feet, due to the mix of coastal plains, steep hills, and rugged mountains. Located on the San Francisco Peninsula, the County is surrounded by the Pacific Ocean to the west and San Francisco Bay to the east. North of San Mateo County is the City of San Francisco, south is Santa Cruz County, and southeast is Santa Clara County. The majority of the San Francisco Bay is divided into four (4) smaller Bays – South Bay, Central Bay, North Bay, and Suisun Bay, stretching 60 miles long and three (3) to 12 miles wide. San Mateo County borders the shallower South Bay that extends south into quiet backwaters surrounded by restored marshes, salt ponds, office parks, and lagoon communities.[7] The South Bay is also home to the Don Edwards San Francisco Bay National Wildlife Refuge, managed by the United States Fish and Wildlife Service. The Refuge was established in 1972 and provides 30,000 acres of protected habitat for millions of migratory birds and endangered species.[8]

The County is home to part of the Golden Gate National Recreation Area, which extends north of San Mateo County into Marin County and contains numerous ecologically and historically significant landscapes. Protecting over 82,000 acres, the Recreation Area supports 19 distinct ecosystems with over 2,000 plant and animal species.[9] Much of the Recreation Area is land formerly used by the United States Army.

Along the Coast, the County is home to the State-managed Montara State Marine Reserve and Pillar Point State Marine Conservation Area, which extend offshore from Montara to Pillar Point. Combined, the two (2) protect 18.5 square miles of marine habitat to depths greater than 170 feet.[10] These two (2) Marine Protected Areas feature sandy beaches, rocky shores, surf-grass beds, expansive sandy seafloor, and an immense rocky reef with kelp forests.

The San Mateo County Parks Department manages 24 parks throughout the County, encompassing over 16,000 acres.[11] San Mateo County's land management agencies and stewards are responsible for caring for a diverse mix of ecosystems. Home to more than 110,000 acres of protected lands, the County's open spaces provide community members and visitors with water, recreational opportunities, scenic vistas, wildlife habitat, and vital refuges for threatened, endangered, and special-status species.[12] The County's environment provides numerous ecological, economic, and social benefits that are vitally linked to the

[6] San Mateo County. (n.d.). Fast Facts. Retrieved from https://www.smcgov.org/fast-facts.
[7] San Francisco Estuary Partnership. (n.d.). About the Estuary. Retrieved from https://www.sfestuary.org/our-estuary/about-the-estuary/.
[8] United States Fish and Wildlife Service. (n.d.) Don Edwards San Francisco Bay National Wildlife Refuge. Retrieved from https://www.fws.gov/refuge/don-edwards-san-francisco-bay.
[9] National Park Service. (n.d.). Golden Gate National Recreation Area. Retrieved from https://www.nps.gov/goga/index.htm.
[10] California Department of Fish and Wildlife. (n.d.). Montara State Marine Reserve and Pillar Point State Marine Conservation Area. Retrieved from https://wildlife.ca.gov/Conservation/Marine/MPAs/Montara-Pillar-Point.
[11] San Mateo County Parks Department. (n.d.). About the San Mateo County Parks Department. Retrieved from https://www.smcgov.org/parks/about-san-mateo-county-parks-department.
[12] Sustainable San Mateo County. (n.d.) Parks and Open Space. Retrieved from https://sustainablesanmateo.org/home/2008-indicators-report/parks-and-open-space/.

County's communities. These natural resources also face pressure from development, invasive species, natural hazards, and climate change.

The urban and industrial development of the San Francisco Peninsula and regional marshland since the 19th century has caused damage, pollution, and loss to many of the region's ecosystems. Human activities severely altered the physical processes that create and maintain estuarine habitats.[13] The San Francisco Bay is one of the few areas with natural conditions that allow for salt extraction from seawater. Since the mid-19th century, industrial salt makers have drained the tidal marshes of the South Bay to create salt evaporation ponds.[14] Restoration efforts date back to 2003, when the land was purchased from agribusiness giant Cargill. The South Bay Salt Pond Restoration Project is a 50-year effort to restore over 15,000 acres of industrial salt ponds into their historic tidal marshland. In addition to the environmental, economic, and social benefits, the restoration will boost the Bay's resilience to storms and flooding.

3.1. History

Members of a Spanish exploration team in 1769 were the first Europeans to set foot on what is now San Mateo County. Led by Gaspar de Portola, the team was also the first to discover San Francisco Bay, spotting it from a hill now called Sweeney Ridge, between the cities of San Bruno and Pacifica. The Spanish found the Peninsula inhabited by approximately 2,400 Native Americans, known as the Ohlone. Subsequently, the Spanish developed a pathway linking missions along the California coast. This pathway grew into El Camino Real (The King's Highway) and played a central role in shaping the region's development. Spain ruled California until Mexico assumed control in 1821. The Mexican government granted large tracts of land to private owners to encourage settlement. The names of some of the ranchos from this period can still be seen throughout San Mateo County today, including Buri Buri, Pulgas, San Gregorio, San Pedro, and Pescadero.

California came under the control of the United States following hostilities with Mexico. The discovery of gold in the Sierra foothills brought a wave of settlers and, in 1849, statehood to California. The Peninsula's redwoods helped to build a booming San Francisco, while the region's fishing and cattle industries helped to feed the growing population. When California achieved statehood, most of modern San Mateo County was within San Francisco County. But in 1856, the southern portion of San Francisco County was separated to form San Mateo County as part of the effort to reform San Francisco's corrupt government. More territory was added in 1868 from Santa Cruz County.

By 1864, daily trains were running along the Peninsula from San Francisco to San Jose. During this period, wealthy businessmen from throughout the West began buying large tracts of land on which to build estates. These include William Ralston, Alvinza Hayward, Harriet Pullman Carolan, James Flood, and William Bourn. While most are now gone (Hayward's burned, and Flood's was torn down), a few still survive. Ralston Hall stands at Notre Dame de Namur University in the City of Belmont, the Carolands Mansion in the Town of Hillsborough remains one of the largest residences in the United States, and Bourn's mansion near Woodside, Filoli, is open to the public for tours.

[13] Ibid.
[14] United States Fish and Wildlife Service. (n.d.). South San Francisco Bay Restoration. Retrieved from https://www.fws.gov/project/south-san-francisco-bay-restoration.

Cities began to take shape along the railroad line and across the Peninsula. Redwood City, the county seat, was incorporated in 1867. The next to incorporate was the City of San Mateo in 1894. The new century brought a wave of efforts to create new cities, such as South San Francisco, San Bruno, and Daly City. Logging, farming, meatpacking, shipbuilding, salt production, and cement work fueled the local economy. Meanwhile, the Spring Valley Water Company was busy acquiring what became the Crystal Springs watershed to supply fresh water to San Francisco and the Peninsula.

As more people moved to the Peninsula, the transportation system improved. An electric streetcar line linked San Mateo to San Francisco in 1903. The Dumbarton Railway Bridge crossed the Bay in 1910. Automobiles could cross the Bay on the Dumbarton Bridge in 1925 and the San Mateo-Hayward Bridge in 1929. Mills Field, which later became San Francisco International Airport, opened next to the Bay during this period.

On the Coastside, a different kind of business was taking off. Rumrunners and bootleggers were busy during Prohibition. The coast's isolation and the often foggy shoreline made it an ideal location for smugglers whisking cargo to San Francisco or Peninsula roadhouses. The outbreak of World War II fueled a new wave of growth along the Peninsula. After the war, thousands of new homes were built as the County's population swelled from 115,000 in 1940 to 235,000 in 1950. The highest growth rate followed, swelling to nearly 450,000 in the next decade. New cities continued to form to provide municipal services.

The influx of workers and the rise of technology changed the area's economy. Electronics emerged as the leading post-war industry. Stockyards, steel mills, and tanneries quickly gave way to industrial parks, warehouses, and light manufacturing. San Francisco International Airport helped fuel growth as air travel changed the way people traveled and goods were shipped. Public schools and colleges, libraries, recreation centers, and parks were built to keep pace with the soaring population.

The fast pace of development had other consequences. A strong conservation movement sprang up to preserve the coast and open spaces from sprawl. Residents worked to limit air and water pollution, to halt filling the Bay for more homes and office parks, and to fight freeway expansions. The County's population grew to 556,000 by 1970, a gain of 112,000 during the 1960s. The rapid pace of growth began to slow, but significant events continued to shape the Peninsula. The Junipero Serra Freeway, Interstate 280, was completed in 1976. Two (2) years later, the San Mateo County Transit District (SamTrans) consolidated several city bus lines into one (1) system.

Long a home to innovators, the Peninsula continued to evolve. During the 1980s and 1990s, biotechnology companies moved into South San Francisco while computer software, internet, and gaming companies shifted the boundary of Silicon Valley to the north. San Francisco International Airport opened a $1 billion international terminal in 2000 as the region's gateway to the Pacific Rim.

Today, San Mateo County is inhabited by over 742,000 residents across 20 municipalities and various unincorporated areas, ranging from verdant suburbs to secluded coastal hamlets. The dynamic economy, mild climate, and high quality of life draw individuals from around the globe.[15]

[15] San Mateo County. (2017). County of San Mateo 2017-2019 Profile. Retrieved from https://www.smcgov.org/media/3181/download?inline=.

3.2. Topography

San Mateo County covers 455 square miles of land and 292 miles of water across four (4) regions – North County, South County, Mid-County, and the Coastside.[16] The County is surrounded on the north by the City and County of San Francisco, on the east by San Francisco Bay, on the west by the Pacific Ocean, and on the south by Santa Clara and Santa Cruz counties. The dense urbanization of the Bayside stands in marked contrast to the agricultural areas, parks and preserves, and undeveloped lands of the rural Coastside region.

The topography of San Mateo County is extremely varied. Elevation ranges from sea level to 2,572 feet atop the Santa Cruz Mountains. The Santa Cruz Mountain range bisects San Mateo County, running in a north-south direction, essentially creating three (3) regions:[17]

- The **Bayside** largely consists of mudflats, marshes, artificial fill, and broad, flat alluvial plains. The low-lying Bayside region gradually rises toward the Santa Cruz Mountains, eventually becoming rolling foothills. The San Andreas Fault parallels the Santa Cruz Mountain range, delineating the threshold of the Bayside and the beginning of the Santa Cruz mountainside.
- The **Santa Cruz Mountains** are generally rugged with dense forest and steep slopes, often exceeding 50%. This area is characterized by large amounts of open space, recreational areas, and trails, including Wunderlich Park, Huddart Park, and the Fifield-Cahill Ridge Trail.
- The **Coastside** of San Mateo County consists of sloping foothills of the Santa Cruz Mountains to nearly sea-level coastal terraces along the Pacific Ocean. The difference in topography along the coastline itself ranges from wide, sandy beaches to rocky coves. In some places, high, rocky cliffs have emerged from the gradual erosion of coastal terraces.

Figure 3-1 illustrates the topographic map of San Mateo County.

Figure 3-1. Topographical Map

[Map is under development…]

3.3. Climate

San Mateo County has a Mediterranean climate, characterized by dry, mild summers and moist, cool winters. Temperatures are strongly influenced by the Pacific Ocean to the west, the San Francisco Bay to the east, and the Santa Cruz Mountains. This combination of features has resulted in a variety of microclimates throughout the County, with hill and ridgetop areas, valley floors, and coastal areas each experiencing different temperatures and precipitation patterns.[18]

The Coastside experiences a marine climate, characterized by cool, foggy summers and relatively wet winters. Meanwhile, the Bayside climate is generally warm and sunny, particularly in the summer months, when hot air from the valleys moving eastward warms the prevailing cool ocean breezes.

[16] San Mateo County. (n.d.). Fast Facts. Retrieved from https://www.smcgov.org/fast-facts.
[17] San Mateo County. (1986). General Plan. Retrieved from https://www.smcgov.org/media/101521/download?inline.
[18] Ibid.

In San Mateo County, the vast majority of annual rainfall is concentrated between December and March. Precipitation patterns are dictated largely by the dramatic local topography; as elevation increases, so does the amount of moisture received. However, the Santa Cruz Mountains create a distinct rain shadow effect, meaning the Coastside generally remains wetter than equivalent elevations on the Bayside. The mountain range acts as a physical barrier, forcing moisture-heavy maritime air to condense into rain or fog as it reaches the higher, colder mountains. While rain is the primary source of moisture, snow falls a few times a year on the highest ridges, and more rarely, the higher valleys receive light dustings.

The Santa Cruz Mountains have moderate annual temperatures, though they are characterized by pronounced diurnal temperature fluctuations. Unlike the steady, insulated climate of the coast, this inland range experiences sharp fluctuations between day and night. These temperature swings become particularly extreme during heat waves, depending on the specific terrain. Furthermore, there is considerable day-to-day variation in temperature in both summer and winter, with shifting wind directions and fluctuations in the marine influence.

In the winter (December through February), the average daily temperature in San Mateo County is 52.3°F, with daytime temperatures reaching the low 70s and high 60s and evening temperatures in the high 30s and low 40s. During the summer (June through August), the average daily temperature is 63.8°F, with daytime temperatures reaching the mid-to-upper 80s and evening temperatures in the low 50s. On average, the coldest month in San Mateo County is January, and the warmest month is September. The monthly climate summary, based on the San Francisco International Airport weather station, is listed in **Table 3-1**.[19]

Table 3-1. San Mateo County Monthly Climate Summary (2000 – 2025)

Average Daily Temperature *(°F)*												
Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Mean**
51.7	53.3	55.3	57.2	59.9	62.6	63.8	64.9	65.6	63.1	56.5	51.8	58.8
Average Maximum Temperature *(°F)*												
Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Mean**
57.8	60.3	62.6	64.7	67.6	70.8	71.5	72.7	74.3	71.6	63.7	57.7	66.2
Average Minimum Temperature *(°F)*												
Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Mean**
45.5	46.4	48.1	49.7	52.2	54.4	56.0	57.1	57.0	54.5	49.4	45.9	51.3
Average Total Precipitation *(inches)*												
Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Mean**
3.24	3.38	2.54	1.27	0.34	0.10	0.00	0.01	0.08	0.94	1.91	4.76	18.6

[19] National Weather Service. (2026). NOWData: Monthly Summarized Data (2000 - 2025), San Francisco International Airport Weather Station. Retrieved from https://www.weather.gov/wrh/climate?wfo=mtr.

3.4. Geology, Hydrology, and Ecology

3.4.1. Geology

The San Francisco Peninsula is a relatively narrow band of rock at the north end of the Santa Cruz Mountains, separating the Pacific Ocean from San Francisco Bay. It represents one mountain range in a series of northwesterly-aligned mountains forming the Coast Ranges geomorphic province, which stretches from the Oregon border nearly to Point Conception (in Santa Barbara County, CA). In the San Francisco Bay area, most of the Coast Ranges have developed on a basement of tectonically mixed Cretaceous- and Jurassic-age (between 70 and 200 million years old) rocks of the Franciscan Complex. These basement rocks are capped locally by younger sedimentary and volcanic rocks. Most of the Coast Ranges are covered by younger surficial deposits that reflect geologic conditions for about the last million years.[20]

The major fault in the region is the San Andreas Fault. Lateral and vertical movement on the many splays of the San Andreas Fault system and other secondary faults has produced a dominant northwest-oriented topographic trend throughout the Coast Ranges. This trend reflects the boundary between the North American plate to the east and the Pacific plate to the west. The San Andreas Fault system is about 40 miles wide in the Bay Area and extends from the San Gregorio fault at the coastline to the Coast Ranges-Central Valley blind thrust at the western edge of the Great Central Valley. The San Andreas Fault is the dominant structure in the system, nearly spanning the length of California and capable of producing the highest-magnitude earthquakes. Many other subparallel or branch faults within the San Andreas system are equally active and capable of generating large earthquakes. Right-lateral movement dominates on these faults, but an increasingly large amount of thrust faulting resulting from compression across the system is now being identified.[21]

3.4.2. Hydrology

The Bayside of San Mateo County has experienced extensive urban development, necessitating flood-control modifications in nearby watersheds. Streams that once naturally flooded and meandered around hillsides before reaching the San Francisco Bay were hardscaped and straightened into channels. However, the Coastside consists mostly of open space and agricultural land with sparsely distributed towns. Most watersheds on the Coastside have few to no flood-control modifications; however, water diversions, lack of riparian-zone management, and water-quality issues all pose challenges for these resources.

A watershed is the area of land where all the water drains into a particular creek, bay, or ocean. Everyone lives in a watershed, and activities in this area can affect water and habitat quality for wildlife and people. Pollution in one part of a watershed can affect areas downstream. Human actions, whether positive or negative, can influence the health of a watershed, including water quality, wildlife, vegetation, and overall quality of life. In San Mateo County, most stormwater runoff eventually travels through storm drains and

[20] City of San Mateo. 2004. San Mateo Land Use/Transportation Corridor Plan and the Bay Meadows Specific Plan Amendment. Retrieved from https://www.cityofsanmateo.org/DocumentCenter/View/3945/413-Geology.
[21] Ibid.

creeks, flowing into the San Francisco Bay or the Pacific Ocean. There are nine (9) major watersheds in San Mateo County:[22]

- **Gazos Creek:** Gazos Creek is considered a priority watershed for steelhead and coho salmon recovery. Major tributaries include Old Woman Creek and Middle Fork Gazos Creek.
- **Pilarcitos Creek:** Pilarcitos Creek originates on the eastern side of Montara Mountain and flows for 12 miles before draining into the Pacific Ocean. It is home to the California red-legged frog, San Francisco garter snake, the tidewater goby, and the steelhead trout.
- **Pescadero-Butano Creek:** The Pescadero Creek Watershed is the largest watershed in San Mateo County. The Pescadero-Butano watershed drains 81 square miles of the Santa Cruz Mountains and forms a large lagoon at the confluence of Pescadero and Butano creeks. The watershed also contains an impressive marsh that is home to several native and protected species, including steelhead, the California red-legged frog, and the San Francisco garter snake.
- **Colma Creek:** Colma Creek separates the Santa Cruz Mountains and San Bruno Mountain. The San Mateo County Flood Control District manages the lower reaches of Colma Creek.
- **San Francisquito Creek:** Major tributaries include Los Trancos Creek, Corte Madera Creek, and Bear Gulch Creek. Los Trancos and San Francisquito form the boundary between San Mateo and Santa Clara counties.
- **San Gregorio Creek:** San Gregorio drains a watershed of about 51 square miles, and its major tributaries include El Corte de Madera Creek, Alpine Creek, and La Honda Creek. A small lagoon forms at the mouth of San Gregorio Creek during the dry season.
- **San Mateo Creek:** The San Mateo Creek watershed includes three (3) reservoirs – San Andreas Lake, and the Upper and Lower Crystal Springs reservoirs. The watershed drains 35 square miles. The Creek headwaters originate near Sweeney Ridge in the Santa Cruz Mountains.
- **Belmont Creek:** Belmont Creek begins along the hills west of Belmont and flows east for about three (3) miles until it drains into Steinberger Slough. In 1878, a dam was built on Belmont Creek to form Water Dog Lake.
- **Atherton Creek:** Atherton Creek is one of the two (2) largest creeks in San Mateo County. The Creek flows from headwaters just west of Interstate 280 to Alameda de las Pulgas. Further downstream, the Creek is highly modified, flowing through a concrete channel to El Camino Real, then through a combination of concrete channels and culverts to San Francisco Bay. Several small tributaries drain into Atherton Creek above Alameda de las Pulgas, but further downstream, the drainage network consists of underground culverts or storm drains. It is home to California red-legged frogs and dusky-footed woodrats.

3.4.3. Ecology

San Mateo County's natural resources range from forested mountains to bayside marshlands and coastal ecosystems. These natural resources face pressure from development, invasive species, natural hazards, and climate change. The Bay Area is home to 35 species protected under the Endangered

[22] San Mateo County Sustainability Department. (n.d.). San Mateo County Watersheds. Retrieved from https://www.smcsustainability.org/water-protection/keeping-our-waterways-clean/.

Species Act.[23] These resources are an integral part of the economy, sense of place, and traditional culture of the island communities. Thus, it needs to be considered in hazard mitigation planning because they are affected by natural hazards and can influence how hazards alter the built environment.

San Mateo County's land management agencies and stewards are responsible for caring for a diverse mix of ecosystems, including estuarine, marine, oak woodland, redwood forest, coastal scrub, and oak savannah. Home to more than 112,000 acres of protected lands, the County's open spaces provide community members and visitors with water, recreational opportunities, scenic vistas, wildlife habitat, and vital refuges for threatened, endangered, and special status species. The County's natural resources provide numerous ecological, economic, and social benefits vital to its communities.

3.5. Demographics

Note: At the time of this Plan update, population and demographics data for the municipalities were not available for 2025; for consistency, 2024 data were used for all jurisdictions.

3.5.1. Population and Population Density

San Mateo County has a population of 742,893 as of July 2024, the 15th-largest in the State. Between 2010 and 2020, the population increased by approximately 6.4%; however, it decreased by 2.8% between 2020 and 2024. **Table 3-2** shows San Mateo County's population distribution by jurisdiction between 2010 and 2023.[24]

Table 3-2. Population Estimates

Jurisdiction	2010	2020	2024	Population Change *(2020 – 2024)*
Town of Atherton	6,914	7,188	7,022	-2.3%
City of Belmont	25,835	28,335	27,132	-4.2%
City of Brisbane	4,282	4,851	4,692	-3.3%
City of Burlingame	28,806	31,386	30,885	-1.6%
Town of Colma	1,792	1,507	1,636	8.6%
City of Daly City	101,123	104,901	101,418	-3.5%
City of East Palo Alto	28,155	30,034	29,296	-2.5%
City of Foster City	30,567	33,805	32,657	-3.4%
City of Half Moon Bay	11,324	11,795	11,324	-4.0%
Town of Hillsborough	10,825	11,387	11,171	-1.8%
City of Menlo Park	32,026	33,780	33,040	-2.2%
City of Millbrae	21,532	23,216	23,321	0.5%
City of Pacifica	37,234	38,640	37,056	-4.2%

[23] Center of Biological Diversity. (n.d.). Bay Area Wild. Retrieved from https://www.biologicaldiversity.org/campaigns/bay_area_wild/.
[24] United States Census Bureau. (2023). QuickFacts. Retrieved from https://www.census.gov/quickfacts/.

Jurisdiction	2010	2020	2024	Population Change *(2020 – 2024)*
Town of Portola Valley	4,353	4,456	4,305	-3.4%
City of Redwood City	76,815	84,292	82,982	-1.6%
City of San Bruno	41,114	43,908	42,035	-4.2%
City of San Carlos	28,406	30,722	29,403	-4.3%
City of San Mateo	97,207	105,661	103,006	-2.5%
City of South San Francisco	63,632	66,105	64,660	-2.2%
Town of Woodside	5,287	5,309	5,123	-3.6%
Unincorporated County	66,509	68,473	65,852	-3.8%
Total	**723,738**	**769,751**	**748,016**	**-2.8%**

Table 3-2 shows the population of the County and its incorporated cities between 2010 and 2024. The cities of Daly City and San Mateo are the largest cities in San Mateo County, together accounting for 27.4% of the planning area's population in 2010 and 27.3% in 2024. Unincorporated areas accounted for 9.2% of the County's population in 2010 and 8.8% in 2024. There was a 1.0% population decline in unincorporated areas between 2010 and 2024; Daly City's population increased about 0.3% during the same timeframe, and the City of San Mateo by about 6.0%.

3.5.2. Income and Socioeconomic Status

Socioeconomic status can be a helpful indicator of a person's or community's ability to absorb losses and enhance resilience to the impacts of hazards. For instance, wealth enables people and communities to absorb losses and recover more quickly through insurance, access to resources, and social safety nets. In 2024, the median household income in San Mateo County was $158,855. About 7.2% of the households in San Mateo County are below the poverty level.[25] The United States Census Bureau identified households with two (2) adults and two (2) children and an annual household income below $31,812 as "low-income". **Table 3-3** outlines the 2024 poverty thresholds by the size of the family unit.[26]

Table 3-3. Poverty Threshold for 2025 by Size and Family

Size of Family Unit	Weighted Average Thresholds
One (1) Person	$15,940
Two (2) People	$20,220
Three (3) People	$24,950
Four (4) People	$32,130
Five (5) People	$38,110
The source of the weighted average thresholds is the 2025 Current Population Survey Annual Social and Economic Supplement (CPS ASEC).	

[25] Ibid.
[26] United States Census Bureau. (2024). Poverty Thresholds. Retrieved from https://www.census.gov/data/tables/time-series/demo/income-poverty/historical-poverty-thresholds.html.

3.5.3. Education

In San Mateo County, approximately 90.2% of the population (25 years old and over) has a high school diploma or higher, while 54.9% have a bachelor's degree or higher. **Table 3-4** outlines the educational attainment distribution of the San Mateo County population aged 25 and over.[27]

Table 3-4. Educational Attainment (2024)

Education	Estimate	Percent
Less than 9th Grade	32,628	6.0%
9th to 12th Grade *(No Diploma)*	20,314	3.7%
High School Graduate *(Includes Equivalent)*	79,646	14.7%
Some College, No Degree	82,188	15.1%
Associate's degree	36,691	6.8%
Bachelor's Degree	160,494	29.6%
Graduate or Professional Degree	130,844	24.1%

3.5.4. Sex and Age Distribution

Approximately 18.9% of the population in San Mateo County is 65 years old and over, compared to the State average of 18.8%. It is also estimated that 18.9% of the County's population is under 18 years old, compared to the State average of 18.9%. Females make up 50.2% of the San Mateo County population, and the average median age is 41.5 years old. The age group with the highest percentage is 30 to 34 years old, while the 40 to 44 years old age group is the second highest. The overall age distribution for San Mateo County is outlined in **Table 3-5**.[28]

Table 3-5. Age Distribution (2024)

Education	Estimate	Percent
Under 5 Years	37,891	5.0%
5 to 9 Years	38,311	5.1%
10 to 14 Years	42,694	5.2%
15 to 19 Years	41,248	5.5%
20 to 24 Years	39,391	5.4%
25 to 34 Years	105,649	6.4%
35 to 44 Years	108,820	7.8%
45 to 54 Years	99,644	7.2%
55 to 59 Years	50,149	7.5%

[27] United States Census Bureau. (2024). S1501: Educational Attainment (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S1501?g=050XX00US06081.
[28] United States Census Bureau. (2024). S0101: Age and Sex (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSDP5Y2024.DP05?g=050XX00US06081.

Education	Estimate	Percent
60 to 64 Years	46,301	6.5%
65 to 74 Years	74,619	6.6%
75 to 84 Years	39,418	6.8%
85 Years and Over	18,205	6.0%

Children are considered vulnerable to hazards because they depend on others to access resources safely during emergencies and may face increased health risks from exposure. The elderly are more likely to lack the physical and economic resources necessary to respond to hazardous events and to suffer health-related consequences. Additionally, the elderly are more likely to live in senior care and living facilities where facility operators determine emergency preparedness. However, those living on their own may have more difficulty evacuating without additional assistance.

3.5.5. Race and Ethnic Distribution

Disasters occur at the intersection of nature and culture and often dramatically illustrate their mutuality. However, not all individuals or groups perceive or define disasters the same way, which is why understanding cultural conditions is important. Cultural perceptions of hazards, both natural and technological, vary significantly; therefore, people's responses and preparations for disasters will also differ. From theoretical and practical standpoints, understanding people's perceptions of disaster will greatly enhance mitigation efforts. A deeper understanding of specific cultural groups and characteristics within a community will enable community practitioners, civic leaders, and policymakers to better understand their community's tendencies and level of vulnerability. Because disasters first occur at the local level, it is critical that this process begin there.

The majority of the population in San Mateo County is White (37.8%), followed by Asian (31.4%). Furthermore, 24.9% of the County's population is Hispanic or Latino. **Table 3-6** outlines the racial and ethnic distribution in San Mateo County.[29]

Table 3-6. Racial and Ethnic Distribution (2024)

Race and Ethnicity	Estimate	Percent
White (not Hispanic or Latino)	280,904	37.8%
Black or African American	15,785	2.1%
American Indian and Alaska Native	8,434	1.1%
Asian	232,971	31.4%
Native Hawaiian and Other Pacific Islanders	8,444	1.1%
Some Other Race Alone	88,602	11.9%
Two (2) or More Races	107,200	14.4%
Hispanic or Latino	184,940	24.9%

[29] Ibid.

Individuals with limited English proficiency are vulnerable because they may lack access to accurate, timely information due to language barriers. Cultural differences can also add complexity to how information is conveyed to populations with limited English proficiency, including race and ethnic minorities. Approximately 35.7% of the County's population is foreign-born.[30] 54.2% of the population in San Mateo County only speaks English. Other than English, the most commonly spoken languages in the County are Asian and Pacific Island languages (19.9%) and Spanish (17.6%).[31]

3.5.6. Disabled Population

Approximately 9.4% of the San Mateo County population has a disability type (i.e., hearing, vision, cognitive, or ambulatory, self-care, and independent living difficulty). People with disabilities are more likely to require assistance when responding to a hazard event and more likely to require assistance during the 72 hours after a hazard event, which is the period generally reserved for self-help. Furthermore, individuals with disabilities are likely to be compounded with other vulnerabilities (e.g., age, economic disadvantage, race, and ethnicity). **Table 3-7** summarizes estimates of the disabled population by disability type, age, race, and ethnicity in San Mateo County.[32]

Table 3-7. Disability Characteristics (2024)

Disability Type	Estimate	Percent
Hearing Difficulty	21,106	2.9%
Vision Difficulty	11,833	1.6%
Cognitive Difficulty	28,550	4.1%
Ambulatory Difficulty	32,350	4.6%
Self-Care Difficulty	16,504	2.4%
Independent Living Difficulty	28,917	4.9%
Age	**Estimate**	**Percent**
Under 5 Years	63	0.2%
5 to 17 Years	4,388	4.1%
18 to 34 Years	8,858	5.6%
35 to 64 Years	18,985	6.2%
65 to 74 Years	12,785	17.2%
75 Years and Over	24,284	43.1%

[30] United States Census Bureau. (2024). QuickFacts: San Mateo County, California. Retrieved from https://www.census.gov/quickfacts/fact/table/sanmateocountycalifornia/.
[31] United States Census Bureau. (2024). S1601: Language Spoken at Home (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S1601?g=050XX00US06081.
[32] United States Census Bureau. (2024). S1810: Disability Characteristics (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S1810?g=050XX00US06081.

Race and Ethnicity	Estimate	Percent
White (not Hispanic or Latino)	29,173	11.4%
Black or African American	2,474	16.4%
American Indian and Alaska Native	884	10.5%
Asian	18,635	8.0%
Native Hawaiian and Other Pacific Islanders	923	11.0%
Some Other Race Alone	6,830	7.7%
Two (2) or More Races	7,958	7.4%
Hispanic or Latino	15,288	8.3%

3.5.7. Underserved Population

FEMA defines underserved populations as groups that have limited or no access to resources or that are otherwise disenfranchised. These groups may include, but are not limited to, socioeconomically disadvantaged people, people with limited English proficiency, geographically isolated or educationally disenfranchised people, people of color, as well as those of ethnic and national origin minorities, women and children, individuals with disabilities and others with access and functional needs, and seniors.[33]

Identifying the underserved population within the community can help San Mateo County target preparedness, response, and mitigation actions. Populations with higher vulnerability may be more severely affected during an emergency or disaster. Underserved populations have unique needs that public officials must consider to ensure the safety of high-risk communities.

CDC's SVI is considered an appropriate and authoritative dataset for identifying areas where efforts can be prioritized to ensure equitable outcomes in mitigation planning and actions. Social vulnerability refers to a community's capacity to prepare for and respond to the stress of natural, human-caused, and technological disasters. CDC's SVI combines 16 census-derived social factors across four (4) themes (i.e., socioeconomic status, household characteristics, racial and ethnic minority status, and housing type and transportation) to summarize the extent to which an area is socially vulnerable to disasters. The overall SVI combines all variables to provide a comprehensive assessment, and the possible scores range from zero (0) (lowest vulnerability) to one (1) (highest vulnerability).[34]

The overall SVI score for San Mateo County is 0.290, indicating a low-to-medium level of vulnerability. **Table 3-8** outlines the SVI information for each social factor for San Mateo County.[35]

[33] Federal Emergency Management Agency. (n.d.). Glossary: Underserved Population/Communities. Retrieved from https://www.fema.gov/about/glossary.
[34] Centers for Disease Control and Prevention. (2024). SVI Data & Documentation Download. Retrieved from https://www.atsdr.cdc.gov/place-health/php/svi/svi-data-documentation-download.html.
[35] Centers for Disease Control and Prevention. (2022). CDC/ATSDR Social Vulnerability Index (SVI). Retrieved from https://www.atsdr.cdc.gov/place-health/php/svi/svi-interactive-map.html.

Table 3-8. Social Vulnerability Index (2022)

Theme	Social Factor	Population	Percent
Socioeconomic Status	People Below 150% Poverty	77,460	10.3%
	Unemployed *(Civilian 16 years old and older)*	19,184	2.5%
	Housing Cost Burden	50,757	6.7%
	No High School Diploma	51,598	6.8%
	No Health Insurance	28,253	3.7%
Household Characteristics	65 Years Old and Older	127,520	16.9%
	17 Years Old and Younger	150,187	19.9%
	Civilian with a Disability	65,466	8.7%
	Single-Parent Household	9,372	1.2%
	English Language Proficiency	46,949	6.2%
Racial and Ethnic Minority Status	Hispanic or Latino (of any race) Black or African American Asian American Indian or Alaska Native Native Hawaiian or Pacific Islander Two (2) or More Races Other Races	475,035	63.0%
Housing Types and Transportation	Multi-Unit Structures	62,701	8.3%
	Mobile Homes	3,111	0.4%
	Crowding	19,366	2.6%
	No Vehicles	14,752	2.0%
	Group Quarters	12,030	1.6%

San Mateo County intersects 35 Census Tracts where vulnerability to climate change exceeds the United States average. **Table 3-9** outlines indicators of a population that is more likely to experience adverse outcomes from disruptions due to extreme weather events, climate change, pollution, or limited health care access. High percentages for any of these indicators may indicate populations at higher risk and in need of outreach from disaster planning, public health, or social service organizations.[36]

Table 3-9. Neighborhoods At Risk (2024)

Indicators	Population *(within at-risk Census Tracts)*	Percentage	United States Population	Percent Difference *(County vs. United States)*
People Under 5 Years Old	7,224	5.0%	5.6%	-11%
People Over 65 Years Old	23,102	15.9%	17.2%	-8%

[36] Northeast Regional Climate Center. (2024). Find At-Risk Neighborhoods. Retrieved from https://nar.headwaterseconomics.org/.

Indicators	Population *(within at-risk Census Tracts)*	Percentage	United States Population	Percent Difference *(County vs. United States)*
People of Color (including Hispanic)	112,703	77.4%	42.6%	58%
People Who Do Not Speak English Well	16,964	12.3%	4.3%	96%
People Without a High School Degree	16,602	15.8%	10.4%	41%
Families in Poverty	32,040	7.3%	8.8%	-19%
Housing Units That are Rentals	26,847	54.8%	34.8%	45%
Households Without a Car	4,134	8.4%	8.4%	0%
People with Disabilities	16,892	11.7%	13.3%	-13%
People Without Health Insurance	9,854	6.8%	8.4%	-21%
ACS 5-year estimates: 2024 represents average characteristics from 2020 – 2024.				

3.5.8. Computer and Internet Accessibility

Understanding a community's accessibility to computers and the internet helps determine its ability to receive emergency information in a timely manner before, during, and after an emergency or disaster. Society's dependence on internet service amplifies the impacts on communication systems during a disaster.[37] Therefore, individuals who may not have access to a computer or the internet (e.g., the elderly, low-income) may require alternate means of communication in the event of a hazard. In San Mateo County, approximately 97.7% of households have a computer, and 95.7% have a broadband internet subscription.[38]

3.6. Economy

In 2024, 67.3% of the 16 and over population was in the labor force. Of the 393,458 civilian-employed population, 81.3% were employed in the private sector. San Mateo County is currently experiencing an average unemployment rate of 4.8%. Professional, scientific, management, and administrative and waste management services represent the largest sector, employing over 22.0% of the workforce.[39] The County hosts a variety of enterprises, ranging from global corporations to small retail outlets and manufacturing entities. **Table 3-10** outlines the major employers in San Mateo County.[40]

[37] Federal Emergency Management Agency. (n.d.). Guide to Expanding Mitigation: Making the Connection to Communications Systems. Retrieved from https://www.fema.gov/sites/default/files/documents/fema_connecting-mitigation-communications-systems.pdf.
[38] United States Census Bureau. (2024). QuickFacts: San Mateo County, California. Retrieved from https://www.census.gov/quickfacts/fact/table/sanmateocountycalifornia/.
[39] United States Census Bureau. (2024). DP03: Selected Economic Characteristics (2024: ACS 5-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP5Y2024.DP03?g=050XX00US06081.
[40] California Employment Development Department. (2026). Major Employers in San Mateo County. Retrieved from https://labormarketinfo.edd.ca.gov/majorer/countymajorer.asp?CountyCode=000081.

Table 3-10. Major Employers in San Mateo County

Employer Name	Jurisdiction	Industry
3SIXTY Bistro	City of Burlingame	Full-Service Restaurant
Ann's Nails Spa, Inc.	City of Menlo Park	Manicuring
Bart Station	City of Daly City	Transit Lines
Electronic Arts, Inc.	City of Redwood City	Game Designers (mfrs)
Fisher Investments	City of San Mateo and Town of Woodside	Investment Management
Forced Dump Debris Box Services	City of Burlingame	Garbage Collection
Franklin Resources, Inc.	City of San Mateo	Asset Management
Genentech, Inc.	City of South San Francisco	Biotechnology Products and Services
Gilead Sciences, Inc.	City of Foster City	Biological Products (mfrs)
Kaiser Permanente	City of Redwood City and City of South San Francisco	Hospitals
Kellymoore Paint Co., Inc.	City of San Carlos	Paint-Retail
Lsa Global	City of Redwood City	Training Consultants
Menlo Park VA Medical Center	City of Menlo Park	Hospitals
Meta Platforms, Inc.	City of Menlo Park	Social Media & Blogs
Mills-Peninsula Medical Center	City of Burlingame	Hospitals
Plateau Systems	City of San Mateo	Software/Application/Platform Publishing
San Francisco International Airport (SFO)	San Francisco	Airports
San Mateo County Behavior	City of San Mateo	Government Offices-County
San Mateo County Tax Collector	City of Redwood City	Tax Return Preparation & Filing
San Mateo Medical Center	City of San Mateo	Hospitals
SLAC National Accelerator Lab	City of Menlo Park	Education Centers
SRI International	City of Menlo Park	Engineers-Research
Visa International Services Association	City of Foster City	Credit Card and Other Credit Plans

Tables 3-11 through **3-13** provide a breakdown of the economic characteristics of San Mateo County.[41]

Table 3-11. Employment Status (2024)

Employment Status	Estimate	Percent
Civilian Labor Force	413,189	67.2%

[41] United States Census Bureau. (2024). DP03: Selected Economic Characteristics (2024: ACS 5-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP5Y2024.DP03?g=050XX00US06081.

Employment Status	Estimate	Percent
Employed	393,458	64.0%
Unemployed	19,731	3.2%
Armed Forces	564	0.1%
Not in Labor Force	201,476	32.7%

Table 3-12. Employment by Industry (2024)

Industry Sector	Estimate	Percent
Agriculture, forestry, fishing, hunting, and mining	2,249	0.6%
Construction	21,300	5.4%
Manufacturing	29,536	7.5%
Wholesale Trade	6,514	1.7%
Retail Trade	33,301	8.5%
Transportation, warehousing, and utilities	22,685	5.8%
Information	19,376	4.9%
Finance and insurance, real estate, and leasing	25,501	6.5%
Professional, scientific, management, and administrative	86,532	22.0%
Educational services, health care, and social assistance	84,137	21.4%
Arts, entertainment, recreation, accommodation, and food	30,526	7.8%
Other services (except public administration)	18,259	4.6%
Public administration	13,542	3.4%
Civilian Employed Population 16 Years and Over	**393,458**	

Table 3-13. Occupation (2024)

Occupation Type	Estimate	Percent
Management, business, science, and arts	217,848	55.4%
Service occupations	59,656	15.2%
Sales and office occupations	63,152	16.1%
Natural resources, construction, and maintenance	22,900	5.8%
Production, transportation, and material moving	29,902	7.6%
Civilian Employed Population 16 Years and Over	**393,458**	

The median household income in San Mateo County, estimated in 2024, was $158,855, while 4.4% of households in the County have an annual income of less than $15,000 and are therefore below the poverty level. **Table 3-14** outlines the breakdown of household income in San Mateo County.[42]

[42] Ibid.

Table 3-14. Income (2024)

Income	Estimate	Percent
Less than $10,000	7,358	2.8%
$10,000 to $14,999	4,272	1.6%
$15,000 to $24,999	7,015	2.7%
$25,000 to $34,999	7,953	3.0%
$35,000 to $49,999	14,311	5.4%
$50,000 to $74,999	23,074	8.7%
$75,000 to $99,999	22,305	8.4%
$100,000 to $149,999	39,915	15.1%
$150,000 to $199,999	32,583	12.3%
$200,000 or more	105,633	39.9%

3.7. Housing

A housing unit is defined as a house, an apartment, a mobile home, a group of rooms, or a single room that is occupied (or if vacant, is intended for occupancy) as separate living quarters. A household is defined as all the individuals who occupy a housing unit. Therefore, there may be more than one (1) household per housing unit. In 2020, the United States Census Bureau reported 278,756 housing units in San Mateo County, which increased to 287,184 in 2024, a 3.0% increase. **Table 3-15** outlines the housing summary for San Mateo County.[43,44]

Table 3-15. Housing Summary (2024)

Housing Category	Estimate
Total Housing Units	287,184
Owner-Occupied Housing Unit Rate	58.5%
Median Value of Owner-Occupied Housing Units	$1,559,600
Median Selected Monthly Owner Costs (with mortgage)	$4,000
Median Selected Monthly Owner Costs (without mortgage)	$29,700
Median Gross Rent	$2,922
Households *(i.e., occupied housing units)*	264,419
Persons per Household	2.89

[43] United States Census Bureau. (2020). DP04: Selected Housing Characteristics (2020: ACS 5-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP5Y2020.DP04?g=050XX00US06081.
[44] United States Census Bureau. (2024). DP04: Selected Housing Characteristics (2024: ACS 5-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP5Y2024.DP04?g=050XX00US06081.

In 2024, single-family detached units account for the largest share (55.3%) of the County's housing stock, followed by multifamily buildings with 20 or more units (17.0%). **Table 3-16** outlines the housing inventory by type.[45]

Table 3-16. Housing Inventory by Unit Type (2024)

Unit Type	Estimate	Percent
1-Unit (Detached)	158,871	55.3%
1-Unit (Attached)	25,053	8.7%
2 Units	5,690	2.0%
3 or 4 Units	11,491	4.0%
5 to 9 Units	16,093	5.6%
10 to 19 Units	17,525	6.1%
20 or More Units	48,827	17.0%
Mobile Home	3,300	1.1%
Boat, RV, Van, etc.	334	0.1%

3.8. Political Governance

San Mateo County provides for the health and welfare of all people within its borders and serves as the local government for the unincorporated areas. The County is governed by a five (5) member Board of Supervisors. Each member represents a geographic district covering both incorporated and unincorporated areas in the County. Board members represent one (1) of five (5) districts of roughly equal population within the County and are elected only by voters in their own district. Most of the County's unincorporated areas fall under District 3, which contains the majority of the western and southern lands in the County. Additionally, voters elect six (6) additional County officials - the Assessor-County Clerk-Recorder/Chief Elections Officer, District Attorney, Controller, Coroner, Sheriff, and Treasurer-Tax Collector.

San Mateo County departments encompass:

- Department of Agriculture/Weights and Measures
- Office of Assessor-County Clerk-Recorder and Chief Elections Officer
- Board of Supervisors
- Child Support Services
- Controller's Office
- Coroner's Office
- Human Services Agency
- County Libraries
- Parks Department
- Planning and Building Department
- Probation Department
- Office of Public Safety Communications
- Department of Public Works

45 Ibid.

- County Attorney's Office
- County Executive's Office
- Superior Court
- District Attorney's Office
- Department of Emergency Management
- Health (San Mateo County Health)
- Department of Housing
- Human Resources Department
- Revenue Services
- Fire Department
- Sheriff's Office
- Sustainability Department
- Tax Collector's Office
- Technology Services Department
- Treasurer/Tax Collector Office

3.9. Land Use

Land use planning is a fundamental component of hazard mitigation (e.g., agricultural, low-density land use areas face a lower risk in a floodplain than high-density residential areas). In California, each local jurisdiction, including San Mateo County and its 20 municipalities, is legally required to adopt a comprehensive, long-term General Plan to guide community development. By State law, the General Plan must contain eight (8) mandated elements – land use, circulation, housing, conservation, open space, noise, safety, and environmental justice. Additionally, the General Plan must comprise an integrated and internally consistent set of goals, policies, and implementation measures. Local regulatory capabilities for each plan participant are detailed in their respective annex.

The land in Unincorporated San Mateo County is primarily designated for resource management, with permitted uses including agricultural, commercial, and residential types of development. The County has adopted these land use designations to promote community values for the benefit of future generations. San Mateo County's primary land use controls are General Plan policies, the zoning code, subdivision regulations, and building codes. Through these controls, the County maintains standards that allow and incentivize appropriate development while ensuring compatibility of uses, public safety, and environmental protection.

As the County's fundamental land use and development policy document, the General Plan establishes the parameters for the type and extent of housing permitted within the Unincorporated County. It outlines overarching development policies that are further operationalized through zoning and subdivision regulations. Specifically, the General Plan establishes basic land use designations for all unincorporated areas and maintains an urban/rural boundary. The boundary defines the allowed intensity and type of development based on the characteristics of a given area and sets specific ranges for development densities.

The San Mateo County General Plan balances competing land use objectives, including:

- Preserving and enhancing the character of local communities and environments.
- Preventing or minimizing negative impacts on natural resources.
- Supporting land use distributions that provide resources and opportunities for all residents to obtain adequate housing, employment, and services.

- Maximizing the strength and viability of local economies.
- Minimizing the costs of providing public improvements, facilities, and services.
- Minimizing energy usage and exposure of life and property to environmental hazards.
- Creating and maintaining physically coherent, workable, vital communities.

The urban/rural boundary demarcates areas appropriate for urban or rural development, with higher residential densities generally permitted in urban areas. By setting these densities, the General Plan provides clear direction on where housing and other urban development are appropriate and where resources are available to support it. Conversely, in rural areas, the plan encourages lower-density development compatible with agriculture, recreational open space, and resource management.

Table 3-17 outlines the permitted residential development densities for each land use designation, including urban and rural residential densities. Allowed residential densities range from roughly 0.2 units/acre (Very Low Density Residential) to 120 units/acre (Commercial Mixed-Use). These designations establish the mandatory minimum and maximum densities for all permitted residential development.

Table 3-17. Land Use Designations and Densities

Designation	Residential Density *(units/net acre)*
Urban Land Uses	
Low Density Residential	0.3 – 2.3
Medium Low Density Residential	2.4 – 6.0
Medium Density Residential	6.1 – 8.7
Medium High Density Residential	8.8 – 17.4
High Density Residential	17.5 – 87.0
Single-Family Residential (North Fair Oaks)	15.0 – 24.0
Multi-Family Residential (North Fair Oaks)	24.0 – 60.0
Neighborhood Mixed-Use	24.0 – 60.0
Commercial Mixed-Use	24.0 – 80.0
Commercial Mixed-Use/Middlefield Junction	60.0 – 120.0
Industrial Mixed-Use	0 – 40.0**
General Commercial	n/a
Neighborhood Commercial	n/a
Commercial Recreation	n/a
Office Commercial	n/a
Office/Residential	n/a
General Industrial	n/a

Designation	Residential Density *(units/net acre)*
Heavy Industrial	n/a
Industrial Buffer	n/a
Institutional	n/a
Airport/Airport Transportation-Related	n/a
Public Recreation	n/a
Private Recreation	n/a
General Open Space	n/a
Rural Land Uses	
Very Low Density Residential	Roughly 1 unit/5 acres
Low Density Residential	0.3 – 2.3
Medium-Low Density Residential	2.4 – 6.0
Medium Density Residential	6.1 – 8.7
Neighborhood Commercial	n/a
General Commercial	n/a
General Open Space	n/a
Agriculture	n/a

Designations highlighted in blue are new land use designations adopted in Housing Element Cycle 5. All designations except Industrial Mixed Use require that the majority of any project must be multi-family residential, with no more than one (1) ground-floor story of non-residential uses allowed. The Single- and Multi-Family Residential designations allow only residential uses, at greater densities than previously allowed. The Commercial Mixed-Use designations allow 100% multifamily residential uses by right and entirely disallow non-residential uses.

***Residential uses are allowed but not required in IMU areas, with allowed densities varying by location.*

The County's Zoning Regulations refine the broad designations outlined in the General Plan by defining specific permitted uses, structure size and placement, structure design, parking requirements, facilities and community benefits, and a variety of other standards that determine what can be built on a specific parcel. In combination with land use designations, these regulations play a significant role in determining the types and densities of housing permitted in the Unincorporated County. The County's Zoning Regulations can be accessed via the San Mateo County Zoning page.

To address the unique needs of diverse unincorporated communities, the County utilizes specialized plans that provide a more granular land use and housing policies.

- **Specific Area Plans:** The County has adopted seven (7) area plans for specific unincorporated communities – North Fair Oaks Community Plan, Emerald Lake Hills Community Plan, Montara-Moss Beach-El Granada Community Plan, San Bruno Mountain General Plan Amendment, Skyline Area General Plan Amendment, and the Colma BART Station Area Plan. Each of these plans contains land use, development, and housing-related policies that apply to the specific area.

- **Local Coastal Program (LCP):** For areas within the coastal zone, the LCP establishes specific land use policies, along with zoning and other regulations that constitute the Implementation Plan.
- **Airport Land Use Compatibility:** There are three (3) airports within the County, which have adopted Airport Land Use Compatibility Plans – San Francisco International Airport, Half Moon Bay Airport, and San Carlos Airport. ***Note:*** *Although the San Francisco International Airport is physically located within San Mateo County, it is owned and operated by the City and County of San Francisco as an enterprise department.*

The San Mateo County General Plan and its elements are accessible via the San Mateo County General Plan page.

3.10. Changes in Development

An understanding of population and development trends can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place to protect public health, life safety, the environment, and community infrastructure. Communities are required to consider land use trends in hazard mitigation, which can alter the need for and priority of mitigation options over time. Land use and development trends significantly affect exposure and vulnerability to various hazards. For example, significant development in a hazard area increases the building stock and population exposed to that hazard.

New developments that have occurred over the last five (5) years and potential future developments in the next five (5) years, as identified by each jurisdiction, are addressed in each jurisdiction's annexes.

Areas targeted for future growth and development have been identified across the County. According to the Association of Bay Area Governments (ABAG), San Mateo County anticipates significant growth, with households projected to increase approximately 37% to 394,000 by 2050. In 2026, the County is proposing an ordinance that creates and applies new high-density residential mixed-use zoning districts to implement the County's Housing Element Rezoning Program, allowing and facilitating additional high-density residential development to meet the County's quantified share of regional housing need. The proposed zoning map amendments apply to parcels identified in the Housing Element Rezoning Program in Broadmoor, the Harbor Industrial area, and unincorporated Colma.

In June 2025, the California Department of Housing and Community Development (HCD) approved the ABAG Regional Housing Needs Allocation (RHNA) Plan. The current housing allocation for the 21 listed jurisdictions in San Mateo County (20 municipalities and Unincorporated County) is 47,687 housing units. Very low income and above moderate income housing types make up a sizeable portion of this allocation.[46] At the time of this LHMP update, all cities and the County were updating their housing elements. This will assess housing needs from 2023 to 2031 and establish policies and programs to address them. The housing element must also demonstrate that the Unincorporated County has sites

[46] Association of Bay Area Governments. (2025). Final Regional Housing Needs Allocation (RHNA) Plan: San Francisco Bay Area, 2023 – 2031. Retrieved from https://abag.ca.gov/tools-resources/digital-library/final-rhna-methodology-report-2023-2031jun2025update0pdf.

that can be developed or redeveloped to meet the County's regional housing needs allocation. In fiscal year 2023-2024, the County's Planning and Building Department issued 1,255 building permits.[47]

3.11. Critical Facilities

San Mateo County determined that the definition of critical facilities should align with FEMA's Community Lifeline framework.[48] This approach ensures the vulnerability assessment accounts for essential services required for community stability and disaster recovery, maintains consistency with federal standards, and enhances cross-jurisdictional coordination.

- **Safety and Security:** Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Hydration, Shelter:** Food, Hydration, Shelter, Agriculture
- **Health and Medical:** Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy:** Power Grid, Fuel
- **Communications:** Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation:** Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Materials:** Facilities, HAZMAT, Pollutants, Contaminants
- **Water Systems:** Potable Water Infrastructure, Wastewater Management

Figure 3-2 shows the locations of critical facilities. Due to the sensitivity of this information, a detailed list of facilities is not included in this Plan. The list is on file with the San Mateo County Department of Emergency Management.

Figure 3-2. Critical Facilities in San Mateo County

[Map is under development…]

[47] California Department of Housing and Community Development. (2025). Annual Progress Reports - Data Dashboard and Downloads. Retrieved from https://www.hcd.ca.gov/housing-open-data-tools/apr-dashboard.
[48] Federal Emergency Management Agency. (2024). Community Lifelines. Retrieved from https://www.fema.gov/emergency-managers/practitioners/lifelines.

CHAPTER 4. HAZARD IDENTIFICATION AND RISK ASSESSMENT

A risk assessment is the process of measuring the potential loss of life, personal injury, economic losses, and property damage resulting from identified hazards. It allows planning personnel to address and reduce hazard impacts and emergency management personnel to establish early response priorities by identifying potential hazards and vulnerable assets. Results of the risk assessment are used in subsequent mitigation planning processes, including determining and prioritizing mitigation actions to reduce each jurisdiction's risk from a specified hazard. Past, present, and future conditions must be evaluated to most accurately assess risk for the County and each jurisdiction. The process focuses on the following elements:

- **Hazard Identification:** Use all available information to determine what types of hazards may affect a jurisdiction, how often they can occur, and their potential severity.
- **Vulnerability Identification:** Determine the impact of natural hazard events on the population, environment, economy, and lands of the region. Develop hazard profiles to understand each hazard in terms of:
    - Location (geographic area within the planning area most affected by the hazard)
    - Extent/Severity (severity of each hazard)
    - Probability and Frequency
    - Past Events
- **Assess Vulnerability and Impacts:**
    - *Exposure identification:* Estimate the total number of assets in the jurisdiction that are likely to experience a hazard event if it occurs by overlaying hazard maps with the asset inventories.
    - *Vulnerability identification and loss estimation:* Assess the impact of hazard events on the people, property, economy, and lands of the region, including estimates of the cost of potential damage or the cost that can be avoided by mitigation.
    - *Future changes that may impact vulnerability:* Analyze how demographic changes, projected development, and future conditions can impact current exposure and vulnerability.
    - *Secondary hazards:* Assess the potential secondary indirect impacts of the hazard (e.g., wildfire-related erosion).

This LHMP is designated to comply with the requirements of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended, and Related Authorities and 44 CFR Part 201 (44 CFR § 201.6), which states that local governments must have an approved hazard mitigation plan in place for eligibility of pre-disaster and/or post-disaster mitigation grant funds. This Plan is also designed to comply with FEMA and Cal OES guidance documents (particularly the Local Mitigation Planning Policy Guide, effective April 11, 2025), as well as other applicable federal, state, and local regulations. This was accomplished by evaluating the impacts of known natural hazards, prioritizing mitigation alternatives, and coordinating hazard mitigation with other San Mateo County programs and policies.

4.1. Identified Hazards

To provide a strong foundation for mitigation actions in this LHMP, San Mateo County analyzed a full range of potential hazards, identifying and ranking those of greatest concern. While disaster planning generally categorizes threats as natural, human-caused, or technological, this Plan focuses specifically on the natural hazards relevant to the planning area.

The identification process and frequency evaluation incorporated input from the Steering Committee, plan participants (municipalities and special districts), and the public while utilizing a historical analysis of the following resources:

- **Stakeholder Input:** Steering Committee, municipalities, special districts, the public (via survey, community outreach, and engagement)
- **Planning Documents:** 2021 San Mateo County Local Hazard Mitigation Plan, 2023 California State Hazard Mitigation Plan, and other hazard planning documents developed by state, federal, and private agencies
- **Technical Data:** National Oceanic and Atmospheric Administration (NOAA), National Centers for Environmental Information (NCEI), National Weather Service (NWS), United States Geological Survey (USGS), FEMA National Risk Index

While some hazards can affect the entire County, others (e.g., flooding) are more localized. Hazards that have been identified as significant in San Mateo County and that will be considered in this Plan are listed in **Table 4-1**.

Table 4-1. San Mateo County Hazards

Natural Hazards
Dam Failure
Drought
Earthquake
Flood *(riverine flooding, urban/flash flooding, coastal flooding)*
Landslide
Sea Level Rise
Severe Weather *(heavy rainfall, severe thunderstorms, strong winds, tornadoes, heat wave/extreme heat, fog)*
Tsunami
Wildfire

Additionally, the Steering Committee identified several *hazards of interest*. While the federal guidelines do not require these to be evaluated, the Committee determined it was important to recognize them qualitatively. Profiles for these hazards, provided without a quantitative risk assessment (without a full risk assessment), are listed in **Table 4-2**.

Table 4-2. Hazards of Interest

Human-Caused/Technological
Aircraft Incidents
Communication Failure
Cyberattack
Hazardous Materials Release
Pipeline and Tank Failure
Public Health and Pandemic
Terrorism

Per FEMA's requirement to consider all natural hazards, the following were not included because they are not considered significant for the San Mateo County planning area, given its geographic location and the lack of significant historical occurrences.

- Avalanche
- Cold Wave
- Hail
- Hurricane
- Ice Storm
- Lightning
- Volcanic Activity
- Winter Weather

4.2. Presidential Disaster and Emergency Declarations

Presidential disaster declarations are typically issued for hazard events that cause more damage than state and local governments can manage without assistance from the Federal government. However, no specific dollar loss threshold has been established for these declarations. A presidential disaster declaration initiates federal recovery programs to assist disaster victims, businesses, and public entities. State programs match some of the programs. **Table 4-3** lists all emergency proclamations (State) and federal disaster declarations in San Mateo County between 1953 and 2025, according to FEMA and Cal

OES.[49,50,51] Since 1953, San Mateo County has had one (1) emergency declaration, 24 disaster declarations, and one (1) fire management assistance declaration. This list provides the foundation for identifying the hazards that pose the most significant risk to San Mateo County.

Table 4-3. State and Federal Declarations for San Mateo County

Event Type/Name	State Proclamation Date	Disaster Number	Federal Declaration Date	FEMA Disaster Number
March 2024 Storms	5/3/2024	Not Available	Not Declared	n/a
Severe Winter Storms, Straight-line Winds, Flooding, Landslides, Mudslides *(Late February-Early March 2023 Winter Storms)*	3/1/2023 3/8/2023	2023-05	4/3/2023	DR-4699
Severe Winter Storms, Flooding, Landslides, Mudslides *(2022-2023 Early Winter Storms)*	1/4/2023	2023-01	1/14/2023	DR-4683
Winter Storms	12/31/2021	Not Available	Not Declared	n/a
Wildfire *(August 2020 Wildfires)*	8/18/2020	2020-06	8/22/2020 8/20/2020	DR-4558 FM5336
Severe Winter Storms, Flooding, Mudslides *(February 2017 Storms)*	3/7/2017	2017-03	4/1/2017	DR-4308
Severe Winter Storms, Flooding, Mudslides *(Late January 2017 Storms)*	2/10/2017	2017-02	3/16/2017	DR-4305
Pacifica Storms	1/22/2016	2016-01	Not Declared	n/a
March 2011 California Tsunami	3/11/2011	2011-02	Not Declared	n/a
Pacifica Storm Drain Outfall	4/7/2010	2010-04	Not Declared	n/a
Severe Storms, Flooding, Landslides, Mudslides *(Spring Storm 2006)*	4/10/2006	2006-03	6/5/2006	DR-1646
Levee Erosion	3/28/2006	2006-02	Not Declared	n/a
Severe Storms, Flooding, Landslides, Mudslides *(2005-2006 Winter Storms)*	1/12/2006	2006-01	2/3/2006	DR-1628
March Storms and Landslides	3/1/2005	2005-05	Not Declared	n/a
Daly City Flooding	2/1/2004	2004-02	Not Declared	n/a
Millbrae Landslide	2/1/2000	2000-01	Not Declared	n/a

49 Federal Emergency Management Agency. (2025). Disaster and Other Declarations. Retrieved from https://www.fema.gov/disaster/declarations.
50 California Office of Emergency Services. (2023). California State Hazard Mitigation Plan: Appendix F (Emergency Proclamations and Disaster Declarations. Retrieved from https://www.caloes.ca.gov/wp-content/uploads/Hazard-Mitigation/Documents/2023-California-SHMP_Volume-2-Appendix-F_12.15.2023.pdf.
51 California Office of Emergency Services. (2026). Open State of Emergency Proclamations. Retrieved from https://www.caloes.ca.gov/office-of-the-director/policy-administration/legal-affairs/emergency-proclamations/.

Event Type/Name	State Proclamation Date	Disaster Number	Federal Declaration Date	FEMA Disaster Number
Severe Winter Storms, Flooding	Not Available	98-01	2/9/1998	DR-1203
Severe Storms, Flooding *(1997 January Floods)*	1/2/1997 – 1/31/1997	97-01	1/4/1997	DR-1155
Winter Storms	1/2/1997 – 1/31/1997	97-01	Not Declared	n/a
Torrential Rain, Winds	1/2/1995	96-01	Not Declared	n/a
Severe Winter Storms, Flooding, Landslides, Mudslides *(1995 Late Winter Storms, Northern CA)*	3/12/1995 – 3/24/1995	95-03	3/12/1995	DR-1046
Severe Winter Storms, Flooding, Landslides, Mudslides *(1995 Severe Winter Storms)*	1/6/1995 – 3/14/1995	95-01 95-02 95-03 95-04	1/10/1995	DR-1044
Severe Winter Storms, Flooding, Landslides, Mudslides *(1995 Winter Storms Northern CA)*	1/9/1995 – 2/17/1995	95-01	1/10/1995	DR-1044
Severe Freeze *(1990 Freeze)*	12/19/1990 – 1/18/1991	Not Available	2/11/1991	DR-894
Loma Prieta Earthquake	10/18/1989 – 10/30/1989	89-05	10/18/1989	DR-845
Severe Storms, Flooding *(1986 Storms)*	2/18/1986 – 3/12/1986	86-01	2/21/1986	DR-758
Coastal Storms, Flooding, Landslides, Tornadoes *(1982-1983 Floods)*	12/8/1982 – 3/21/1982	82-18	2/9/1983	DR-677
Severe Storms, Flooding, Mudslides, High Tide *(1982 Winter Storms)*	1/5/1982 – 1/9/1982	Not Available	1/7/1982	DR-651
Wave Action, High Tides	3/1981	81-01	No Declared	n/a
1980 April Storms	4/1/1980	80-01 – 80-25	No Declared	n/a
Drought	Not Proclaimed	n/a	1/20/1977	EM-3023
1976 Drought	2/9/1976 2/13/1976 2/24/1976 3/26/1976 7/6/1976	Not Available	Not Declared	n/a
Severe Storms, High Ties, Flooding	1/23/1973 1/30/1973 2/8/1973 2/28/1973	Not Available	2/3/1973	DR-364
Storms, Flooding	4/11/1973	n/a	Not Declared	n/a
1966 Landslides	12/16/1966	n/a	Not Declared	n/a
Severe Storms, Heavy Rains, Flooding	Not Proclaimed	n/a	2/25/1963	DR-145

Event Type/Name	State Proclamation Date	Disaster Number	Federal Declaration Date	FEMA Disaster Number
Severe Storms, Flooding	10/24/962	Not Available	10/24/1962	DR-138
Heavy Rainstorms, Flooding *(1958 April Storms and Floods)*	4/2/1958	Not Available	4/4/1958	DR-82
Forest Fire *(1956 Fires)*	Not Proclaimed	n/a	12/29/1956	DR-65
Flooding	Not Available	12/22/1955	12/23/1955	DR-47
Flooding, Erosion	n/a	n/a	2/5/1954	DR-15

4.3. Risk Assessment Methodology

As part of San Mateo County's hazard mitigation planning process, the risk assessment evaluates natural hazards that may impact all or portions of the County. Hazard identification, historical occurrences, and risk modeling (where applicable and available for specific hazards) information was collected from multiple sources, including, but not limited to:

- Environmental Systems Research Institute (Esri)
- Federal Emergency Management Agency (FEMA)
- National Centers for Environmental Information (NCEI)
- National Weather Services (NWS)
- United States Geological Survey (USGS)
- United States Drought Monitor
- Hazus (for Earthquakes and Flood)
- Local repositories

This information was analyzed to assess the risks, vulnerabilities, and impacts on people, underserved populations, property, infrastructure, current and future development, the economy, the environment, and the jurisdiction's continuity of services/delivery of services. Furthermore, a risk ranking was performed for the hazards of concern described in this LHMP. The risk ranking is an important step in developing an action plan, as it enables jurisdictions to compare risk factors across different hazards. That comparison provides critical information for selecting hazard mitigation actions and their priorities. This process is intended not only to focus actions on the highest-ranking hazards, but also to ensure that jurisdictions are aware of hazards that rank low yet still pose a significant risk.

To provide an informed and comprehensive analysis and ranking of the hazards included in this Plan, four (4) key factors were evaluated – probability, extent, vulnerability, and impact. The scores for extent, vulnerability, and impact were weighted and combined to produce a consequence score. This consequence score was then multiplied by the probability score to calculate the total risk score for each hazard.

Extent + Vulnerability + Impact = Consequence
Consequence x Probability = Total Risk Score

These results were determined by conducting a data-driven quantitative assessment, reviewing and ranking local knowledge from local subject matter experts, and developing additional risk elements by the Core Planning Team based on the collected data. These elements were then aggregated to inform the analysis.

At the fundamental level, consequence is an assessment of the potential impact(s) if the hazard incident were actually to occur. In this risk assessment, the consequence score (i.e., the consequence of an event) will be interdependent on the following factors:

- **Extent** of the hazard (i.e., severity, catastrophic potential).
- **Vulnerability** of the population, property (including critical infrastructure), and changes in development.
- **Impact** on population life safety (including underserved communities), property (including critical infrastructure), the economy, the environment, continuity of operations/delivery of services, future development, and climate change.

The probability of the hazard is not included in assessing the consequence because, without the event, there is no consequence or impact.

4.3.1. Probability of Occurrence

The probability of occurrence of a hazard is indicated by a probability factor based on the likelihood of an annual occurrence. Numerical probability factors were assigned as follows.

Table 4-4 outlines the probability of occurrence factors used in the risk assessment calculations for this Plan. A *significant hazard* event is defined as any hazard occurrence that directly or indirectly damages structures or infrastructure, impedes normal business operations, and/or is likely to cause serious or fatal injuries.

Table 4-4. Probability of Occurrence

Probability	Description	Probability Factor
High	A significant hazard event is likely to occur annually.	3
Medium	A significant hazard event is likely to occur within 25 years.	2
Low	A significant hazard event is likely to occur within 100 years.	1
Unlikely	There is little to no probability of a significant occurrence, or the recurrence interval is greater than every 100 years.	0

The assessment of hazard frequency is generally based on past hazard events in the area and the professional judgment of local subject matter experts.

4.3.2. Extent Factors

Extent was assessed in two (2) categories – extent/severity potential and catastrophic probability of the hazard. Numerical extent factors were assigned as follows.

4.3.2.1. Extent/Severity Factor

Extent is defined as the range of anticipated intensities of the identified hazards. Severity refers to the potential degree of harm or damage that could result from a hazard. This category is most commonly expressed using various scientific scales (e.g., the Saffir-Simpson Hurricane Wind Scale, the Enhanced Fujita Scale, the Modified Mercalli Intensity). The scientific scales are hazard-specific and are detailed under each hazard profile. **Table 4-5** outlines the extent/severity factors used in the risk assessment calculations for this analysis.

Table 4-5. Extent/Severity Factor

Extent	Description	Extent Factor
High	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a high-intensity incident.	3
Medium	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a medium-intensity incident.	2
Low	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a low-intensity incident.	1
Unlikely	Historical and/or probabilistic models/studies for this hazard indicate the possibility of little to no intensity.	0

4.3.2.2. Catastrophic Factor

The probability that a hazard could be catastrophic. A catastrophic incident can be defined as any natural, human-caused, or technological disaster that results in extraordinary levels of casualties, damage, or disruption, severely affecting the population (including mass evacuations), infrastructure, environment, economy, national morale, or government functions in the area.[52] **Table 4-6** outlines the catastrophic factors used in the risk assessment calculations for this Plan.

Table 4-6. Catastrophic Factor

Extent	Description	Extent Factor
High	High potential that this hazard could be catastrophic.	3
Medium	Medium potential that this hazard could be catastrophic.	2
Low	Low potential that this hazard could be catastrophic.	1
Unlikely	Virtually no probability that this hazard could be catastrophic.	0

[52] Federal Emergency Management Agency. (2019). National Response Framework (Fourth Edition). Retrieved from https://www.fema.gov/sites/default/files/documents/NRF_FINALApproved_2011028.pdf.

Each category was assigned a weighting factor to reflect its significance, consistent with methods typically used for evaluating extent. A weighted factor of three (3) was assigned for *Extent/Severity* and its *Catastrophic* potential.

4.3.3. Vulnerability Factors

Vulnerabilities are assessed in three (3) categories – population exposure, property exposure, and exposure based on changes in development. Numerical vulnerability factors were assigned as follows.

4.3.3.1. Population Exposure

Population exposure values were assigned based on the percentage of the total population that is exposed to the hazard event. **Table 4-7** outlines the population exposure factors used in the risk assessment calculations for this Plan.

Table 4-7. Population Exposure Factor

Vulnerability	Description	Vulnerability Factor
High	30% or more of the population is exposed to the hazard.	3
Medium	15% to 29% of the population is exposed to the hazard.	2
Low	14% or less of the population is exposed to the hazard.	1
Unlikely	None of the population is exposed to the hazard.	0

4.3.3.2. Property Exposure Factor

Property exposure values were assigned based on the percentage of the total property value that is exposed to the hazard event. **Table 4-8** outlines the property exposure factors used in the risk assessment calculations for this Plan.

Table 4-8. Property Exposure Factor

Vulnerability	Description	Vulnerability Factor
High	25% or more of the total assessed property value is exposed to the hazard.	3
Medium	10% to 24% of the total assessed property value is exposed to a hazard.	2
Low	9% or less of the total assessed property value is exposed to a hazard.	1
Unlikely	None of the total assessed property value is exposed to a hazard.	0

4.3.3.3. Changes in Development Factor

Changes in development (e.g., land use, population growth, redevelopment) over the past five (5) years that have increased or decreased the community's vulnerability (exposure) to the hazard. **Table 4-9** outlines the changes in development factors used in the risk assessment calculations for this Plan.

Table 4-9. Changes in Development Factor

Vulnerability	Description	Vulnerability Factor
High	Changes in development have increased the community's exposure to the hazard by 10% or more.	3
Medium	Changes in development have increased the community's exposure to the hazard between 5% and 9%.	2
Low	Changes in development have increased the community's exposure to the hazard by 4% or less.	1
Unlikely	Changes in development have had no effect and/or have decreased the community's exposure to the hazard.	0

Each category was assigned a weighted factor reflecting its significance, consistent with methods typically used to evaluate vulnerability (i.e., exposure). A weighted factor of three (3) was assigned for *Population Exposure*, and a weighted factor of one (1) was assigned for *Property Exposure* and *Changes in Development*.

4.3.4. Impact Factors

Hazard impacts were assessed in eight (8) categories – population and life safety; underserved population; property, facilities, and infrastructure; economic; environmental; continuity of operations/delivery of services; future development; and climate change. Numerical impact factors were assigned as follows.

4.3.4.1. Population and Life Safety Factor

Population and life safety values were assigned based on the best available data (historical and probabilistic) for people vulnerable to the hazard event and whether the affected population is likely to experience adverse impacts from the hazard incident. **Table 4-10** outlines the population and life safety factors used in the risk assessment calculations for this Plan.

Table 4-10. Population and Life Safety Factor

Impact	Description	Impact Factor
High	Populations exposed to this hazard are likely to experience significant adverse impacts, such as fatalities and severe injuries.	3
Medium	Populations exposed to this hazard are likely to experience some adverse impacts, such as injuries requiring acute medical care.	2
Low	Populations exposed to this hazard are likely to experience minimal adverse impacts, such as ambulatory injuries.	1
Unlikely	Populations exposed to this hazard are not likely to experience significant adverse impacts.	0

4.3.4.2. Underserved Population Factor

Underserved population values were assigned based on the best available data for underserved populations vulnerable to the hazard, and on whether the affected population is likely to experience adverse/disproportionate impacts from the hazard event, resulting in greater equity disparities. **Table 4-11** outlines the underserved population factors used in the risk assessment calculations for this Plan.

Table 4-11. Underserved Population Factor

Impact	Description	Impact Factor
High	Underserved populations exposed to the hazard are likely to experience significant adverse/disproportionate impacts, such as fatalities and severe injuries.	3
Medium	Underserved populations exposed to the hazard are likely to experience some adverse/disproportionate impacts, such as injuries requiring acute medical care.	2
Low	Underserved populations exposed to the hazard are likely to experience minimal adverse/disproportionate impacts, such as ambulatory injuries.	1
Unlikely	Underserved populations exposed to the hazard are not likely to experience significant adverse/disproportionate impacts.	0

4.3.4.3. Property, Facilities, and Critical Infrastructure Damage Factor

Property, facilities, and critical infrastructure damage values were assigned based on the expected total property damage incurred from a hazard event. It is essential to note that values represent estimates of the potential loss from a single *significant event*, based on historical data, probabilistic models, and studies. **Table 4-12** outlines the property, facilities, and critical infrastructure damage factors used in the risk assessment calculations for this Plan.

Table 4-12. Property, Facilities, and Critical Infrastructure Damage Factor

Impact	Description	Impact Factor
High	More than $5 million in property, facilities, and infrastructure damage is expected from a single significant event, or damages are expected to occur to 15% or more of the property value within the jurisdiction.	3
Medium	More than $500,000 but less than $5 million in property, facilities, and infrastructure damage is expected from a single significant event, or damages are expected to occur to more than 5% but less than 15% of the property value within the jurisdiction.	2
Low	Less than $500,000 in property, facilities, and infrastructure damages is expected from a single significant event, or damages are expected to occur to less than 5% of the property value within the jurisdiction.	1
Unlikely	Little to no property, facilities, and infrastructure damage is expected from a single significant event.	0

4.3.4.4. Economic Factor

An estimate of the impact, expressed in dollars, on the local economy is based on a loss of business revenue, crops, worker wages, and local tax revenues, or on the impact on the local gross domestic product (GDP) from a single *significant event*. **Table 4-13** outlines the economic factors used in the risk assessment calculations for this Plan.

Table 4-13. Economic Factor

Impact	Description	Impact Factor
High	Total economic impact is likely to be greater than $10 million.	3
Medium	Total economic impact is likely to be greater than $100,000, but less than or equal to $10 million.	2
Low	Total economic impact is not likely to be greater than $100,000.	1
Unlikely	Virtually no significant economic impact.	0

4.3.4.5. Environmental Factor

An estimate of the environmental impact from a single *significant event* requiring outside resources and support; and/or repair, cleanup, restoration, and/or preservation work. **Table 4-14** outlines the environmental factors used in the risk assessment calculations for this Plan.

Table 4-14. Environmental Factor

Impact	Description	Impact Factor
High	Environmental impact from a single significant event is likely to be substantial, requiring extensive outside resources and support; and/or repair, cleanup, restoration, and/or preservation work.	3
Medium	Environmental impact from a single significant event is likely to be localized, requiring some outside resources and support; and/or repair, cleanup, restoration, or preservation work.	2
Low	Environmental impact from a single significant event is likely to be minimal, requiring little to no outside resources and support; and/or minimal repair, cleanup, restoration, or preservation work.	1
Unlikely	No environmental impacts from a significant event are likely.	0

4.3.4.6. Continuity of Operations/Delivery of Services Factor

The continuity of operations/delivery of services factor assesses the impact on the jurisdiction's ability to meet the community's essential day-to-day operational needs (i.e., continuity of operations) following a single *significant event*. **Table 4-15** outlines the continuity of operations/delivery of services factors used in the risk assessment calculations for this Plan.

Table 4-15. Continuity of Operations/Delivery of Services Factor

Impact	Description	Impact Factor
High	Impact lasting more than 72 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single significant event.	3
Medium	Impact lasting between 24 and 72 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single significant event.	2

Impact	Description	Impact Factor
Low	Impact lasting less than 24 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single significant event.	1
Unlikely	No impact on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single significant event.	0

4.3.4.7. Future Development Factor

The future development factor assesses how planned or anticipated growth (e.g., new residential subdivisions, land use changes, critical infrastructure) could increase or decrease the hazard impacts in the community. For example, an increase in population density in a hazard-prone area can lead to greater economic losses from a single hazard event. **Table 4-16** outlines the future development factors used in the risk assessment calculations for this Plan.

Table 4-16. Future Development Factor

Impact	Description	Impact Factor
High	Future development trends will significantly increase the impacts of this hazard.	3
Medium	Future development trends will increase the impacts of this hazard, but not significantly.	2
Low	Future development trends will minimally increase the impacts of this hazard.	1
Unlikely	Future development trends will not increase the impacts of this hazard, and/or may even decrease it.	0

4.3.4.8. Climate Change Factor

The climate change factor assesses how climate change trends may increase or decrease the hazard impacts in the community. **Table 4-17** outlines the climate change factors used in the risk assessment calculations for this Plan.

Table 4-17. Climate Change Factor

Impact	Description	Impact Factor
High	Climate Change trends will significantly increase the impacts of this hazard.	3
Medium	Climate Change trends will increase the impacts of this hazard, but not significantly.	2
Low	Future development trends will minimally increase the impacts of this hazard.	1
Unlikely	Climate Change trends will minimally increase the impacts of this hazard.	0

Each category was assigned a weighted factor reflecting its significance, consistent with methods typically used to evaluate impacts. A weighted factor of three (3) was assigned for *Population and Life Safety* and *Underserved Population*; a weighted factor of two (2) was assigned for *Property, Facilities, and Critical Infrastructure Damage*; and a weighted factor of one (1) was assigned for *Economic*, *Environmental*, *Continuity of Operations/Delivery of Services*, *Future Development*, and *Climate Change*.

4.4. FEMA National Risk Index Score

The National Risk Index (NRI) is a dataset and online tool that helps illustrate which United States communities are most at risk from 18 natural hazards.

- Avalanche
- Coastal Flooding
- Cold Wave
- Drought
- Earthquake
- Hail
- Heat Wave
- Hurricane
- Ice Storm
- Inland Flooding
- Landslide
- Lightning
- Strong Wind
- Tornado
- Tsunami
- Volcano Activity
- Wildfire
- Winter Weather

Not all the hazards on this list are applicable to San Mateo County; therefore, only those hazards with a defined risk to the County will be included in this Plan, as listed in **Table 4-1**. The NRI's goal is to fill gaps in available data and analyses to inform better federal, state, local, tribal, and territorial decision-makers as they develop risk reduction strategies.

In the NRI, risk is defined as the potential for negative impacts resulting from a natural hazard. The Risk Index is based on three (3) components – a natural hazards component (Expected Annual Loss), a consequence-enhancing component (Social Vulnerability), and a consequence-reduction component (Community Resilience). Using these components, the composite and hazard type Risk Index values are calculated for each community (county and Census Tract). Risk Index values form an absolute basis for measuring Risk within the NRI and are used to generate Risk Index percentiles and ratings across communities.[53] **Table 4-18** illustrates the Risk Index rating and score for San Mateo County.

Table 4-18. Risk Index Score for San Mateo County *(FEMA National Risk Index)*

Rating	Score
Relatively High	99.2

Risk Index Values are calculated by combining the Social Vulnerability and Community Resilience components into a single Community Risk Factor, which is then multiplied by the Expected Annual Loss component (Expected Annual Loss x (Social Vulnerability / Community Resilience) = Risk Index).

4.4.1. Expected Annual Loss

The Expected Annual Loss (EAL), the natural hazards component of the NRI, represents the average economic loss in dollars to buildings, people, and/or agriculture (consequence types) each year due to

[53] Federal Emergency Management Agency. (2025). National Risk Index Data: Technical Documentation. Retrieved from https://www.fema.gov/sites/default/files/documents/fema_national-risk-index_technical-documentation.pdf.

natural hazards. The EAL score and rating represent a community's relative level of expected annual losses compared to other communities at the same level. Since the score is positively associated with a community's risk, the higher EAL score results in a higher Risk Index score.[54] **Table 4-19** illustrates the EAL rating and score for San Mateo County.

Table 4-19. Expected Annual Loss for San Mateo County *(FEMA National Risk Index)*

Rating	Score
Relatively High	99.4
Expected Annual Loss scores are calculated using an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).	

An EAL score and rating are calculated independently for each consequence type (i.e., buildings, population, and agriculture) for each county and Census Tract. The population EAL is measured in terms of fatalities and injuries, while the building and agricultural values are measured in dollars. However, for consistency in the unit of measurement, population loss is monetized into a population-equivalence value using a Value of Statistical Life approach, in which each fatality or 10 injuries is treated as $13.7 million in economic loss, an inflation-adjusted Value of Statistical Life used by FEMA.[55]

4.4.2. Social Vulnerability

Social vulnerability, the consequence-enhancing risk component of the NRI, measures the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. The Social Vulnerability score and rating represent the relative level of a community's social vulnerability compared to all other communities at the same level. A higher Social Vulnerability score results in a higher Risk Index score.[56] **Table 4-20** illustrates the Social Vulnerability rating and score for San Mateo County.

Table 4-20. Social Vulnerability for San Mateo County *(FEMA National Risk Index)*

Rating	Score
Relatively Low	20.5
Social Vulnerability is measured using the Centers for Disease Control and Prevention's (CDC)/Agency for Toxic Substances and Disease Registry's (ATSDR) Social Vulnerability Index (SVI).	

4.4.3. Community Resilience

Community resilience, the consequence reduction risk component, measures a community's ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. The Community Resilience score and rating represent the relative level of a community's resilience compared to all other communities at the same level. Since the score is inversely proportional to a community's risk, the higher Community Resilience score results in a lower Risk Index score.[57] **Table 4-21** illustrates the Community Resilience rating and score for San Mateo County.

[54] Ibid.
[55] Ibid.
[56] Ibid.
[57] Ibid.

Table 4-21. Community Resilience for San Mateo County *(FEMA National Risk Index)*

Rating	Score
Very High	97.6
Community Resilience is measured using the Baseline Resilience Indicators for Communities (HVRI BRIC) published by the University of South Carolina's Hazards and Vulnerability Research Institute (HVRI).	

4.5. Climate Change

NOAA defines climate change as changes in average weather conditions that persist over multiple decades or longer. Climate change encompasses both increases and decreases in temperature, shifts in precipitation, changes in the frequency and location of severe weather events, and changes in other features of the climate system.[58]

Greenhouse gases (GHG) emissions consist of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and three (3) human-made gases – chlorofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). The first three (3) gases are naturally present in Earth's atmosphere and create the greenhouse effect, which allows conditions to be habitable. However, increasing the levels of these greenhouse gases in the atmosphere traps heat near the Earth's surface, causing the global average temperature to rise.[59]

Some gases are more potent at trapping heat. For instance, methane (the main component of natural gas) is 20 times more potent than carbon dioxide. That means one (1) unit of methane emitted into the atmosphere is equivalent to 20 units of carbon dioxide. This relative potency is known as a gas's global warming potential (GWP). The most notable sources of methane emissions are landfills, livestock (especially cows), and leaks during the extraction, storage, and combustion of natural gas. Nitrous oxide is even more potent than methane; each unit of nitrous oxide is equivalent to almost 300 units of carbon dioxide. Nitrous oxide is emitted from some agricultural activities, especially from fertilizer use, and fossil fuel combustion.

Other human-made gases are extremely potent greenhouse gases. Sulfur hexafluoride, used as an electric insulator, heat conductor, and freezing agent, is rated as the most powerful greenhouse gas ever released to the atmosphere, at 24,000 times more harmful than carbon dioxide. HFCs and PFCs are also powerful greenhouse gases commonly used in refrigeration and air-conditioning equipment, with GWPs in the thousands relative to carbon dioxide.[60]

4.5.1. Climate Change Indicators

4.5.1.1. Global Indicators

Earth's climate has changed throughout its history; it is part of Earth's cycle. However, scientists from agencies such as NASA and NOAA, as well as the Intergovernmental Panel on Climate Change (IPCC),

[58] Climate.gov. (2025). Key Definitions and Literature Cited. Retrieved from https://www.climate.gov/teaching/climate/key-definitions-and-literature-cited.
[59] National Aeronautics and Space Administration. (n.d.). What is the Greenhouse Effect? Retrieved from https://climate.nasa.gov/faq/19/what-is-the-greenhouse-effect/.
[60] San Mateo County Office of Sustainability. (2022). Community Climate Action Plan. Retrieved from https://www.smcsustainability.org/wp-content/uploads/SMC-CCAP.pdf.

agree that climate change is occurring faster than expected. Global surface temperatures continue to rise unequivocally as a result of greenhouse gas emissions from human activities. Between 2011 and 2020, global surface temperatures were 1.1 degrees Celsius (1.1°C) higher than the average between 1850 and 1900, with larger increases over land (1.6°C) than over the ocean (0.9°C). Global surface temperatures have increased at a faster rate since 1970 than any other 50-year period over the last 2,000 years.[61] The warmest years on record were between 2015 and 2024, with 2024 the warmest, at about 1.6°C above pre-industrial levels.[62]

Increasing global temperatures have affected weather patterns worldwide. In the United States, since 1950, the number of extreme heat events has increased, the number of record-low temperature events has decreased, and the number of heavy rainfall events has increased. Other climate change impacts include rising ocean temperatures and ocean acidification, shrinking ice sheets, retreating glaciers, decreasing snow cover, sea level rise, and declining Arctic sea ice.[63] Global climate change indicators are outlined in **Table 4-22**.[64]

Table 4-22. Climate Change Global Indicators

Indicators	Description
Global Temperature	The planet's average surface temperature has risen about 1°C (2°F) since the late 19th century, a change driven largely by increased carbon dioxide emissions into the atmosphere and other human activities. Most of the warming occurred in the past 40 years, with the seven (7) warmest years on record.
Warming Oceans	The oceans have absorbed much of this increased heat, with the top 328 feet of the ocean warming by more than 0.33°C (0.67°F) since 1969. The ocean stores 90% of the extra energy.
Shrinking Ice Sheets	The Greenland and Antarctic ice sheets have decreased in mass. Data from the National Aeronautics and Space Administration (NASA) show that Greenland lost an average of 279 billion tons of ice per year between 1993 and 2019, while Antarctica lost about 148 billion tons of ice per year during the same period.
Retreating Glaciers	Glaciers are retreating almost everywhere around the world, including in the Alps, Himalayas, Andes, Rockies, Alaska, and Africa.
Decreasing Snow Cover	Satellite observations reveal that spring snow cover in the Northern Hemisphere has decreased over the past five (5) decades, and snow is melting earlier.
Sea Level Rise	Global sea level rose about eight (8) inches (20 centimeters) in the last century. The rate in the last two (2) decades, however, is nearly double that of the last century and accelerating slightly every year.
Declining Arctic Sea Ice	Both the extent and thickness of Arctic sea ice have declined rapidly over the last several decades.
Increasing Extreme Events	Since 1950, the number of record high temperature events in the United States has been increasing, while the number of record low temperature events has been decreasing. The United States has also witnessed increasing numbers of intense rainfall events.

[61] Intergovernmental Panel on Climate Change. (2023). Climate Change 2023 Synthesis Report: Summary for Policymakers. Retrieved from https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf.
[62] World Meteorological Organization. (2025). WMO Confirms 2024 as Warmest Year on Record at About 1.55°C Above Pre-Industrial Level. Retrieved from https://wmo.int/news/media-centre/wmo-confirms-2024-warmest-year-record-about-155degc-above-pre-industrial-level.
[63] National Aeronautics and Space Administration. (n.d.). How Do We Know Climate Change Is Real? Retrieved from https://climate.nasa.gov/evidence/.
[64] National Aeronautics and Space Administration. (n.d.).Evidence. Retrieved from https://science.nasa.gov/climate-change/evidence/.

Indicators	Description
Increasing Ocean Acidification	Since the beginning of the Industrial Revolution, the acidity of surface ocean waters has increased by about 30%. This increase is due to humans emitting more carbon dioxide into the atmosphere, and hence, more is absorbed into the ocean. The ocean has absorbed between 20% and 30% of total anthropogenic carbon dioxide emissions in recent decades (7.2 to 10.8 billion metric tons per year).

4.5.1.2. California Indicators

Monitoring and research efforts across California have generated data that describe changes already underway in the State. As indicated in the Indicators of Climate Change in California (Fourth Edition), notable examples across the State include the following:[65]

- Dissolved oxygen in Southern California coastal waters is declining
- Lake Tahoe's waters warmed by almost twice over the past half century; six (6) of the last 10 years ranked among the warmest.
- Since 1950, the northern Sierra Nevada has shown an overall snowpack decline.
- Unusually warm waters occurred in the Pacific Ocean from 2014 to 2016, leading to widespread impacts on marine life. This marine heat wave first appeared as a large area of exceptionally high sea surface temperatures in the Gulf of Alaska in November 2013. It later extended along the entire west coast of North America.
- The surface area of the largest Sierra Nevada glaciers has decreased dramatically since the beginning of the 20th century. In 2021, some of the largest glaciers in the Sierra Nevada lost an average of 75% of their area. Of the two (2) glaciers in the Trinity Alps, one (1) has recently disappeared, and the other has lost more than 98% of its area.
- The fraction of snowmelt runoff from the Sierra Nevada into the Sacramento River and the San Joaquin River hydrologic regions between April and July, relative to total year-round water runoff, while highly variable, has declined over the past century.
- Compared to the 1930s, forests across much of California today have lower densities of large trees and higher densities of small trees. Water stress, which increases in a warming climate, poses a greater risk to large trees than to small trees.
- Annual tree mortality in California forests increased after the 2012-2016 Drought, and steep increases in mortality followed in subsequent years. An estimated 170 million trees in forest lands died between 2010 and 2021. Most of these trees were stressed from higher temperatures and decreased water availability, making them more vulnerable to insects and pathogens.
- Heat-related deaths and illnesses in California increased dramatically. Reported deaths and emergency department visits were also elevated in 2017, another notably warm year. Deaths related to this heat wave were largely attributed to elevated nighttime temperatures.
- The area burned by wildfires and the number of large fires (10,000 acres or more) across the State have increased markedly in the last 20 years, trends influenced by altered fuel conditions and climate change. Wildfires in 2020 burned an unprecedented four (4) million acres across

[65] California Office of Environmental Health Hazard Assessment. (2022). Indicators of Climate Change in California (Fourth Edition). Retrieved from https://oehha.ca.gov/climate-change/2022-report-indicators-climate-change-california.

California. In 2021, about 2.6 million acres burned, making it the second-highest year, followed by 2018, with 1.5 million acres burned.

4.5.2. San Mateo County Community Climate Action Plan

In 2017, San Mateo County met the climate action goals three (3) years early by achieving a 33% reduction in GHG emissions below 1990 levels by successfully launching Peninsula Clean Energy, a local clean energy provider. Additionally, the County established the Office of Sustainability, and the County Board of Supervisors adopted a resolution affirming the Paris Climate Accord. In 2019, the Board declared a climate emergency, and in 2021, the County adopted an updated Government Operations Climate Action Plan. With this Community Climate Action Plan (CCAP), the County builds on this work and sets a bold vision for climate action in our unincorporated communities. Equity is a central component of the CCAP. It recognizes that climate change does not affect all residents equally and that underserved communities often face disproportionate risks. Underserved populations are more likely to experience the effects of climate change more severely, and historically underserved neighborhoods are especially vulnerable to extreme heat. The County has identified racial equity as a priority, and the CCAP is one part of its broader effort to reduce persistent community disparities.[66]

The following sections consist of direct excerpts from the County's CCAP.

San Mateo County Climate Impacts

San Mateo County residents and communities are already facing a new reality – coastal flooding and erosion, reduced water supply, severe wildfires, and heat waves are increasing in frequency and severity. These occurrences are no longer hypothetical scenarios. To mitigate the severity of these impacts in the decades to come, considerable reductions in GHG emissions are necessary.

Climate change is expected to increase the frequency and severity of extreme heat, drought, wildfires, and days with poor air quality. These primary impacts are likely to create secondary impacts on people and systems in the County. Health risks from heat waves, poor air quality, and flooding will increase. Disaster response and relief costs are expected to rise as flooding, storms, droughts, wildfires, and other climate-related natural disasters become more frequent. Flood insurance and flood prevention costs will rise due to the increasing risks of sea level rise and extreme storm events. Climate change is expected to affect County buildings, stormwater and transportation infrastructure, community services, and land use planning and development.

Primary impacts include biophysical and physiological changes in the environment, including:

- Rising temperatures and wildfire risk.
- Changes in the water cycle.
- More frequent and intense severe weather (e.g., heavy rainfall).
- Rising sea levels.

[66] San Mateo County Office of Sustainability. (2022). Community Climate Action Plan. Retrieved from https://www.smcsustainability.org/wp-content/uploads/SMC-CCAP.pdf.

Secondary Impacts include the effects of climate change on humans, infrastructure, and systems, including impacts to:

- Public health and equity.
- Energy systems and use.
- Natural landscapes.
- Agriculture.
- Transportation and emergency services.

Anthropogenic activities are warming the planet at an unprecedented rate and driving local changes that are harmful to San Mateo County.

- **Increased Heat:** The Region's annual maximum temperature increased 1.7°F between 1950 and 2005. By 2050, 10 or more additional days in a year could feel hotter than 90°F. Air temperatures in San Mateo County are expected to increase by 5°F by 2070, causing widespread impacts on infrastructure and public health.
- **Rising Sea Levels:** Sea level has risen over eight (8) inches in the last century and could rise an additional one (1) to two (2) feet by 2050, and three (3) to seven (7) feet by 2100 (and up to 10 feet in an extreme ice-melt scenario). San Mateo County is the most vulnerable county in California to the first three (3) feet of sea level rise, with respect to population (including underserved populations), number of homes, property values, and number of contaminated sites.
- **Larger and Faster Spreading Fires:** San Mateo County faces an increasing risk of loss of life and widespread property damage caused by wildfires. In 2020, the CZU Lightning Complex fires burned 86,509 acres across San Mateo and Santa Cruz counties. The wildfire destroyed 1,490 structures, damaged an additional 140, and resulted in one (1) fatality.
- **Less Fog:** Coastal fog is less frequent than ever before. The presence and duration of coastal fog on the San Mateo Coast are critical to agricultural production, and changes in its pattern or density can pose major challenges for producers.
- **Severe Drought:** The 2012-2016 Drought was one of the most severe over the last 1,200 years and led to a 500-year low in Sierra snowpack. By 2100, snowpack is projected to decline 80%. On April 21, 2020, the United States Department of Agriculture (USDA) declared a drought disaster that included San Mateo County.
- **Beach Erosion:** San Mateo County's beaches tend to have sand rather than cliffs at the shore. This geology makes the beaches vulnerable to erosion from wind, sea level rise, and inland flooding events, all of which are expected to increase.

In San Mateo County, climate change could lead to major threats to homes and people, services and the economy, and wildlife and the environment.

- **Homes and People**

  - Health risks from heat exposure will increase, especially for those who lack air conditioning, have pre-existing conditions, the elderly, children, and pregnant women.
  - Hazardous waste sites are at risk of flooding, creating a serious threat of contamination to nearby low-income and densely populated communities.
  - Increased air pollution may create a greater risk for people with lung and heart disease.
- **Services and Economy**
  - Businesses and services are vulnerable to increased flooding and energy costs.
  - The County's electrical grid is susceptible to outages from wind and wildfire events (e.g., Public Safety Power Shutoffs).
  - Wine production in the region could be in danger due to increased temperatures and water scarcity.
- **Wildlife and Environment**
  - Forests are at risk as the future climate becomes less suitable for redwood and Douglas fir trees.
  - Wetland, beach, and marsh habitats are in danger from sea level rise and diminished shorelines.
  - Fish and other aquatic species will be at risk from changing water flows and temperatures.

Note: The climate change impacts for each hazard assessed in this LHMP are presented in the *Impacts* section of each hazard profile.

4.5.3. Global Projections

Climate change projections contain inherent uncertainty, largely because they depend on future GHG emission scenarios. Generally, uncertainty in GHG emissions is addressed by presenting low- and high-emissions scenarios. In low-emissions scenarios, GHG emissions are reduced substantially from current levels. Conversely, in high-emissions scenarios, GHG emissions generally increase or continue at current levels. Uncertainty in outcomes is generally addressed by averaging a variety of model outcomes. Despite this uncertainty, climate change projections provide valuable information to guide decision-making under possible future conditions.

In 1990 and 1992, the IPCC developed long-term emission scenarios, which have been extensively used in analyses of climate change, its impacts, and mitigation.[67] Over the years, these scenarios have been evaluated and updated based on the scientific data and technology available at the time of each update. These scenarios were developed to account for uncertainty about how societies and governments will address human emissions of GHGs in the future. **Table 4-23** provides an overview of the five (5) major scenarios used in IPCC's 2021 Report.[68]

[67] Intergovernmental Panel on Climate Change. (2000). IPCC Special Report: Emissions Scenarios. Retrieved from https://www.ipcc.ch/site/assets/uploads/2018/03/sres-en.pdf.
[68] University Corporation for Atmospheric Research. (2021). Compare IPCC Scenarios Interactive. Retrieved from https://scied.ucar.edu/interactive/compare-ipcc-scenarios.

Table 4-23. IPCC Scenarios

Scenario	Description	Expected Temperature Increase
SSP1-1.9 (Most Optimistic)	No increase in greenhouse gas emissions. Global carbon dioxide emissions do not increase (are cut to net zero) by approximately 2050.	1°F
SSP1-2.6 (Next Best)	Small levels of greenhouse gas emissions. Severe carbon dioxide emissions cuts, and no longer increase (are cut to net zero) after 2050.	1.8°F
SSP2-4.5 (Middle of the Road)	Medium greenhouse gas emissions scenario. Carbon dioxide emissions start to fall around mid-century but do not reach net zero until after 2100.	2.7°F
SSP3-7.0 (Dangerous)	Medium to high greenhouse gas emissions scenario. Emissions rise steadily, with total carbon dioxide doubling the current level by 2100.	3.6°C
SSP5-8.5 (Avoid at All Costs)	The highest greenhouse gas emissions scenario. Yearly emissions amounts are double the current levels by 2100.	4.4°C
The Scenarios are based on Shared Socioeconomic Pathways (SSPs), which project likely greenhouse gas emissions under different climate policies.		

4.6. Hazard Profiles

4.6.1. Dam Failure

Dams are engineered structures built across a watercourse for the purpose of retaining water.[69] Dams are a critical and vital part of the nation's infrastructure that store water, wastewater, or liquid-borne materials for many reasons— irrigation, electrical generation, flood control, renewable/clean energy, water storage, pollution control, containment of mine tailings, sediment/hazardous materials control, navigation, fisheries, and recreation.[70] Many dams fulfill a combination of these functions.

The California Water Code (Division 3) defines a dam as any artificial barrier, together with appurtenant works, that does or may impound or divert water, and that either:

- Is 25 feet or more in height from the natural bed of the stream or watercourse at the downstream toe of the barrier (or from the lowest elevation of the outside limit of the barrier if it is not across a stream channel or watercourse) to the maximum possible water storage elevation.
- Has an impounding capacity of 50 acre-feet or more.

Dams can be classified according to their purpose, the construction materials or methods used, their slope or cross-section, the mechanisms by which they resist hydrostatic pressure, or the means used to control seepage. Materials used to construct dams include earth, rock, tailings from mining or milling, concrete, masonry, steel, timber, plastic, rubber, and combinations of these.

Dam failure is the sudden, rapid, and uncontrolled release of impounded water or liquid-borne solids. The term "dam failure" encompasses a wide variety of circumstances. Situations that would constitute a dam failure vary widely, from developing problems to a partial or catastrophic collapse of the entire dam. There are numerous potential causes of dam failure, which can be attributed to deficiencies in the original design of the structure, the quality of construction, the maintenance of the dam, the operation of the appurtenances, and acts of nature, including precipitation in excess of the design, flood, and damage from earthquakes. Dam failures are most likely to happen for one (1) of five (5) reasons listed in **Table 4-24**.[71]

Table 4-24. Dam Failure Types

Type	Description
Overtopping	Caused by water spilling over the top of a dam. Overtopping of a dam is often a precursor of dam failure. National statistics indicate that overtopping resulting from inadequate spillway design, debris blockage, or dam crest settlement accounts for approximately 34% of all dam failures in the United States.

[69] American Society of Civil Engineers. (2010). So, You Live Behind a Levee! Retrieved from https://www.spl.usace.army.mil/Portals/17/SoYouLiveBehindLevee.pdf.
[70] Federal Emergency Management Agency. (2020). The National Dam Safety Program: 25 Years of Excellence. Retrieved from https://www.govinfo.gov/content/pkg/GOVPUB-HS5_100-PURL-LPS62689/pdf/GOVPUB-HS5_100-PURL-LPS62689.pdf.
[71] Association of State Dam Safety Officials. (n.d.). Understanding Dam Failures. Retrieved from https://damsafety.org/dam-failures.

Type	Description
Foundation Defects	This includes settlement and slope instability, which cause about 30% of all dam failures.
Cracking	Caused by movements like the natural settling of a dam.
Inadequate Maintenance and Upkeep	Inadequate Maintenance and Upkeep
Piping	When seepage through a dam is not properly filtered, soil particles continue to progress and form sinkholes in the dam. Another 20% of United States dam failures have been caused by piping (internal erosion caused by seepage). Seepage often occurs around hydraulic structures (e.g., pipes and spillways), through animal burrows, around roots of woody vegetation, and through cracks in dams, dam appurtenances, and dam foundations.

Many dam failures in the United States have been secondary results of other disasters. The most common causes are earthquakes, landslides, extreme storms, equipment malfunction, structural damage, foundation failures, and sabotage. Poor construction, lack of maintenance and repair, and deficient operational procedures are preventable or correctable by a program of regular inspections. Terrorism and vandalism are serious concerns that all operators of public facilities must plan for; these threats are continually monitored by public safety agencies.

A dam failure can be extremely dangerous if it occurs catastrophically with little or no warning. Dam inundation areas may contain large populations, significant critical infrastructure, and valuable ecosystems. During a catastrophic failure, the water flow may reach dozens of feet in height and flow at high velocity. For large dams, evacuation procedures may be inadequate to prevent significant loss of life and property damage.

Planning Requirements

A jurisdictional dam (one that falls under the jurisdiction of the State dam regulations) is defined by the California Water Code as a dam with a height greater than six (6) feet that impounds 50 acre-feet or more, or a height greater than 25 feet with a storage capacity of 15 acre-feet or more. Over 1,250 jurisdictional dams are under the jurisdiction of California's Department of Water Resources (DWR), Division of Safety of Dams (DSOD). Dams and reservoirs operated by the Federal government are not subject to State jurisdiction except as otherwise provided by Federal Law. In California, there are currently 220 dams operated by federal government agencies, including the United States Forest Service (USFS), the United States Bureau of Reclamation, and the United States Army Corps of Engineers (USACE).[72]

All dams whose inundation areas may impact San Mateo County have an Emergency Action Plan (EAP) and inundation maps on file. An Inundation map shows flooding that could result from a hypothetical failure of a dam or its critical appurtenant structure. The EAPs are required to include the following:[73]

[72] California Office of Emergency Services. (2023). California State Hazard Mitigation Plan. Retrieved from https://www.caloes.ca.gov/wp-content/uploads/Hazard-Mitigation/Documents/California-SHMP_Vol-1_Update_2.23.26_Full.pdf.
[73] California Office of Emergency Services (Cal OES). (n.d.). Dam Safety Planning. Retrieved from https://www.caloes.ca.gov/office-of-the-director/operations/planning-preparedness-prevention/planning-preparedness/dam-safety-planning/.

- Emergency notification flow charts.
- Information on a four (4) step response process.
- Description of agencies' roles and actions in response to an emergency incident.
- Description of actions to be taken in advance of an emergency (e.g., surveillance and monitoring at the dam, educating the community).
- Inundation maps.
- Additional information, such as revision records and distribution lists.

After the EAPs and inundation maps are approved by the State, the law requires dam owners to distribute the approved EAPs to relevant stakeholders. Local public agencies can then adopt emergency procedures that incorporate the information in the EAP, in a manner that conforms to local needs and includes methods and procedures for alerting and warning the public, as well as other response and preparedness-related items.[74]

The potential for catastrophic flooding from dam failures led to the passage of the National Dam Safety Act (Public Law 92-367), which authorized the USACE to inventory and inspect non-federal dams.[75] The National Dam Safety Program, managed by FEMA, works to reduce risks from dam failures by providing financial assistance to states, supporting dam safety research, offering training for dam safety professionals, and maintaining the National Inventory of Dams (NID).[76]

USACE is responsible for safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. The USACE has inventoried dams; surveyed each state and federal agency's capabilities, practices, and regulations regarding design, construction, operation, and maintenance of the dams; and developed guidelines for inspection and evaluation of dam safety.

Dams that fall under the jurisdiction of the Federal Energy Regulatory Commission (FERC) also have specified planning requirements. FERC has the largest dam safety program in the United States. It collaborates with numerous federal and state agencies to ensure and promote dam safety and, more recently, homeland security. FERC requires licensees to prepare EAPs and conduct training sessions on how to develop and test these plans. The plans are designed to serve as an early warning system for potential or sudden releases of water from a dam failure or dam-related accident. The plans include operational procedures that may be employed, such as lowering reservoir levels and reducing downstream flows, as well as procedures for notifying affected community members and agencies responsible for emergency management. These plans are frequently updated and tested to ensure that in emergency situations, everyone knows what to do, thus saving lives and minimizing property damage.

4.6.1.1. Location

The USACE's NID contains information about dams that meet at least one (1) of the following criteria:

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[74] Ibid.
[75] Federal Emergency Management Agency. (2023). Federal Guidelines for Dam Safety. Retrieved from https://damsafety-prod.s3.amazonaws.com/s3fs-public/files/FEMA%20P-93_Federal%20Guidelines%20for%20Dam%20Safety_2023.pdf.
[76] Federal Emergency Management Agency. (2025). National Dam Safety Program. Retrieved from https://www.fema.gov/grants/mitigation/learn/dam-safety.

- Dams where a failure or misoperation will likely result in loss of human life (i.e., high hazard potential).
- Dams where a failure or misoperation would likely result in disruption of access to critical facilities, damage to public and private facilities, and require difficult mitigation efforts (i.e., significant hazard potential).
- Dams that meet minimum height and reservoir size requirements, even though they do not pose the same level of life or economic risk as high and significant hazard dams. These dams are equal to or exceed 25 feet in height and exceed 15 acre-feet in storage, or equal to or exceeding 50 acre-feet in storage and exceeding six (6) feet in height (i.e., low hazard potential).

Although the goal of the NID is to include all dams in the United States that meet these criteria, in reality, this inventory is limited to information that can be gathered and properly interpreted. In most cases, dams within the NID criteria are regulated (e.g., through construction permits, inspections, and/or enforcement) by federal or state agencies, which have basic information on the dams within their jurisdiction. All high hazard dams have EAPs in place; however, due to data privacy and the protection of sensitive information, this information is not included in this LHMP. Existing EAPs include inundation data for all listed high hazard dams. According to the NID, most high hazard dams do not include a USACE risk assessment as outlined in the NID tool's risk tab.[77]

According to the NID, there are 21 dams within San Mateo County – 12 are classified as high hazard dams (**Table 4-25**), one (1) is classified as significant hazard potential (**Table 4-26**), and eight (8) are classified as low hazard potential (**Table 4-27**).[78] **Figure 4-1** displays the dams within San Mateo County and the hazard potential for each.

Table 4-25. High Hazard Dams in San Mateo County

Name	National ID	Owner	Type	Year Built	Primary Purpose	Height *(feet)*	Capacity *(acre-feet)*	Max Discharge *(cubic feet/second)*
Bear Gulch	CA00658	California Water Service Company	Earth	1896	Water Supply	61	725	70
Coastways	CA01007	Coastways Ranch	Earth	1951	Water Supply, Irrigation	46	100	Not Available
Crocker	CA00672	Town of Hillsborough	Earth	1891	Water Supply, Irrigation	45	22	Not Available
Emerald Lake 1 Lower	CA00668	Emerald Lake Country Club	Earth	1885	Water Supply, Recreation	57	45	Not Available
Laurel Creek	CA00901	City of San Mateo	Earth	1969	Flood Risk Reduction	40	55	Not Available
Lower Crystal Springs	CA00127	City and County of San Francisco	Gravity	1888	Water Supply	149	57,910	Not Available

[77] United States Army Corps of Engineers. (n.d.). National Inventory of Dams: Mission & History. Retrieved from https://nid.sec.usace.army.mil/#/about-the-nid/mission.
[78] United States Army Corps of Engineers. (n.d.). National Inventory Dams. Retrieved from https://nid.sec.usace.army.mil/#/.

Name	National ID	Owner	Type	Year Built	Primary Purpose	Height *(feet)*	Capacity *(acre-feet)*	Max Discharge *(cubic feet/second)*
Notre Dame	CA00674	Belmont City Department Of Public Works	Earth	N/A	Water Supply, Recreation	51	120	Not Available
Pilarcitos	CA00128	City and County of San Francisco	Earth	1866	Water Supply	103	3,100	Not Available
Pomponio Ranch	CA01008	Scott Cook and Signe Ostby	Earth	1952	Irrigation, Water Supply, Other	64	274	Not Available
San Andreas	CA00129	City and County of San Francisco	Earth	1870	Water Supply	107	19,027	Not Available
Searsville	CA00669	Stanford University Board of Trustees	Gravity	1890	Water Supply, Irrigation	68	1,840	Not Available
Spencer Lake	CA00673	Town of Hillsborough	Earth	1876	Flood Risk Reduction	87	73	Not Available
Note: *All high hazard dams in San Mateo County have an EAP prepared.*								

Table 4-26. Significant Hazard Dams in San Mateo County

Name	National ID	Owner	Type	Year Built	Primary Purpose	Height *(feet)*	Capacity *(acre-feet)*	Max Discharge *(cubic feet/second)*
Bear Gulch	CA01584	Evans Brothers Inc.	Earth	Not Available	Other	30	5	Not Available

Table 4-27. Low Hazard Dams in San Mateo County

Name	National ID	Owner	Type	Year Built	Primary Purpose	Height *(feet)*	Capacity *(acre-feet)*	Max Discharge *(cubic feet/second)*
Bean Hollow #2	CA00665	Lake Lucerne Mutual Water Company	Earth	1938	Water Supply, Irrigation	31	900	Not Available
Bean Hollow #3	CA00666	Lake Lucerne Mutual Water Company	Earth	1939	Water Supply, Irrigation	40	461	Not Available
Canada Road	CA00055	California Department of Transportation	Earth	1971	Water Supply, Other	52	74	Not Available
Green Oaks #1	CA01010	Ana Nuevo Ranch	Earth	1936	Water Supply, Other	39	322	Not Available
Johnston	CA00667	Peninsula Open Space Trust	Gravity	1919	Water Supply, Fire Protection, Stock, Small Fish Pond	31	30	Not Available
Lake Lucerne	CA00664	Lake Lucerne Mutual Water Company	Earth	1923	Water Supply, Irrigation	21	455	Not Available
Marina Lagoon	CA01429	City of San Mateo	Earth	1953	Flood Risk Reduction, Recreation	17	1,600	Not Available

Name	National ID	Owner	Type	Year Built	Primary Purpose	Height *(feet)*	Capacity *(acre-feet)*	Max Discharge *(cubic feet/second)*
Rickey	CA01009	Mid-Peninsula Open Space District	Earth	1951	Water Supply, Irrigation	64	47	Not Available

Further details on each of the dams within San Mateo County can be found in the USACE's NID website. The NID contains information about a dam's location, type, size, purpose, uses and benefits, last inspection, other structural and geographical information, and more than 70 data fields for each dam. The NID is also used to assist federal, state, and local agencies in developing dam safety policies.[79]

Figure 4-1. Dams in San Mateo County

[Map under development…]

DSOD classifies dams slightly differently from NID. The DSOD scale defines the intensity or potential severity of dam failure solely based on potential downstream impacts to life and property, and the hazard is not related to the condition of the dam or its pertinent structures. *Refer to the Extent/Severity section of this profile for further details on the DSOD's classification.* According to DSOD, 24 dams are in San Mateo County, and 12 of these, plus another nearby in Santa Clara County, could endanger lives and property if an uncontrolled release or catastrophic failure occurs (**Table 4-28**).

Table 4-28. DSOD Downstream Hazard Potential Classification Dams in San Mateo County

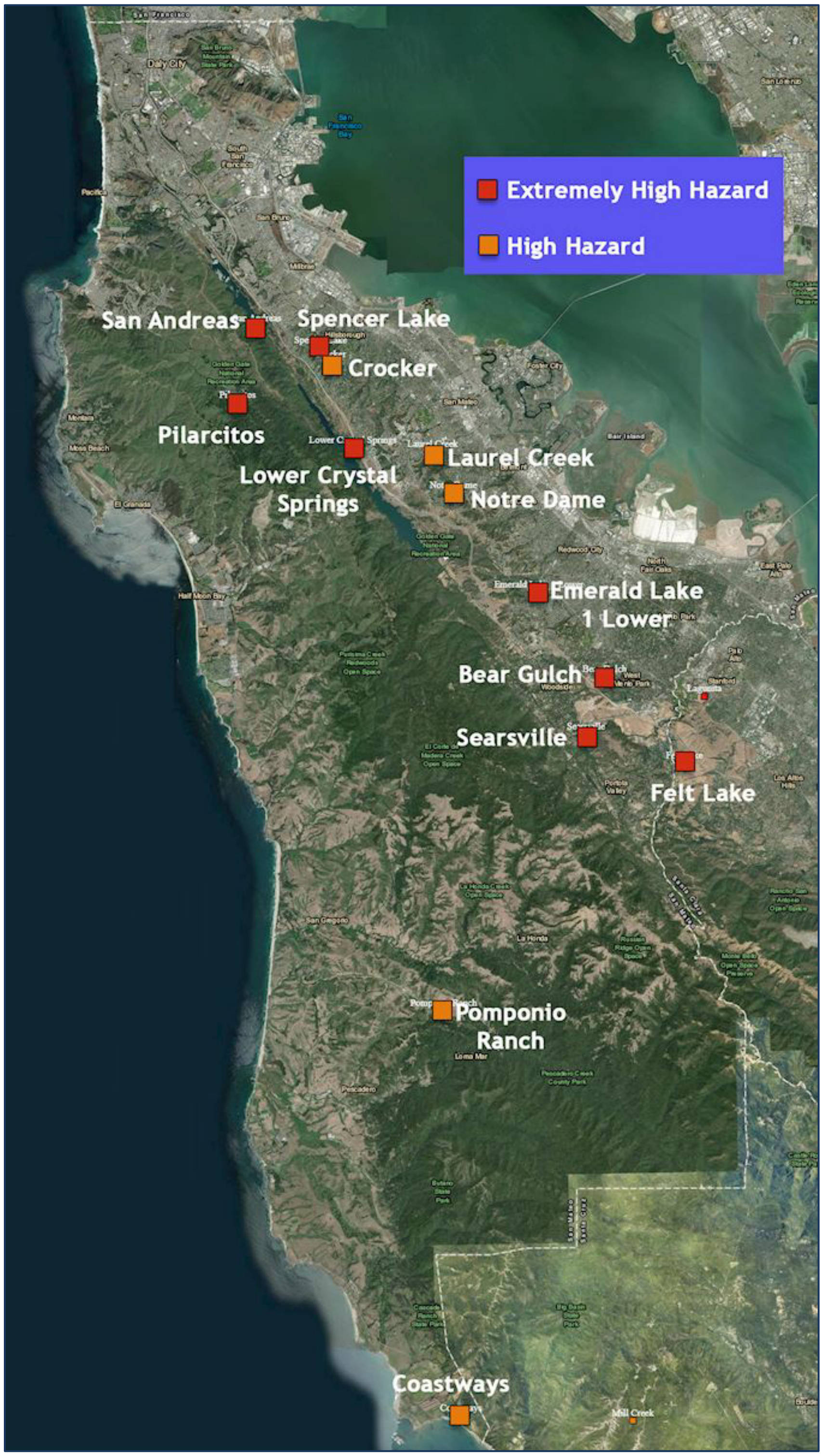
Name	National ID	Downstream Hazard Potential
Bear Gulch	CA00658	Extremely High
Coastways	CA01007	High
Crocker	CA00672	High
Emerald Lake 1 Lower	CA00668	Extremely High
Felt Lake**	CA00670	Extremely High
Laurel Creek	CA00901	High
Lower Crystal Springs	CA00127	Extremely High
Notre Dame	CA00674	High
Pilarcitos	CA00128	Extremely High
Pomponio Ranch	CA01008	High
San Andreas	CA00129	Extremely High
Searsville	CA00669	Extremely High
Spencer Lake	CA00673	Extremely High

*** Felt Lake is within Santa Clara County, approximately 1,300 feet from the San Mateo County boundary line. It has been included in this list due to its close proximity to San Mateo County.*

[79] United States Army Corps of Engineers. (n.d.). National Inventory of Dams: Mission & History. Retrieved from https://nid.sec.usace.army.mil/#/about-the-nid/mission.

Figure 4-2 illustrates the dams in San Mateo with the potential to endanger lives and property (DSOD Downstream Hazard Potential Classification).

Figure 4-2. DSOD Downstream Hazard Potential Classification in San Mateo County



Lower Crystal Springs Dam: The Lower Crystal Springs Dam is the largest dam in San Mateo County, making it a higher priority for regulation and preventative maintenance by county, state, and federal officials. This Dam impounds water to form the Lower Crystal Springs Reservoir, which supplies water to San Francisco and most cities in San Mateo County. Although located directly on the San Andreas Fault, the Dam survived both the 1906 San Francisco earthquake and the 1989 Loma Prieta earthquake. In 2010, DSOD inspected the Lower Crystal Springs Dam to investigate the effects of a magnitude 8.3 earthquake (on the Richter Scale) and determined that dam failure was a low probability. Despite this low probability, the County and the dam owner, the San Francisco Public Utilities Commission (SFPUC), are seeking to enhance the safety and quality of the Dam. Significant upgrades to the Dam and a nearby overpass bridge were completed between 2010 and 2015 to restore the reservoir's maximum storage capacity. The project involved widening the spillway, raising the parapet wall, and replacing the stilling basin with a new and larger facility.[80]

4.6.1.2. Extent/Severity

A dam failure can be catastrophic to all life and property downstream. The extent of a dam failure can be assessed using inundation maps, which show the area projected to be flooded by a failure or an uncontrolled release from the structure. Inundation maps account for different failure scenarios, such as non-rainfall failure (e.g., sunny-day or fair-weather failure) and rainfall-induced failure. These inundation areas can be much larger than the 1% annual chance (100-year) floodplain. Furthermore, engineers and emergency managers use dam failure flood inundation maps to determine warning and evacuation areas downstream of a dam. The dam failure flood inundation maps do not reflect a dam's safety or integrity. Dams that meet safety regulations and are well operated and maintained may still have a dam failure flood inundation map.[81]

The severity of a dam failure can be assessed in accordance with federal (i.e., USACE) and State guidelines for dam safety. Federal guidelines provide for a three (3) level classification system that defines low, significant, and high-hazard potential classifications depending on the potential for loss of life, economic loss, and environmental damage resulting from a hypothetical dam failure. The USACE dam hazard categories are listed in **Table 4-29**.[82]

Table 4-29. USACE Dam Hazard Classification System

Hazard Potential Classification	Description	Loss of Human Life	Economic, Environmental, Lifeline Losses
Low	Dams where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.	None expected.	Low and generally limited to the owner.

[80] San Mateo County Sheriff's Office, Homeland Security Division, Office of Emergency Services. (2015). County of San Mateo Hazard Vulnerability Assessment: Appendix to the Emergency Operations Plan. Retrieved from https://hsd.smcsheriff.com/sites/default/files/downloadables/2%20-%20Hazard%20Vulnerability%20Assessment.pdf.
[81] Association of State Dam Safety Officials. (n.d.). Frequently Asked Questions. Retrieved from https://damsafety.org/media/faq.
[82] Federal Emergency Management Agency. (2004). Federal Guidelines for Dam Safety: Hazard Potential Classification System for Dams. Retrieved from https://www.ferc.gov/sites/default/files/2020-04/fema-333.pdf.

Hazard Potential Classification	Description	Loss of Human Life	Economic, Environmental, Lifeline Losses
Significant	Dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas, but could be located in areas with population and significant infrastructure.	None expected.	Yes
High	Dams where failure or misoperation will probably cause loss of human life.	Probable. One (1) or more expected.	Yes, but not necessary for this classification.

DSOD uses its own scale to define the intensity or potential severity of dam failure based solely on potential downstream impacts on life and property. Additionally, the hazard is unrelated to the condition of the dam or its associated structures. This scale has four (4) categories, including the Federal categories, and adds a fourth category, "extremely high". Dams classified as extremely high hazard may impact densely populated areas or critical facilities, or have short evacuation warning times. **Table 4-30** outlines the downstream hazard potential classifications used by DSOD.[83]

Table 4-30. State of California Downstream Hazard Potential Classification

Hazard Category	Direct Loss of Life	Economic, Environmental, Lifeline Losses
Low	None expected.	Low and principally limited to the dam owner's property.
Significant	None expected.	Yes.
High	Probable (one or more expected).	Yes, but not necessary for this classification.
Extremely High	Considerable.	Yes, major impacts on critical facilities and property.

Inundation maps are a key element for EAPs required for dams in California. The DSOD reviews and approves inundation maps prepared by licensed civil engineers and submitted by dam owners for extremely high, high, and significant hazard dams and their critical appurtenant structures. Inundation maps approved by DSOD are a tool used to develop EAPs. They provide general information for emergency planning. For this LHMP, the available dam-inundation maps prepared by DSOD were combined into a single inundation area for San Mateo County. The combined dam inundation area is shown in **Figure 4-3**. Simultaneous failure of all dams is highly unlikely, but the assessment provides sufficient information for planning purposes.

Figure 4-3. San Mateo County Combined Dam Failure Inundation Map

[Map under development…]

[83] California Department of Water Resources, Division of Safety of Dams. (2021). Downstream Hazard. Retrieved from https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/All-Programs/Division-of-Safety-of-Dams/Files/Publications/Division-of-Safety-of-Dams-Definitions-for-Downstream-Hazard-and-Condition-Assessment.pdf.

Extent/Severity		Extent Factor	Weighted Factor	Score
Medium	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a medium-intensity incident.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Extent/Severity Score = Extent Factor x Weighted Factor***				

Catastrophic Potential

A catastrophic incident can be defined as any natural, human-caused, or technological disaster that results in extraordinary levels of casualties, damage, or disruption, severely affecting the population (including mass evacuations), infrastructure, environment, economy, national morale, or government functions in the area.[84] The catastrophic potential for a dam failure event is medium in San Mateo County.

Catastrophic Potential		Extent Factor	Weighted Factor	Score
Medium	Medium potential that this hazard could be catastrophic.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Catastrophic Score = Extent Factor x Weighted Factor***				

4.6.1.3. Warning Time

Dam failures can occur with little or no warning, or they can be anticipated. Extreme precipitation or heavy snowmelt events can be predicted in advance, allowing sufficient time for evacuations. In the event of a structural failure due to an earthquake, there may be no or limited warning time. The USGS Earthquake Hazards Program has several earthquake programs related to dam safety, including dam-specific earthquake monitoring programs in California that help assess safety concerns after seismic events.

San Mateo County and its stakeholders have established protocols for emergency warning and response through its adopted Emergency Operations Plan (EOP). The San Mateo County Department of Emergency Management maintains copies of the most recent dam EAPs and inundation maps, and it has used this information to plan notification needs for downstream areas in the event of a failure. Many dam owners and their stakeholders have also established protocols for flood warning and response to imminent dam failure within the flood warning section of their adopted EOP. These protocols are tied to the EAP developed by the dam owners.

The type of dam also influences how quickly failure occurs and how much warning is given. Earthen dams usually do not fail instantly or completely; the breach can develop over a few minutes to several hours. Once a breach begins, flowing water erodes it until either the reservoir is depleted or the breach resists further erosion. Concrete gravity dams often experience partial breaches, as the escaping water forces apart one or more sections.

[84] Federal Emergency Management Agency. (2019). National Response Framework (Fourth Edition). Retrieved from https://www.fema.gov/sites/default/files/documents/NRF_FINALApproved_2011028.pdf.

4.6.1.4. Probability and Frequency

The probability of occurrence for a dam failure in San Mateo County is low because a *significant* event is likely to occur within 100 years. As a dam ages, the probability of failure increases due to ongoing structural deterioration. Proactive preventive measures can reduce the probability of future dam failures in regulated dams, in accordance with current federal and State dam safety programs.

Dam failure events are infrequent and typically coincide with or follow earthquakes, landslides, and extreme rainfall or snowmelt. Dam failures are often exacerbated by flooding, and the probability of failure can be linked to projected flood probabilities and frequencies. *Refer to Section 4.5.4 (Flood) for further information on flooding.* The probability of such failures remains low in today's regulatory environment. The single recorded dam failure in the planning area, at El Granada in 1926, corresponds to a frequency of approximately one (1) event per 100 years. Between 1954 and 2025, there has been one (1) Federal disaster declaration due to a dam failure in 2004 in California.[85] No dam failures have been recorded in San Mateo County. However, dam safety incidents, which are less severe than dam failures, have occurred.

Probability of Occurrence		Probability Factor	Weighted Factor	Score
Low	A significant hazard event is likely to occur within 100 years.	1	N/A	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology).				

FEMA NRI Annualized Frequency

The FEMA NRI does not assess dam failures.

4.6.1.5. Past Events

The only recorded dam failure in San Mateo County was the failure of a small dam in the community of El Granada in 1926. According to the California State Hazard Mitigation Plan, there have been nine (9) failures of federally regulated dams elsewhere in the State since 1950. Overtopping accounted for two (2) of the nine (9) dam failures in the State; the others were caused by seepage or leaks. The most catastrophic event was the failure of the St. Francis Dam in Los Angeles County, which failed in 1928 and resulted in the deaths of more than 450 people and the destruction of nearly 1,000 homes and buildings. If a dam is determined to be unsafe, DSOD requires lowering the water level to permit partial collapse without catastrophic loss of water.

The State's most recent dam emergency occurred in February 2017 when the Oroville Dam in Butte County was on the verge of overflow. The Dam's concrete spillway was eroded, and a massive hole developed. The auxiliary spillway was used to prevent dam overtopping, but it also experienced erosion. Evacuation orders were issued in advance of a potential large, uncontrolled release of water from Lake Oroville, but no such release occurred. After this incident, state officials ordered that flood-control spillways be re-inspected on 93 California dams with potential geologic, structural, or performance issues that could jeopardize their ability to safely pass a flood event. The San Andreas Dam near the cities of Millbrae and San Bruno was one of the dams that was re-inspected.

[85] Federal Emergency Management Agency. (2026). OpenFEMA Dataset: Disaster Declarations Summaries - v2. Retrieved from https://www.fema.gov/openfema-data-page/disaster-declarations-summaries-v2.

4.6.1.6. Vulnerability

Population Exposed

15% to 29% of the population in San Mateo County is exposed to dam failures. The population most vulnerable to a dam failure is those downstream within the dam inundation areas. Additionally, the underserved populations that are uniquely vulnerable include, but are not limited to, racial and ethnic minorities, low-income individuals, those with limited English proficiency, the elderly, and those with access and functional needs. The potential for loss of life is influenced by the capacity and number of evacuation routes available to residents in areas at risk of dam inundation. **Table 4-31** summarizes the estimated population living in the evaluated dam failure inundation areas.

Table 4-31. Vulnerable Population in Evaluated Dam Failure Inundation Areas

Population Exposed	Percent of Total Planning Area Population
111,185	14.4%

Population Exposure		Vulnerability Factor	Weighted Factor	Score
Medium	15% to 29% of the population is exposed to the hazard.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population Exposure Score = Extent Factor x Weighted Factor***				

Property Exposed

10% to 24% of the total assessed property, infrastructure, and resources value is exposed to dam failure in San Mateo County. Physical structures, essential services, and other key community assets may be adversely affected during and/or after a dam failure. Vulnerable properties are those closest to the dam and within the inundation area. These properties would experience the largest, most destructive surge of water. Low-lying areas are also vulnerable, as they are where water from the dam and levee would collect. Properties in the dam failure inundation zone that are built to NFIP minimum construction standards may have some level of protection against dam failure inundation, depending on the velocity and elevation of the inundation waters. These properties are also more likely to have flood insurance. Any physical structure near a dam or dike may be flooded or damaged after a failure.

Exposed critical infrastructure includes the following major roadways.

- State Highway 1 (Pacific Coast Highway)
- State Highway 82 (El Camino Real)
- State Highway 84 (Woodside Road)
- State Highway 92
- State Highway 109 (University Avenue, East Palo Alto)
- State Highway 114 (Willow Road, Menlo Park)
- US Highway 101

- Interstate 280

Property Exposure		Vulnerability Factor	Weighted Factor	Score
Medium	10% to 24% of the total assessed property value is exposed to a hazard.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property Exposure Score = Extent Factor x Weighted Factor***				

Changes in Development

Information on changes in development within San Mateo County is provided in **Chapter 3** (Community Profile) of this Assessment.

The changes in development have increased San Mateo County's exposure to dam failure by 4% or less. The vulnerability associated with flooding from a dam failure is directly related to the development located within the boundaries of the dam inundation area and the floodplain. Dam failure is not currently addressed as a standalone hazard in many of the safety elements of the municipal partners' general plans, whereas flooding is. Flood-related policies in the general plans will help to reduce the risk associated with dam failure for all future development in the planning area. Municipalities participating in this LHMP have established comprehensive land use policies for identified flood hazard areas. Most areas vulnerable to the more severe impacts of dam failure intersect the mapped flood hazard areas. However, structures on the perimeter of the dam failure inundation area outside the regulated floodplain are not subject to floodplain management codes and standards. These structures would be more vulnerable than those constructed with floodplain codes and standards.

Changes in Development		Vulnerability Factor	Weighted Factor	Score
Low	Changes in development have increased the community's exposure to the hazard by 4% or less.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Changes in Development Score = Extent Factor x Weighted Factor***				

4.6.1.7. Impacts

Population and Life Safety

A population that is exposed to dam failure is likely to experience some adverse impacts (e.g., injuries requiring acute medical care). Dam failures can cause casualties or injuries among the population, particularly those residing in areas immediately downstream of the dam, as these locations are most vulnerable to the swift, abrupt movement of floodwaters. The potential for loss of life is influenced by the number and capacity of evacuation routes available to residents in areas at risk of dam inundation. A sudden failure of a dam may induce rapid floodwater, which could lead to loss of life. Furthermore, the force and unpredictability of floodwaters resulting from dam failures can cause physical injuries to individuals. Dam failures can displace individuals from their homes, either temporarily or permanently, due to flood damage. This displacement can have long-term impacts on mental health and community stability. Floodwater can contaminate drinking water sources, leading to infectious diseases, illnesses, and other health complications, a particular concern in urban areas or in areas where industrial and agricultural chemicals may be present. Additionally, significant flooding can overwhelm sewage and sanitation systems, increasing the risk of infectious diseases. The trauma and stress associated with flooding, displacement, loss of property, and potential loss of life can have long-lasting effects on the mental health of victims.

Population and Life Safety Impact		Impact Factor	Weighted Factor	Score
Medium	Populations exposed to this hazard are likely to experience some adverse impacts, such as injuries requiring acute medical care.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population and Life Safety Impact Score = Impact Factor x Weighted Factor***				

Underserved Population

The underserved population exposed to dam failures in San Mateo County is likely to experience significant adverse/disproportionate impacts (e.g., fatalities and severe injuries). This hazard does not disproportionately affect one population over another; however, underserved populations face unique vulnerabilities and impacts from flooding caused by dam failures. These groups include, but are not limited to, racial and ethnic minorities, low-income individuals, those with limited English proficiency, the elderly, and those with access and functional needs.

Often, these communities lack the infrastructure necessary to mitigate flood impacts (e.g., well-maintained levees, flood barriers, and stormwater management systems), and the absence of such protective measures increases their susceptibility to flooding and its impacts. Additionally, these populations are more likely to reside in substandard or low-lying areas that are prone to flooding from dam failures. Such housing frequently lacks flood-resistant construction and fails to provide adequate protection during flood events. Limited financial resources impair their ability to prepare for, respond to, and recover from flooding, making it difficult to purchase flood insurance, repair flood-damaged homes, or access emergency services. The higher prevalence of pre-existing health conditions and limited access to healthcare in these communities can be exacerbated by floods, particularly when contaminated floodwater spreads disease or disrupts medical services. Limited transportation options hinder evacuation efforts during declarations, increasing the population's risk. Furthermore, these populations may have limited access to timely, accurate information about dam failures and related preparedness measures, potentially leading to delayed or inadequate responses to such emergencies.

Underserved Population Impact		Impact Factor	Weighted Factor	Score
High	Underserved populations exposed to the hazard are likely to experience significant adverse/disproportionate impacts, such as fatalities and severe injuries.	3	3	9
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Underserved Population Impact Score = Impact Factor x Weighted Factor***				

Property, Facilities, and Critical Infrastructure

More than $500,000 but less than $5 million in property damage is expected from a *single major* dam failure event, or damages are expected to occur to more than 5% but less than 15% of the property value within San Mateo County. Flooding from dam failures can severely impact property and critical infrastructure, including bridges, roads, railways, and utilities (e.g., water and sewage systems, electrical grids, and gas lines). If transportation routes are damaged or destroyed, it can create isolation issues within the community. The transportation infrastructure most vulnerable to dam failure is already in poor condition and unable to withstand a significant surge of water. These impacts not only cause immediate disruption but also lead to long-term economic consequences due to the time and cost of repairs and reconstruction. Additionally, essential services, including healthcare, education, emergency services, and transportation, can be disrupted, thereby affecting the community's well-being and daily life.

Low-lying areas are also vulnerable, as they are where the dam's waters would collect. Water and wastewater treatment plants are often located near water sources and, therefore, are likely to be affected and temporarily out of operation.

*Note: Although the total property exposed exceeds $5 million, this figure accounts for the combined dam-failure inundation area shown in **Figure 4-3**. However, simultaneous failure of all dams is highly unlikely.*

Property, Facilities, and Critical Infrastructure Impact		Impact Factor	Weighted Factor	Score
Medium	More than $500,000 but less than $5 million in property, facilities, and infrastructure damage is expected from a single significant event, or damages are expected to occur to more than 5% but less than 15% of the property value within the jurisdiction.	2	2	4
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property, Facilities, and Critical Infrastructure Impact Score = Impact Factor x Weighted Factor***				

Economy

A single *significant* dam failure event in San Mateo County is likely to result in a total economic impact greater than $100,000 but less than or equal to $10 million. Dam failures can result in direct and indirect economic impacts, including the cost of rebuilding assets, the cost of response and recovery, downstream damage to property and infrastructure, long-term costs from environmental damage (e.g., remediation and restoration), and loss of business revenue. Agricultural areas may suffer from loss of irrigation water and crop damage, as well as soil erosion, while interruptions to water supply and quality can affect both businesses and residential areas. The overall economic stability of the affected region may be threatened, necessitating significant recovery and rebuilding efforts that often have long-term financial implications.[86]

Economic Impact		Impact Factor	Weighted Factor	Score
Medium	Total economic impact is likely to be greater than $100,000, but less than or equal to $10 million.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Economic Impact Score = Impact Factor x Weighted Factor***				

[86] U.S. Department of Homeland Security. (2011). Dams Sector: Estimating Economic Consequences for Dam Failure Scenarios. Retrieved from https://damsafety.org/sites/default/files/files/DamsSectorConsequenceEstimation_EconomicConsequences.pdf.

FEMA NRI Expected Annual Loss Estimates

The FEMA NRI does not assess dam failures.

Environment

Environmental impact from a single *significant* dam failure event is likely to be substantial, requiring extensive outside resources and support; and/or repair, cleanup, restoration, or preservation work. Dam failures cause catastrophic flooding; however, the flooding can lead to secondary hazards with significant environmental impacts. Failures of dams can result in, but are not limited to, environmental impacts such as:[87]

- Pollution caused by septic system failures, sewage backups, and hazardous materials (e.g., pesticides, herbicides, solvents, petroleum products), including contamination of potable water supplies and soils.
- Changes in land development patterns, the configuration of streams or the floodplain, and downstream hydrogeomorphology.
- Erosion, scour, and sedimentation disruption.
- Loss of wildlife habitat or biodiversity, topsoil or vegetative cover, and indigenous plants.
- Detrimental effects on many species of animals, especially endangered species.
- Degradation of wetlands.
- Exposure to mold and bacteria (during cleanup).

Environment Impact		Impact Factor	Weighted Factor	Score
High	Environmental impact from a single significant event is likely to be substantial, requiring extensive outside resources and support; and/or repair, cleanup, restoration, and/or preservation work.	3	1	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Environmental Impact Score = Impact Factor x Weighted Factor***				

Continuity of Operations/Delivery of Services

There may be impacts lasting between 24 and 72 hours on San Mateo County's ability to meet the essential day-to-day operational demands and needs of the community in the event of a *single major* dam failure. A dam failure can have widespread, cascading impacts on a community's ability to deliver day-to-day services and maintain operational continuity. These impacts include damage to first responder infrastructure (e.g., fire and police stations, emergency operations centers, hospitals), disruption of utilities (e.g., power, water, communications), and the rendering of roads and bridges impassable, hindering the delivery of day-to-day services. Floods can damage power plants, substations, and power lines, resulting in prolonged power outages. Utilities such as overhead power lines, cable, and telephone lines within the inundation zone may be vulnerable. If phone lines are lost, significant communication issues may occur in the planning area due to limited cellular reception in many areas. Water treatment

[87] Federal Emergency Management Agency. (2012). Assessing the Consequences of Dam Failure. Retrieved from https://damsafety.org/sites/default/files/files/FEMA%20TM%20AssessingtheConsequencesofDamFailure%20March2012.pdf

facilities can also be compromised, potentially contaminating drinking water supplies. Furthermore, if critical infrastructure (e.g., fire and police stations) is within the dam inundation area, it can significantly impact response and recovery operations. These impacts may warrant requesting external resources to mitigate their effects on the jurisdiction's continuity of operations/delivery of services.

Continuity of Operations/Delivery of Services Impact		Impact Factor	Weighted Factor	Score
Medium	Impact lasting between 24 and 72 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single significant event.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Continuity of Services/Delivery of Services Impact Score = Impact Factor x Weighted Factor***				

Future Development

Information on changes in development within San Mateo County is provided in **Chapter 3** (Community Profile) of this Assessment.

Future development trends will increase, but not significantly, the impacts of dam failures in San Mateo County. Development downstream from a dam area heightens the potential impacts of a dam failure. Numerous dams were constructed in formerly rural regions where, in the event of dam failure, there would be no downstream impacts; however, development is now evident downstream of dams nationwide. As a result of both new dam construction and downstream development of existing dams, the number of dams that could significantly impact a community if they fail is steadily increasing.[88] Nevertheless, San Mateo County is proactively implementing a range of mitigation strategies to enhance and enforce regulations in floodplains and dam inundation areas, with the objective of reducing the impacts of dam failures.

Dam failure is not currently addressed as a standalone hazard in many of the safety elements of the municipal partners' general plans, whereas flooding is. Flood-related policies in the general plans will help to reduce the risk associated with dam failure for all future development in the planning area. Municipalities participating in this LHMP have established comprehensive land use policies for identified flood hazard areas. Most areas vulnerable to the more severe impacts of dam failure intersect the mapped flood hazard areas. However, structures on the perimeter of the dam failure inundation area outside the regulated floodplain are not subject to floodplain management codes and standards. These structures would be more vulnerable than those constructed with floodplain codes and standards.

Future Development Impact		Impact Factor	Weighted Factor	Score
Medium	Future development trends will increase the impacts of this hazard, but not significantly.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Future Development Impact Score = Impact Factor x Weighted Factor***				

[88] Federal Emergency Management Agency. (2013). Living with Dams. Retrieved from https://www.fema.gov/sites/default/files/2020-08/fema_living-with-dams_p-956.pdf.

Climate Change

Climate change trends will not directly impact dam failures. However, climate change can increase flood frequency and severity, potentially leading to dam failure. For example, as global average temperatures rise, evaporation increases, adding moisture to the atmosphere, which in turn leads to greater precipitation and a higher risk of flooding.[89,90] *Refer to Section 4.5.4 (Flood) for further information on how climate change impacts flood frequency and severity.*

Climate Change Impact		Impact Factor	Weighted Factor	Score
No Impact	Climate change trends will not increase the impacts of this hazard.	0	1	0
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Climate Change Impact Score = Impact Factor x Weighted Factor***				

Secondary Impacts

The following are cascading or indirect hazards that may follow the primary hazard event. These hazards can occur concurrently with or be triggered by the initial event and may exacerbate its overall impact.

- Flood
- Landslides
- Bank Erosion
- Destruction of Downstream Habitat
- Worsening the severity of a drought by releasing water that might have been used as a potable water source. A loss of water supply could exacerbate the wildfire hazard by hindering an impacted area's ability to fight fire.
- Water and Soil Contamination
- Hazardous Materials Incidents
- Power Outage
- Structural Collapse
- Utility Failure

4.6.1.8. Issues

Dam failure presents a range of challenges that can impact a community's preparedness, response, recovery, and mitigation efforts. While not exhaustive, the following outlines key issues related to dam failure that the planning team identified that San Mateo County may encounter during such events.

- A significant number of the structures located in the dam failure inundation area are located outside of FEMA Special Flood Hazard Areas (SFHA), meaning that they are not constructed to withstand floodwaters and are less likely to be covered by flood insurance. Even structures

[89] National Oceanic and Atmospheric Administration. (2025). Climate Change Impacts. Retrieved from https://www.noaa.gov/education/resource-collections/climate/climate-change-impacts.
[90] United States Army Corps of Engineers. (2024). 2024 - 2027 Climate Adaptation Plan. Retrieved from https://www.sustainability.gov/pdfs/usace-2024-cap.pdf.

designed with flood hazards in mind may not withstand the height and velocity of water flow from a dam failure.

- Addressing security concerns and the need to inform the public of the risk associated with dam failure is a challenge for public officials.
- California law requires that a property's location in a dam inundation area be disclosed to a seller if the seller, or the seller's agent, has knowledge of the property's location within the hazard area or if the local 8-12 Dam Failure jurisdiction has compiled a list of parcels that are in the inundation area and has posted at the offices of the county recorder, county assessor, and county planning agency a notice that identifies the location of the list. It is unknown if this list has been compiled for San Mateo County.
- Dam failure inundation areas are often not considered SFHA under the NFIP, so flood insurance coverage in these areas is not common.
- Dam infrastructure may require repair and improvement to withstand climate change impacts, such as changes in the timing and intensity of rain events.
- Federally regulated dams have an adequate level of oversight and sophistication in the development of EAPs for public notification in the unlikely event of failure. However, the protocol for notifying downstream community members of imminent failure must be tied to local emergency response planning.
- Inundation mapping in a digital format to support the risk assessment was available only for state-regulated high-hazard dams in San Mateo County. Such mapping was not available for federal dams.
- Limited warning time gives residents minimal time to react or seek shelter.
- The flooding from dam failure can damage communication systems (e.g., power lines, cell towers), which can leave residents isolated and unable to communicate with first responders.
- Extensive flooding, damaged infrastructure, displaced populations, and the disruption of essential services can make response and recovery operations extremely complex and resource intensive.
- Limited financial resources for dam maintenance during economic downturns result in decreased attention to dam structure operational integrity, because available funding is often directed to more urgent needs. This could increase the potential for maintenance failures.
- Mapping for federally regulated dams is already required and available; however, mapping for non-federally regulated dams that estimates inundation depths is needed to better assess risks associated with the failure of these dams.
- Although mapping is required for federally regulated dams, development downstream of dams and upgrades to older dams may have altered inundation areas; however, these inundation maps may not have been updated for significant periods of time. Encouraging dam property owners to update EAPs and inundation maps will ensure the availability of the most accurate data to support emergency planners and local officials.
- Most dam failure mapping required at the federal level requires the determination of the probable maximum flood. While the probable maximum flood represents a worst-case scenario, it is generally the event with the lowest probability of occurrence. Mapping dam failure scenarios for

non-federal-regulated dams that are less extreme than the probable maximum flood but have a higher probability of occurrence can be valuable to emergency managers and community officials downstream of these facilities. This type of mapping can illustrate areas that may be affected by more frequent events, thereby supporting emergency response and preparedness.

- The concept of residual risk associated with structural flood control projects should be considered in the design of capital projects and the application of land use regulations.
- There may be dams located in the planning area that do not meet regulatory thresholds for jurisdiction under the State of California or federal programs.
- State and national dam lists are inconsistent regarding the number of dams in San Mateo County. These lists should be evaluated and corrected where needed. Currently, the NID maintained by USACE lists 21 dams in the County, while DSOD lists 24.

4.6.1.9. Risk Profile

FEMA Risk Index Score

The FEMA NRI does not assess dam failure.

Overall Risk Score

Table 4-32 represents the Dam Failure Total Risk Score for San Mateo County, based on the Risk Assessment Methodology, as defined in Section 4.3 of this Plan.

Table 4-32. Dam Failure Total Risk Score

Hazard Event	Probability Factor	Sum of Weighted Extent Factors	Sum of Weighted Vulnerability Factors	Sum of Weighted Impact Factors	Consequence Score	Total Risk Score*
Dam Failure	1	12	6	25	43	20

Extent: Sum of the weighted Extent factors.
Vulnerability: Sum of the weighted Vulnerability factors.
Impact: Sum of the weighted Impact factors.

Consequence Score: Extent + Vulnerability + Impact (Sum of all weighted factors).
Total Risk Score = Probability x Consequence
* Normalized to 100

Total Risk Score Legend

Classification	Probability	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 4	0 – 12	0 – 24	0 – 32
Medium (M)	2	7 – 12	5 – 10	13 – 26	25 – 48	33 – 66
High (H)	3	13 – 18	11 – 15	27 – 39	49 – 72	67 – 100

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.2. Drought

Drought can be challenging to define. Some definitions refer to an idea or concept that can be important in establishing drought policy, while others are operational. Operational drought definitions describe how drought functions or operates in a way that can be measured. The National Drought Mitigation Center (NDMC) defines drought as a deficiency of precipitation over an extended period of time, typically a season or more, resulting in a water shortage. The effects of this deficiency are often referred to as drought impacts.[91] NWS defines drought as a deficiency of moisture that results in adverse impacts on people, animals, or vegetation over a sizable area.[92]

Drought is part of the climate cycle and an underestimated, slow-moving hazard that can cause as much damage as faster-moving hazards (e.g., hurricanes, flooding). It is a normal phase in the cycle of Mediterranean climates, such as that of San Mateo County, originating from a prolonged deficiency of precipitation, typically a season or more. However, droughts can have a rapid onset or intensification (timescale of weeks), known as flash drought, when low precipitation is accompanied by weather extremes such as abnormally high temperatures (e.g., heat waves), strong winds, and/or changes in radiation. Unlike traditional droughts, which can occur year-round at any given location, flash droughts typically occur during warm seasons. Additionally, flash droughts are often associated with La Niña events.[93] Drought can impact agriculture, public health, transportation, energy, ecosystems, wildfire risk, and water availability and quality.[94] The impacts of flash drought are not significantly different from those of traditional drought, but the onset can catch individuals off guard.

To assist with drought classification and monitoring, scientists have defined five (5) types of droughts, listed in **Table 4-33**.[95]

Table 4-33. Drought Types

Type	Description
Meteorological	Occurs when precipitation amounts are below normal over a set period. Often, this type of drought is region-specific and based on regional climatology. This type of drought is commonly referred to as a "drought".
Agricultural	Occurs when reduced soil moisture leads to unmet crop demand. This type of drought is specific to a region, crop type, and time (e.g., the growing season) and usually occurs after meteorological droughts. Agricultural drought can cause significant crop losses and economic disruption for communities that depend on agriculture.
Hydrological	It is driven by a deficiency of surface and subsurface water resources, often indicated by reduced streamflow, low lake or reservoir water levels, and a lowered groundwater table height. Due to the complex hydrological network that feeds surface and subsurface water resources, hydrological drought occurs after meteorological drought.

[91] National Drought Mitigation Center. (n.d.). Drought Basics. Retrieved from https://drought.unl.edu/Education/DroughtBasics.aspx.
[92] National Integrated Drought Information System. (2023). What is a Drought? Drought Basics. Retrieved from https://www.drought.gov/what-is-drought/drought-basics.
[93] National Integrated Drought Information System. (n.d.). Flash Drought. Retrieved from https://www.drought.gov/what-is-drought/flash-drought.
[94] National Integrated Drought Information System. (2023). What is a Drought? Drought Basics. Retrieved from https://www.drought.gov/what-is-drought/drought-basics.
[95] National Drought Mitigation Center. (n.d.). Types of Drought. Retrieved from https://drought.unl.edu/Education/DroughtIn-depth/TypesofDrought.aspx.

Type	Description
Socioeconomic	Occurs when physical water shortages impact individuals or communities. Socioeconomic drought impacts can vary according to an individual's or community's ability to adapt or mitigate.
Ecological	Occurs when there is a prolonged and widespread deficit in naturally available water supplies (e.g., changes in natural and managed hydrology) that create multiple stresses across ecosystems.

The severity of drought depends on numerous factors, including duration, intensity, and geographic extent, as well as regional water demand from humans and vegetation. There are three (3) primary reasons why drought differs from other natural hazards.[96]

- The onset and end of a drought are difficult to determine due to the relatively slow accumulation and lingering effects of an event after its apparent end.
- The lack of an exact and universally accepted definition adds to the complexity of its existence and severity.
- In contrast with other natural hazards, the impact of drought is less obvious and may spread over a larger geographic area. These characteristics have hindered many governments' preparation of drought contingency or mitigation plans.

4.6.2.1. Location

Droughts can occur anywhere in San Mateo County and affect the entire planning area. Due to the dynamic nature of drought, conditions vary by location and water sources. For example, ranchers grazing livestock on non-irrigated rangeland and rural residents relying on private wells for groundwater can be quickly affected by dry conditions. On the other hand, large urban water agencies with multiple water resources can manage through several dry years. However, if drought conditions in the area persist for an extended period, everyone will experience the effects.[97]

Water Supply Infrastructure

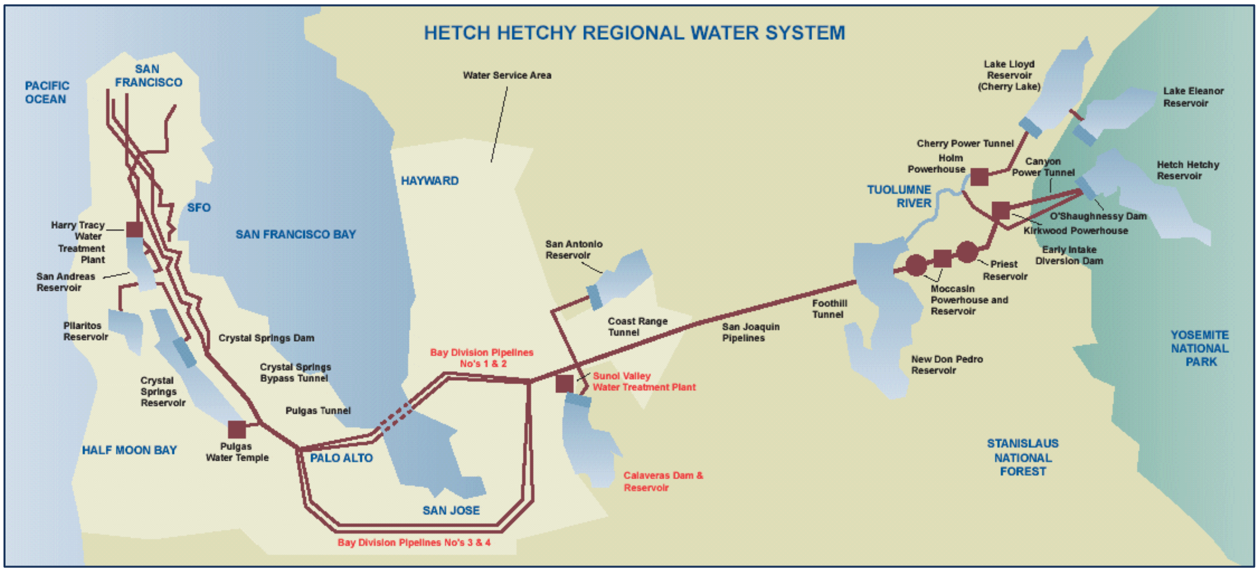
San Mateo County receives 92% of its water through the regional Hetch Hetchy Water System, with the remainder of the County's water supply coming from surface, ground, and recycled water. The water system was so named because 85% of the water supply comes from Sierra Nevada snowmelt stored in the Hetch Hetchy reservoir along the Tuolumne River in Yosemite National Park; the remaining 15% comes from runoff in the Alameda and Peninsula watersheds. **Figure 4-4** displays the Hetch Hetchy Water System.

In 2002, SFPUC adopted a $2.9 billion capital improvement plan to enhance the water system. The need for improvements was recognized following the 1989 Loma Prieta earthquake and the 1990s drought. Much of the water supply system is 75 to 100 years old, does not meet modern seismic codes, and major pipelines cross earthquake faults. A 2000 SFPUC study found that a major earthquake could cripple the water supply system for up to 30 days. SFPUC has highlighted nine (9) priority projects for

[96] Wilhite, D. A. and Svoboda, M. D. (n.d.). Drought Early Warning Systems in the Context of Drought Preparedness and Mitigation. Retrieved from https://www.unisdr.org/files/1882_VL102149.pdf.
[97] California Department of Water Resources. (n.d.). California Water Watch. Retrieved from https://cww.water.ca.gov/droughtindicator.

implementation, the completion of which should help ensure continuity of operations for the water supply system following a large seismic event.[98]

Figure 4-4. Hetch Hetchy Water System



San Mateo County maintains the infrastructure for County Service Area (CSA) 7 and CSA 11, the two (2) local water systems within its borders:

- **CSA 7** includes an intake and pump in Alpine Creek, a water treatment plant, a 500,000-gallon storage tank, and a distribution system. The treatment plant was constructed in the early 1990s, but parts of the distribution system date to the 1920s.
- **CSA 11** was established in 1988 and consists of two (2) wells, a 135,000-gallon distribution tank, and a distribution system. Water flows from the distribution tank through the water system by gravity; no distribution pumps are required. CSA 11 was determined to be necessary after relatively high concentrations of nitrate and other naturally occurring salts were found in local groundwater sources, raising concern that continued use of previously used small domestic wells could lead to unintended health consequences.

Water Supply Strategy

The Bay Area Water Supply Conservation Agency (BAWSCA) is the main water provider for much of the Bay Area. It enables San Mateo County and its municipalities, water districts, and private utilities to coordinate to ensure a continuous water supply necessary to maintain the health, safety, and economic well-being of the community. BAWSCA agencies manage two-thirds of water consumption from the Hetch Hetchy Water System, providing water to 2.4 million people in San Francisco, Santa Clara, Alameda, and San Mateo counties. In San Mateo County, BAWSCA services the cities of Brisbane, Burlingame, Daly City, East Palo Alto, Menlo Park, Millbrae, Redwood City, San Bruno, the Town of Hillsborough, Coastside County Water District, Estero Municipal Improvement District, Guadalupe Valley

[98] Bay Area Water Supply and Conservation Agency. (n.d.). Hetch Hetchy System. Retrieved from https://bawsca.org/water/supply/hetchhetchy.

Municipal Improvement District, Mid-Peninsula Water District, Westborough Water District, and California Water Service Company (private utility).

BAWSCA employs a long-term water supply strategy for its customers throughout the Bay Area. This strategy recognizes that drought year shortfalls can be significant, resulting in systemwide cutbacks of up to 20%. The impacts of water shortages are regional and can lead to secondary adverse economic effects. BAWSCA focuses on identifying options to address all or part of the drought year supply shortfall. Additionally, BAWSCA developed a Water Conservation Implementation Plan with the following objectives:[99]

- Assist BACSWA member agencies in evaluating potential water savings and cost-effectiveness associated with additional water conservation measures.
- Determine potential present and future water savings from a range of new conservation measures.
- Determine BAWSCA's role in helping member agencies achieve individual water conservation goals.
- Develop a regional plan for water conservation measures to serve as a guideline for member agencies.

While BAWSCA is the primary water service agent in the County, it is not the only option for community members and businesses. The San Mateo County Public Works Department operates CSA 7 and CSA 11. These service areas provide potable water to approximately 70 customers in the La Honda community and 90 customers in the Pescadero community. CSA 7 also supplies two (2) county facilities—Camp Glenwood Boys Ranch and Sam McDonald Park.

4.6.2.2. Extent/Severity

The extent and severity of a drought depend on the degree of moisture deficiency, the duration, and the size and location of the affected area. Furthermore, droughts develop gradually over periods of weeks (i.e., flash droughts) to months and affect different systems (e.g., row crops versus aquifers) with different magnitudes and timescales, which can make it difficult to recognize when a drought will occur.

Many drought indices have been developed to measure the extent and severity of drought, including the Palmer Drought Severity Index, the Standardized Precipitation Index, and the U.S. Drought Monitor. The **Palmer Drought Severity Index (PDSI)** uses readily available temperature and precipitation data to estimate relative dryness, indicating prolonged and abnormal moisture deficits or excesses. As an essential climatological tool, the PDSI helps evaluate the extent, severity, and frequency of prolonged periods of abnormally dry or wet weather.[100,101]

[99] Bay Area Water Supply and Conservation Agency. (2009). Water Conservation Implementation Plan. Retrieved from https://bawsca.org/docs/WCIP_FINAL_Report.pdf.
[100] National Weather Service, Climate Prediction Center. (2005). Drought Indices: Explanation. Retrieved from https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/cdus/palmer_drought/wpdanote.shtml.
[101] National Center for Atmospheric Research. (n.d.). Climate Data Guide: Palmer Drought Severity Index (PDSI). Retrieved from https://climatedataguide.ucar.edu/climate-data/palmer-drought-severity-index-pdsi.

The PDSI is a standardized measure that compares moisture deficiency and excess on a numerical scale that usually ranges from positive five (5) to a negative five (5). Positive values indicate an excess of moisture supply, and negative values indicate that moisture demand exceeds supply. **Table 4-34** displays the PDSI categories.

Table 4-34. Palmer Drought Severity Index

Palmer Drought Severity Index	Category
-4.00 and below	Extreme Drought
-3.00 to -3.99	Severe Drought
-2.00 to -2.99	Moderate Drought
-1.99 to 1.99	Mid-Range
2.00 to 2.99	Moderately Moist
3.00 to 3.99	Very Moist
4.00 and above	Extremely Moist

Although the PDSI has had reasonable success in quantifying long-term drought, particularly over low and middle latitudes, it is not comparable across regions and lacks the multi-timescale features of indices such as the **Standardized Precipitation Index (SPI)**.[102] The SPI is a widely used index for characterizing meteorological drought across a range of timescales. It only uses precipitation, and it can characterize drought or abnormal wetness at different time scales, which correspond with the time availability of various water sources (e.g., soil moisture, snowpack, groundwater, river discharge, and reservoir storage) For shorter timescales, the SPI is closely related to soil moisture, and conversely, for longer timescales, the SPI can be related to groundwater and reservoir storage.[103]

The SPI is a probability index that is based on the probability of recording a given amount of precipitation, and the probabilities are standardized so that an index of zero (0) indicates the median (average) precipitation amount (half the precipitation amounts are below the median, and half are above the median). A negative index indicates drought conditions; a positive one, wet conditions. As the severity of dry or wet conditions increases, the index value becomes more negative or positive, respectively. Moreover, the SPI is calculated over multiple time scales, ranging from one (1) month to 24 months, thereby facilitating the assessment of both short-term and long-term drought.[104]

The **U.S. Drought Monitor (USDM)** is a collaboration between the NDMC, the USDA, and NOAA. USDM assesses drought nationwide by intensity, utilizing a D0 (Abnormally Dry) to D4 (Exceptional Drought) scale.[105] However, states do not experience the same set of impacts during a drought. **Table 4-35** outlines the potential impacts of drought in the State of California, and while not an exhaustive list, it

[102] Ibid.
[103] National Center for Atmospheric Research. (n.d.). Climate Data Guide: Standardized Precipitation Index (SPI). Retrieved from https://climatedataguide.ucar.edu/climate-data/standardized-precipitation-index-spi.
[104] National Centers for Environmental Information. (2025). Drought Indices and Data: Standardized Precipitation Index (SPI). Retrieved from https://www.ncei.noaa.gov/access/monitoring/nadm/indices/spi/div.
[105] National Drought Mitigation Center. (n.d.). What is USDM? Retrieved from https://droughtmonitor.unl.edu/About/WhatistheUSDM.aspx.

provides a clearer picture of drought within the State.[106] The USDM map updates weekly to show the location, extent, and intensity of drought across the United States and its territories. Maps and data are available at the national, regional, and state levels; however, drought data (without maps) is also available at the county level.[107] The USDM maps are accessible on the USDM website.

Table 4-35. USDM Classification

Category	California Potential Impacts
D0 (Abnormally Dry)	• Soil is dry; irrigation delivery begins early. • Dryland crop germination is stunted. • Active fire season begins. • Winter resort visitation is low; snowpack is minimal.
D1 (Moderate Drought)	• Dryland pasture growth is stunted; producers give supplemental feed to cattle. • Landscaping and gardens need irrigation earlier; wildlife patterns begin to change. • Stock ponds and creeks are lower than usual.
D2 (Severe Drought)	• Grazing land is inadequate. • Producers increase water efficiency methods and drought-resistant crops. • Fire season is longer, with high burn intensity, dry fuels, and large fire spatial extent; more fire crews are on staff. • Wine country tourism increases; lake- and river-based tourism declines; boat ramps close. • Trees are stressed; plants increase reproductive mechanisms; wildlife diseases increase. • Water temperature increases; programs to divert water to protect fish begin. • River flows decrease; reservoir levels are low, and banks are exposed.

106 National Integrated Drought Information System. (n.d.). Drought Impacts: Drought Impacts by State and U.S. Drought Monitor Category. Retrieved from https://www.drought.gov/impacts.
107 National Integrated Drought Information System. (2025). U.S. Drought Monitor (USDM). Retrieved from https://www.drought.gov/data-maps-tools/us-drought-monitor.

Category	California Potential Impacts
D3 (Extreme Drought)	• Livestock need expensive supplemental feed; cattle and horses are sold; little pasture remains; producers find it difficult to maintain organic meat requirements. • Fruit trees bud early; producers begin irrigating in the winter. • Federal water is not adequate to meet irrigation contracts; extracting supplemental groundwater is expensive. • Dairy operations close. • Fire season lasts year-round; fires occur in typically wet parts of state; burn bans are implemented. • Ski and rafting business is low, mountain communities suffer. • Orchard removal and well drilling company business increase. • Panning for gold increases. • Low river levels impede fish migration and cause lower survival rates. • Wildlife encroach on developed areas; little native food and water is available for bears, which hibernate less. • Water sanitation is a concern; surface water is nearly dry; flows are very low; water theft occurs. • Wells and aquifer levels decrease; homeowners drill new wells. • Water conservation rebate programs increase; water use restrictions are implemented; water transfers increase. • Water is inadequate for agriculture, wildlife, and urban needs; reservoirs are extremely low; hydropower is restricted.
D4 (Exceptional Drought)	• Livestock need expensive supplemental feed; cattle and horses are sold; little pasture remains; producers find it difficult to maintain organic meat requirements. • Fruit trees bud early; producers begin irrigating in the winter. • Federal water is not adequate to meet irrigation contracts; extracting supplemental groundwater is expensive. • Dairy operations close. • Fire season lasts year-round; fires occur in typically wet parts of state; burn bans are implemented. • Ski and rafting business is low, mountain communities suffer. • Orchard removal and well drilling company business increase. • Panning for gold increases. • Low river levels impede fish migration and cause lower survival rates. • Wildlife encroach on developed areas; little native food and water is available for bears, which hibernate less. • Water sanitation is a concern; surface water is nearly dry; flows are very low; water theft occurs. • Wells and aquifer levels decrease; homeowners drill new wells. • Water conservation rebate programs increase; water use restrictions are implemented; water transfers increase. • Water is inadequate for agriculture, wildlife, and urban needs; reservoirs are extremely low; hydropower is restricted.

During critically dry years, the California State Water Resources Control Board can mandate water entitlements on water right holders to address statewide water shortages. **Table 4-36** shows the stages of the state drought management program mandated for water right holders.

Table 4-36. State Drought Management Program

Drought Stage	State Mandated Customer Demand Reduction	Rate Impacts
Stage 0 or 1	Less than 10%	Normal Rates
Stage 2	10% to 15%	Normal rates: drought surcharge
Stage 3	15% to 20%	Normal rates: drought surcharge
Stage 4	Greater than 20%	Normal rates: drought surcharge

Extent/Severity		Extent Factor	Weighted Factor	Score
Low	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a low-intensity incident.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Extent/Severity Score = Extent Factor x Weighted Factor***				

Catastrophic Potential

A catastrophic incident can be defined as any natural, human-caused, or technological disaster that results in extraordinary levels of casualties, damage, or disruption, severely affecting the population (including mass evacuations), infrastructure, environment, economy, national morale, or government functions in the area.[108] The catastrophic potential for a drought event is low in San Mateo County.

Catastrophic Potential		Extent Factor	Weighted Factor	Score
Low	Low potential that this hazard could be catastrophic.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Catastrophic Score = Extent Factor x Weighted Factor***				

4.6.2.3. Warning Time

Generally, droughts cannot be forecast for more than a few weeks into the future. This is because droughts develop gradually over extended periods of time, making them complex to forecast. Only generalized advisories can be issued due to the numerous variables that scientists have yet to fully understand or integrate, which limits the accuracy and precision of drought forecasts. The U.S. Seasonal Drought Outlook, developed by NOAA's Climate Prediction Center (CPC), depicts large-scale trends based on subjectively derived probabilities guided by short and long-range statistical and dynamical forecasts. The Outlook, issued monthly on the third Thursday of the month, predicts whether drought will persist, develop, improve, or be removed over the next three (3) months.[109]

Understanding how large-scale climate patterns (e.g., the El Niño–Southern Oscillation (ENSO)) affect the potential for drought in a region can help forecast when drought conditions are likely to occur.

[108] Federal Emergency Management Agency. (2019). National Response Framework (Fourth Edition). Retrieved from https://www.fema.gov/sites/default/files/documents/NRF_FINALApproved_2011028.pdf.
[109] National Integrated Drought Information System. (2025). U.S. Seasonal Drought Outlook. Retrieved from https://www.drought.gov/data-maps-tools/us-seasonal-drought-outlook.

Empirical studies conducted over the past century have shown that meteorological drought is never the result of a single cause. Rather, it is the result of multiple causes, often synergistic.

Drought forecasting depends heavily on precipitation and temperature patterns. Anomalies in these primary climate drivers can persist for several months to several decades, depending on interactions between the atmosphere and oceans, soil moisture and land surface processes, topography, internal climate dynamics, and the cumulative influence of weather systems on a global scale.[110] Furthermore, forecasting drought persistence is even more complex than predicting its onset. As a result, determining when a drought will end is exceptionally challenging. Additionally, warning times for flash droughts are limited because conditions can intensify over weeks rather than months, resulting in a faster onset.[111]

DWR maintains the California Water Watch website, which offers current local, regional, neighborhood-level, and statewide water conditions. The website includes information on precipitation, temperature, reservoirs, streamflow, groundwater, snowpack, soil moisture, vegetation conditions, and California drought updates. In California, drought is defined by impacts on water users, and observing and monitoring water availability can improve understanding of when and where drought occurs.

4.6.2.4. Probability and Frequency

The probability of occurrence for a drought in San Mateo County is medium because a *significant* event is likely to occur within 25 years. Estimating drought probability remains challenging, despite advances in science and technology. Meteorological droughts can begin and end rapidly, while hydrological droughts develop much more slowly and take longer to recover. Given the significant heterogeneity of drought types, various indices have been developed to measure and monitor drought across sectors. USDM depicts drought across all timescales and distinguishes between agricultural and hydrological impacts.[112] Meanwhile, NOAA utilizes the PDSI to measure drought conditions (**Table 4-34**).

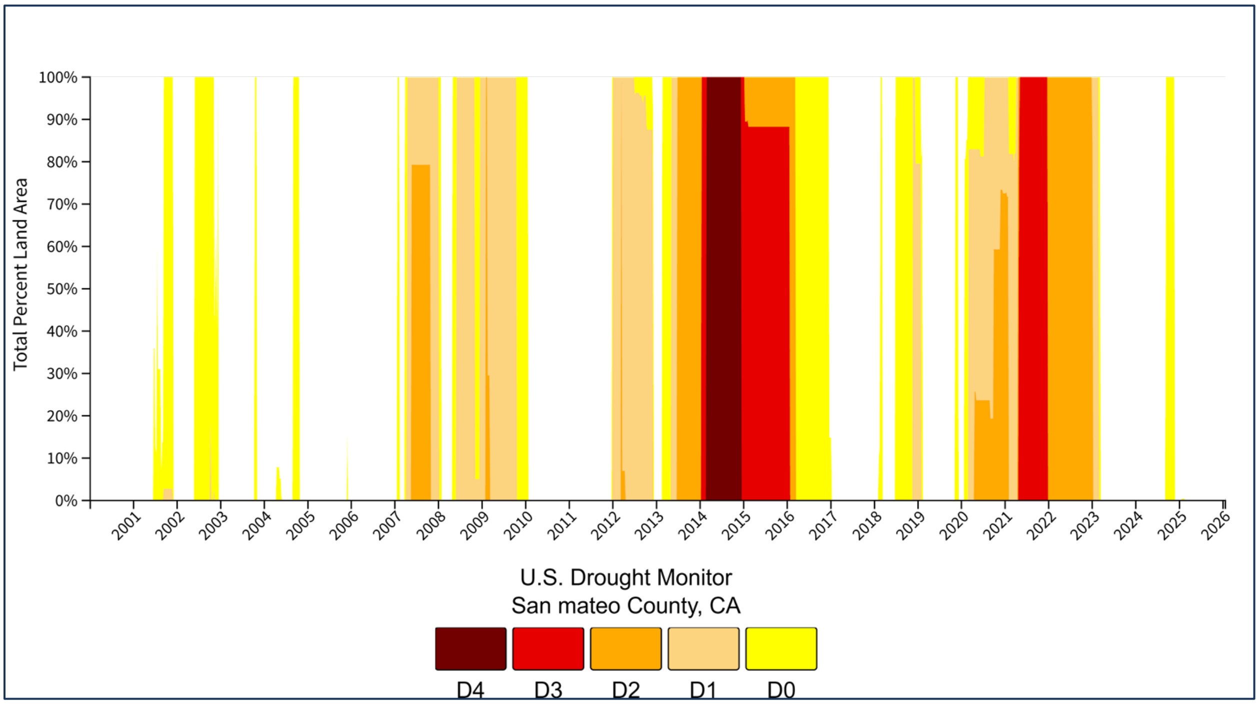
Drought is a recurring hazard in San Mateo County, characterized by prolonged periods of significantly below average precipitation. In recent decades, these events have increased in both frequency and severity, often persisting for multiple years. Historical data from the USDM indicate that San Mateo County experiences drought conditions more frequently than the State and national averages. Since 2000, San Mateo County has spent approximately 723 weeks (60% of the period) in some level of drought (Moderate Drought (D1) or higher), meaning the County is in drought conditions more than one (1) out of every two (2) weeks (**Figure 4-5**). The County has experienced 215 weeks (18% of the time) since 2000 in either Extreme Drought (D3) or Exceptional Drought (D4). Two (2) major events occurred recently, between 2014 and 2016, and between 2021 and 2022. Between 1980 and 2020, the County experienced seven (7) significant multi-year droughts, indicating a recurrence interval of severe drought of approximately every five (5) to six (6) years, on average.[113,114]

110 University of Nebraska-Lincoln, Nebraska Extension Disaster Education. (n.d.). Drought Prediction. Retrieved from https://disaster.unl.edu/understanding-drought/drought-prediction/.
111 Otkin, J. A. et al. (2018). Flash Droughts: A Review and Assessment of the Challenges Imposed by Rapid-Onset Droughts in the United States. Retrieved from https://journals.ametsoc.org/view/journals/bams/99/5/bams-d-17-0149.1.xml.
112 National Oceanic and Atmospheric Administration. (n.d.). Did You Know? Index (Definition of Drought). Retrieved from https://www.ncei.noaa.gov/access/monitoring/dyk/drought-definition.
113 National Integrated Drought Information System. (n.d.). Drought Conditions for San Mateo County. Retrieved from https://www.drought.gov/states/california/county/san%20mateo.
114 California Department of Water Resources. (2015). California's Most Significant Droughts: Comparing Historical and Recent Conditions. Retrieved from https://cawaterlibrary.net/wp-content/uploads/2017/05/CalSignficantDroughts_v10_int.pdf.

Probability of Occurrence		Probability Factor	Weighted Factor	Score
Medium	A significant hazard event is likely to occur within 25 years.	2	N/A	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology).				

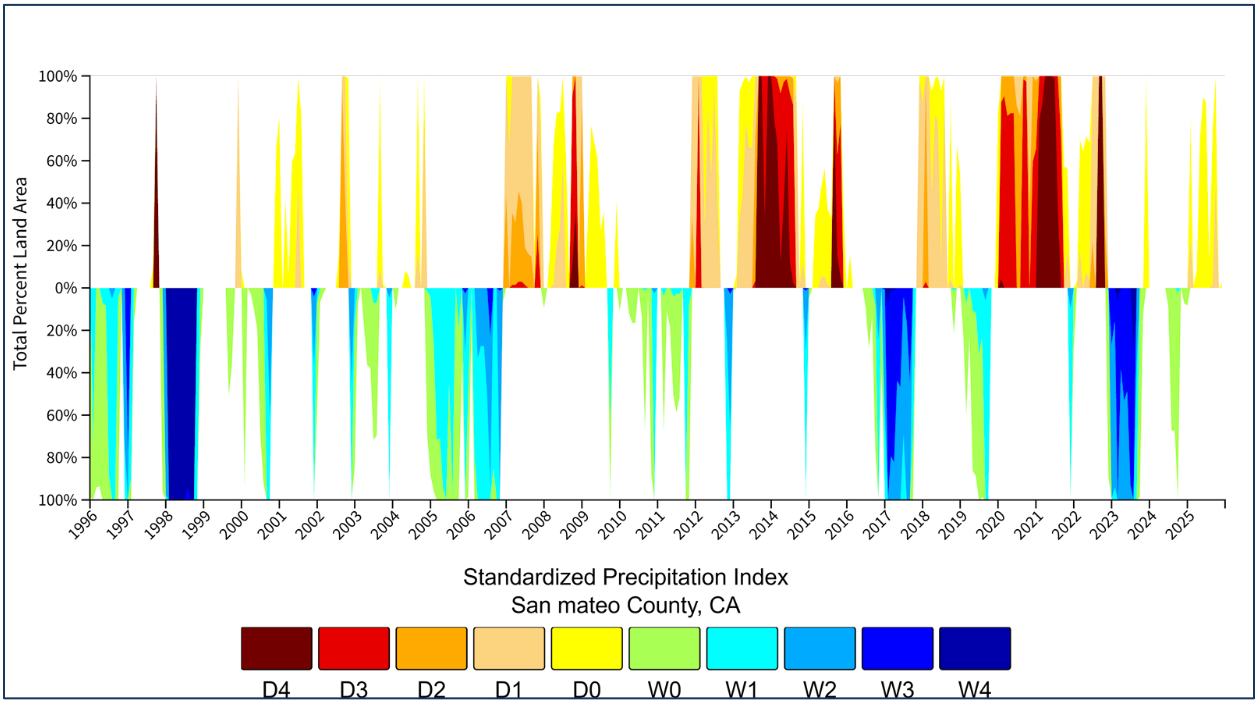
Figure 4-5 illustrates drought occurrences between 2000 and 2025, based on USDM data (which began collecting in 2000), and **Figure 4-6** shows drought occurrences based on the SPI.[115]

Figure 4-5. Drought Past Events (USDM) in San Mateo County



[115] National Integrated Drought Information System. (n.d.). Drought Conditions for San Mateo County. Retrieved from https://www.drought.gov/states/california/county/san%20mateo.

Figure 4-6. Drought Past Events (SPI) in San Mateo County



FEMA NRI Annualized Frequency

The drought annualized frequency value represents the average number of recorded drought hazard occurrences (in event days) per year over the 25-year period of record. A higher annualized frequency value results in higher EAL and Risk Index scores. **Table 4-37** outlines the annualized frequency of drought in San Mateo County, based on FEMA NRI data.

Table 4-37. Drought Annualized Frequency *(FEMA National Risk Index)*

Events on Record *(2000 - 2025)*	Annualized Frequency
987	38.0
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.	

4.6.2.5. Past Events

Droughts recur every few years. Unlike other hazards (e.g., floods and earthquakes), droughts are not easily defined as "events". San Mateo County has experienced multiple droughts between 2000 and 2025, as illustrated in **Figure 4-5**. Key drought events include one (1) between 2013 and 2016, characterized by a rapid transition to Extreme Drought (D3) and Exceptional Drought (D4) levels, and the other between 2020 and 2022, during which the County spent 215 weeks at Extreme Drought (D3) and Exceptional Drought (D4) status.[116] San Mateo was included in one (1) State Disaster Declaration and

[116] United States Drought Monitor. (2025). Time Series: San Mateo County (CA). Retrieved from https://droughtmonitor.unl.edu/DmData/TimeSeries.aspx.

one (1) FEMA Emergency Declaration for drought between 1953 and 2025. A Presidential Disaster Declaration for drought has never been declared in the State of California.[117]

Table 4-38 summarizes the most recent significant drought events that affected California. While not all of these events severely impacted San Mateo County, they illustrate the potential scale and severity of future drought cycles in the region.

Table 4-38. Drought Past Events

Date	Description
2020 – 2024	USDA declared a drought disaster that included San Mateo County on April 21, 2020. April 2021 was the third driest April in the past 127 years.[118] As of June 2021, San Mateo County was under the Extreme Drought (D3) designation, putting the County at year-round risk of wildfire. On April 15, 2021, SFPUC sent wholesale customers a letter on water supply availability estimates for 2021 and current hydrological conditions. The drought emergency declaration for San Mateo County was terminated in September 2024. California's three (3) driest years on record were followed by a wet and very snowy water year.
2012 – 2017	At the time, the period between 2012 and 2014 ranked as the driest three (3) consecutive years for Statewide precipitation. The 2014 calendar year set new records for statewide average temperatures and for low water allocations from the California State Water Project. The 2013 calendar year set minimum annual precipitation records for many communities. Detailed executive orders and regulations addressed water conservation and management. In 2014, California declared a State of Emergency due to the drought and imposed mandatory reductions in urban water use. The Statewide drought emergency was lifted in April 2017.[119] This drought had significant effects on the southern coastline of San Mateo County because many community members in this area rely on creeks and wells that have ceased to flow. Rural communities in the County faced stringent restrictions on bathing, using toilets, and washing clothing, and many ranches and farms in the area experienced significant economic downturns. Urban areas of the San Francisco Bay Area experienced water conservation measures, but not to the extent imposed on rural community members.[120] During this drought, San Mateo County and its municipalities implemented initiatives to maintain the quantity and quality of water resources in the County – San Mateo Countywide Water Pollution Program, Groundwater Protection Program, Land Use and Septic Wells Program, Recreational Water Quality Program, Small Drinking Water Systems Program, and Municipal Facilities Water Conservation Efforts.

[117] California Governor's Office of Emergency Services. (2023). California State Hazard Mitigation Plan (Appendix F). Retrieved from https://www.caloes.ca.gov/wp-content/uploads/Hazard-Mitigation/Documents/2023-California-SHMP_Volume-2-Appendix-F_12.15.2023.pdf.
[118] United States Drought Monitor. (2025). Time Series: San Mateo County (CA). Retrieved from https://droughtmonitor.unl.edu/DmData/TimeSeries.aspx.
[119] California Department of Water Resources. (2021). Report to the Legislature on the 2012–2016 Drought. Retrieved from https://water.ca.gov/-/media/DWR-Website/Web-Pages/Water-Basics/Drought/Files/Publications-And-Reports/CNRA-Drought-Report-final-March-2021.pdf.
[120] Alexander, K. (2014). California Drought Hits San Mateo County Coast Particularly Hard. Retrieved from https://www.sfgate.com/bayarea/article/California-drought-hits-San-Mateo-County-coast-5896053.php.

Date	Description
2007 – 2009	A State Emergency Declaration was issued on June 12, 2008, after the 2008 spring season was the driest spring on record. On February 27, 2009, the State proclaimed a State of Emergency for the entire state amid a severe drought. The largest court-ordered water restriction in California history (at the time) was imposed. Socioeconomic impacts prompted emergency response actions involving social service programs (e.g., food banks and unemployment assistance). This drought also marked a period of unprecedented restrictions in diversions from the Sacramento-San Joaquin River Delta to protect listed fish species impacted by the drought.[121]
1987 – 1992	California received precipitation well below average levels for four (4) consecutive years. While the Central Coast was most affected, the Sierra Nevada range in Northern California and the Central Valley counties were also affected. During this drought, only 56% of the average runoff for the Sacramento Valley was received. In 1991, the California State Water Project sharply decreased deliveries to water suppliers. By February 1991, all 58 counties in California were experiencing drought. Urban and agricultural areas were affected, and 23 counties had declared local drought emergencies by the end of 1991.[122]
1976 – 1977	California experienced a severe drought due to insufficient rainfall during the winters of 1976 and 1977. 1977 was the driest period on record in California at that time, with the previous winter recorded as the fourth driest in California's hydrological history at that time. The cumulative impact led to widespread water shortages and the imposition of severe statewide water conservation measures. Only 37% of the average Sacramento Valley runoff was received, with just 6.6 million acre-feet recorded. Over $2.6 billion in crop damage was recorded in 31 counties. FEMA declared an Emergency Declaration (EM-3023) on January 20, 1977, for 58 California counties.
1920s – 1930s	Dry conditions prevailed during most of the 1920s and well into the 1930s, including the Dust Bowl drought (1928 – 1935) that affected much of the United States. The Dust Bowl drought established hydrologic criteria widely used in the design of storage capacity and yield for large reservoirs in northern California.[123]

4.6.2.6. Vulnerability

Population Exposed

30% or more of the population in San Mateo County is exposed to drought. Generally, the entire population of San Mateo County is vulnerable to drought events. Poor air quality and increased temperatures, which are expected during drought conditions, pose a unique vulnerability to individuals with chronic medical conditions (e.g., cardiovascular disease, respiratory conditions, mental illness), those with lower incomes, children, the elderly, and outdoor workers (e.g., agricultural and construction workers).[124] **Table 4-39** summarizes the underserved population in San Mateo County.

[121] California Department of Water Resources. (2010). California's Drought of 2007–2009. Retrieved from https://water.ca.gov/-/media/DWR-Website/Web-Pages/Water-Basics/Drought/Files/Resources/California-Drought-of-200709.pdf.
[122] California Department of Water Resources. (2000). Preparing for California's Next Drought. Retrieved from https://cawaterlibrary.net/wp-content/uploads/2017/05/Drought_Report_87-92.pdf.
[123] California Department of Water Resources. (2012). Drought in California. Retrieved from https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/california_waterfix/exhibits/docs/CSPA%20et%20al/part2/cspa_251.pdf.
[124] Centers for Disease Control and Prevention. (2024). Populations Impacted by Drought. Retrieved from https://www.cdc.gov/drought-health/toolkit/vulnerable-populations.html.

Table 4-39. Underserved Population in San Mateo County

Category	Estimate	Percent
Population Below Poverty Level[125]	49,359	6.7%
Income Below $25,000 (Households)[126]	18,773	7.1%
Spanish Spoken at Home[127]	124,233	17.6%
Speak English Less Than "Very well"[128]	120,715	17.1%
Language Other Than English[129]	322,325	45.8%
Foreign Born[130]	265,258	35.7%
Household Without a Vehicle[131]	11,869	3.1%
65 Years and Over[132]	132,242	17.8%
Senior (65 Years and Over) Living Alone[133]	8,355	3.2%

Population Exposure		Vulnerability Factor	Weighted Factor	Score
High	30% or more of the population is exposed to the hazard.	3	3	9
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population Exposure Score = Extent Factor x Weighted Factor***				

Property Exposed

9% or less of the total assessed property, infrastructure, and resources value is exposed to drought in San Mateo County. Drought conditions can cause both direct physical damage and significant operational impacts on property and infrastructure. Critical infrastructure, including water and wastewater systems, energy facilities, agriculture-related facilities, and those associated with potable water supplies, is particularly vulnerable. Additionally, green spaces and agricultural lands are highly vulnerable to drought. Furthermore, some structures may become vulnerable to wildfires, which are more likely following years of drought.

125 United States Census Bureau. (2024). S1701: Poverty Status in the Past 12 Months (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S1701?g=050XX00US06081.
126 United States Census Bureau. (2024). S1901: Income in the Past 12 Months (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S1901?g=050XX00US06081.
127 United States Census Bureau. (2024). S1601: Language Spoken at Home (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S1601?g=050XX00US06081.
128 Ibid.
129 Ibid.
130 United States Census Bureau. (2024). DP02: Selected Social Characteristics in the United States (2024: ACS 5-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP5Y2024.DP02?g=050XX00US06081.
131 United States Census Bureau. (2024). S0801: Commuting Characteristics by Sex (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S0801?g=050XX00US06081.
132 United States Census Bureau. (2024). DP05: ACS Demographics and Housing Estimates (2024: ACS 5-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP5Y2024.DP05?g=050XX00US06081.
133 United States Census Bureau. (2024). DP02: Selected Social Characteristics in the United States (2024: ACS 5-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP5Y2024.DP02?g=050XX00US06081.

Property Exposure		Vulnerability Factor	Weighted Factor	Score
Low	9% or less of the total assessed property value is exposed to a hazard.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property Exposure Score = Extent Factor x Weighted Factor***				

Changes in Development

Information on changes in development within San Mateo County is provided in **Chapter 3** (Community Profile) of this Assessment.

The changes in development have increased San Mateo County's exposure to drought by 4% or less. The County and its municipalities have adopted general plans and undertaken other planning activities that provide guidance on hazard mitigation and future development. General plans include policies that direct land use and address water supply and the protection of water resources. These plans provide the local municipal level with the capacity to reduce the vulnerability of future development to drought impacts. In addition, water providers in the planning area have plans and programs in place to balance competing water needs.

Changes in Development		Vulnerability Factor	Weighted Factor	Score
Low	Changes in development have increased the community's exposure to the hazard by 4% or less.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Changes in Development Score = Extent Factor x Weighted Factor***				

4.6.2.7. Impacts

Population and Life Safety

A population that is exposed to drought is likely to experience minimal adverse impacts (e.g., ambulatory injuries). A drought would impact all residents within the community. Increased temperatures associated with drought conditions pose a significant and multifaceted threat to public health and safety. Heat, often exacerbated by drought, is already the leading weather-related cause of death in the United States.[134] Beyond the immediate impacts of heat-related illnesses (e.g., heat stroke, heat exhaustion, heat cramps) and dehydration, extreme heat during drought can increase mortality risk, particularly among vulnerable populations.[135]

Furthermore, disruptions to electricity and water supplies will exacerbate these health problems, as residential and commercial heating, ventilation, and air conditioning (HVAC) systems may malfunction due to drought-induced water shortages, exposing vulnerable populations to extreme heat.[136] Drought events are often accompanied by extreme heat, which makes outdoor workers (e.g., construction, agricultural, and recreational workers) particularly vulnerable because they are required to work outdoors

[134] United States Environmental Protection Agency. (2025). Extreme Heat. Retrieved from https://www.epa.gov/climatechange-science/extreme-heat.
[135] National Integrated Drought Information System. (n.d.). By Sector: Public Health. Retrieved from https://www.drought.gov/sectors/public-health.
[136] Cybersecurity and Infrastructure Security Agency. (2025). Drought and Infrastructure: A Planning Guide. Retrieved from https://www.cisa.gov/sites/default/files/2025-03/drought-and-infrastructure-planning-guide-MAR2025.pdf.

and are at risk of heat-related illnesses (e.g., heat cramps, heat exhaustion, heat stroke). Outdoor work may also be halted during periods of high temperatures, resulting in economic hardship. *Refer to Section 4.5.7 (Severe Weather) for further details on the impacts of heat waves/extreme heat.*

Droughts impact access to clean drinking water, food security, and sanitation, which, in turn, affect human health and safety. Furthermore, drought conditions can increase the incidence of illness and disease (e.g., mosquito-borne diseases, anxiety, depression, and other adverse mental health outcomes). Furthermore, droughts can further exacerbate wildfire risk and dusty, dry conditions. Particulate matter from these events can irritate the bronchial passages and pulmonary tissues, exacerbating pre-existing chronic cardiovascular and respiratory conditions.[137]

San Mateo County, the BAWSCA, regional water providers, and other regional stakeholders have dedicated substantial time and effort to safeguard life, safety, and health during periods of consecutive dry years. Measures have been implemented to analyze and prepare for forecasted water shortages. Through coordination among its municipalities, the County can minimize adverse effects on community members and water consumers.

Population and Life Safety Impact		Impact Factor	Weighted Factor	Score
Low	Populations exposed to this hazard are likely to experience minimal adverse impacts, such as ambulatory injuries.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population and Life Safety Impact Score = Impact Factor x Weighted Factor***				

Underserved Population

The underserved population exposed to drought in San Mateo County is likely to experience some adverse/disproportionate impacts (e.g., injuries requiring acute medical care). This population is particularly susceptible to drought and extreme temperatures due to their age, health conditions, and limited ability to mobilize to reach shelters, cooling, and medical resources. Some drought-related health impacts are short-term, whereas others are long-term.

Droughts have a profound impact on underserved populations, exacerbating existing vulnerabilities and creating new challenges. Individuals most vulnerable to the health impacts of droughts are those with chronic medical conditions (e.g., cardiovascular disease, respiratory conditions, mental illness), lower income, infants and children, and the elderly.[138] Furthermore, drought can degrade air quality by creating dusty, dry conditions (from dry soil and vegetation) and increasing the risk of wildfires. These conditions produce airborne particulates that irritate the lungs and bronchial passages, exacerbating chronic respiratory conditions (e.g., asthma) and having a particularly significant impact on infants, children, and the elderly.[139]

[137] National Integrated Drought Information System. (n.d.). By Sector: Public Health. Retrieved from https://www.drought.gov/sectors/public-health.
[138] U.S. Centers for Disease Control and Prevention. (2024). Heat Stress and Workers. Retrieved from https://www.cdc.gov/niosh/heat-stress/about/index.html.
[139] U.S. Centers for Disease Control and Prevention. (2024). Populations Impacted by Drought. Retrieved from https://www.cdc.gov/drought-health/toolkit/vulnerable-populations.html.

Drought events are often accompanied by extreme heat, which makes outdoor workers (e.g., construction, agricultural, and recreational workers) uniquely vulnerable because they are required to work outdoors and are at risk of heat-related illnesses (e.g., heat cramps, heat exhaustion, heat stroke). Outdoor work may also be halted during periods of high temperatures, resulting in economic hardship.

Underserved Population Impact		Impact Factor	Weighted Factor	Score
Medium	Underserved populations exposed to the hazard are likely to experience some adverse/disproportionate impacts, such as injuries requiring acute medical care.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Underserved Population Impact Score = Impact Factor x Weighted Factor***				

Property, Facilities, and Critical Infrastructure

Less than $500,000 in property damage is expected from a *single major* drought event, or damages are expected to occur to less than 5% of the property value within San Mateo County. While drought conditions rarely cause immediate, direct damage to property, facilities, and critical infrastructure, they can jeopardize the operational integrity of some critical infrastructure. Extended periods of drought and concurrent extreme heat can strain health and emergency services and critical infrastructure (e.g., water, energy, and transportation), and, if people lose crops or livestock, can affect food and livelihoods.[140] Impacts to critical infrastructure include the loss of essential functions due to low water supplies and disruption to water delivery services. Severe droughts can impact drinking water supplies, particularly when public water systems are affected. Additionally, buildings and infrastructure need not be physically damaged to trigger a loss of service. For example, extreme heat reduces the efficiency of power grid equipment while simultaneously increasing demand to meet higher cooling needs. This combination increases the risk of grid overloading, which can potentially lead to brownouts or blackouts. Similarly, drought conditions harm water delivery services but do not cause physical damage to pipes or water treatment plants.

The relationship between drought and the built environment is most viable through secondary hazards. Although structures are not directly impacted by drought, some may become vulnerable to wildfires, which are more likely after prolonged drought. Droughts can have significant impacts on other types of property, such as landscaped areas, public parks, and economically important natural resources. These impacts extend to the industrial sector, where facilities that rely on large volumes of water for operations (e.g., power plants, refineries) may experience reduced output or forced shutdowns due to water scarcity. Additionally, drought is associated with increased insect infestation, plant diseases, and wind erosion, which can impact agricultural properties and facilities.

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[140] U.S. Centers for Disease Control and Prevention. (2024). Health Impacts of Drought. Retrieved from https://www.cdc.gov/drought-health/health-implications/index.html.

Property, Facilities, and Critical Infrastructure Impact		Impact Factor	Weighted Factor	Score
Low	Less than $500,000 in property, facilities, and infrastructure damages is expected from a single significant event, or damages are expected to occur to less than 5% of the property value within the jurisdiction.	1	2	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property, Facilities, and Critical Infrastructure Impact Score = Impact Factor x Weighted Factor***				

Economy

A single *significant* drought event in San Mateo County is likely to result in a total economic impact greater than $100,000 but less than or equal to $10 million. Drought has the most significant economic impacts on industries that use water or depend on it for their operations, most notably agriculture and related sectors (e.g., forestry, fisheries, and waterborne activities), power plants, and oil refineries. In addition to yield losses in crop and livestock production due to water scarcity, drought is associated with increased soil salinity, insect infestations, plant diseases, and wind erosion. These costs are often passed on to consumers through increased prices, and other impacts can include reduced supplies to downstream industries (e.g., food processors) and reduced demand for inputs (e.g., farm labor).[141]

When a drought affects other parts of California and the region, even if San Mateo County is not directly impacted, it can still affect the County's economy. Drought can lead to additional losses because many sectors are affected, including reduced income for farmers and reduced business for retailers and other providers of goods and services to farmers. This leads to unemployment, increased credit risk for financial institutions, capital shortfalls, and loss of tax revenue. Prices for food, energy, and other goods may also increase as supply decreases.

During droughts, the agricultural sector is most vulnerable to economic losses and damages. Crops fail to mature, leading to reduced yields, nutritional deficiencies in wildlife and livestock, lower land values, and financial setbacks for farmers. Agriculture production has been a significant and growing factor in San Mateo County, especially as agricultural effects on the economy start to normalize (after a period of decline).

Direct effects (excluding indirect and induced spending benefits) can be evaluated using information from USDA reports. According to the 2022 Census of Agriculture, San Mateo County had 250 farms, encompassing 44,885 acres of farmland. The average farm size was 180 acres. San Mateo County farms had a total market value of products sold of $87.9 million, averaging $351,449 per farm. **Table 4-40** lists the acreage of agricultural land exposed to the drought hazard.[142]

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[141] National Integrated Drought Information System. (n.d.). By Sector: Agriculture. Retrieved from https://www.drought.gov/sectors/agriculture.

[142] United States Department of Agriculture. (2022). 2022 Census of Agriculture County Profile, San Mateo County, California. Retrieved from https://www.nass.usda.gov/Publications/AgCensus/2022/Online_Resources/County_Profiles/California/cp06081.pdf.

Table 4-40. Agriculture Land in San Mateo County

Number of Farms	Percent Change Since 2017	Land in Farms *(acres)*	Percent Change Since 2017	Average Size of Farm *(acres)*	Percent Change Since 2017
250	4%	44,885	-2%	180	-6%

In 2022, the following were the top categories of agricultural products sold in San Mateo County:[143]

- Nursery, greenhouse, floriculture, and sod at $73.6 million.
- Vegetables, melons, potatoes, and sweet potatoes at $6.9 million.
- Fruits, tree nuts, and berries at $3.7 million.

A prolonged drought can significantly affect a community's economy. Increased demand for water and electricity may lead to shortages and higher costs for these resources. Industries that rely on water for operations may be most affected (e.g., landscaping businesses). Although most businesses will remain operational, they may be affected aesthetically, particularly the recreation and tourism industry. Moreover, droughts in other areas could affect food supply and food prices for community members within the County.

Economic Impact		Impact Factor	Weighted Factor	Score
Medium	Total economic impact is likely to be greater than $100,000, but less than or equal to $10 million.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Economic Impact Score = Impact Factor x Weighted Factor***				

FEMA NRI Expected Annual Loss Estimates

A drought NRI EAL score and rating represent a community's relative level of expected agriculture loss each year due to droughts when compared to the rest of the United States. The EAL score is positively associated with a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-41** outlines the drought EAL for San Mateo County.

Table 4-41. Drought Expected Annual Loss *(FEMA National Risk Index)*

Population	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Expected Annual Loss Rating
n/a	n/a	n/a	$2.33 Million	$2.33 Million	94.8	Relatively High
Population exposure is defined as the estimated number of people determined to be exposed to a hazard according to a hazard type-specific methodology. *Expected Annual Loss scores are calculated using an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).*						

[143] Ibid.

Environment

Environmental impact from a single *significant* drought event is likely to be localized, requiring some outside resources and support; and/or repair, cleanup, restoration, or preservation work. Droughts can have severe environmental impacts. Environmental losses from drought include damage to plants, animals, and wildlife habitats; degradation of air and water quality; forest and range fires; degradation of landscape quality; loss of biodiversity; and soil erosion. Damage to an ecosystem can be temporary, but severe drought can cause permanent damage. Growing public awareness and concern for environmental quality have forced public officials to focus greater attention and resources on these effects. Drought impacts on the environment include, but are not limited to:[144]

- Losses or destruction of fish and wildlife habitats through the loss of wetlands, lakes, and vegetation. The degradation of landscape quality, including increased soil erosion, may lead to a more permanent loss of biological productivity.
- Lack of food and drinking water for wild animals.
- Increase in disease in wild animals due to reduced food and water supplies.
- Migration of wildlife.
- Increased stress on endangered species or even extinction.
- Lower water levels in reservoirs, lakes, ponds, and wells.
- More wildfires due to dry vegetation (more flammable and easily ignited), reduced moisture in soil and atmosphere (leads to faster fire spread), and extreme heat conditions that usually accompany drought conditions.
- Wind and water erosion of soils.
- Poor soil and air quality.

Drought generally does not affect groundwater sources as quickly as surface water supplies, but groundwater sources take longer to recover. Reduced precipitation during a drought means that groundwater supplies are not replenished at a normal rate. This can lead to a reduction in groundwater levels and problems such as reduced pumping capacity or wells going dry. Shallow wells are more susceptible than deep wells. Reduced replenishment of groundwater affects streams. Much of the flow in streams comes from groundwater, especially during the summer, when precipitation is lower, and snowmelt has ended. Reduced groundwater levels mean that even less water will enter streams when streamflow is lowest. Where streamflow is reduced, development that relies on surface water may seek to establish new groundwater wells, which could further increase groundwater depletion.

[144] National Drought Mitigation Center. (n.d.). How Does Drought Affect Our Lives? Retrieved from https://drought.unl.edu/Education/DroughtforKids/DroughtEffects.aspx.

Environment Impact		Impact Factor	Weighted Factor	Score
Medium	Environmental impact from a single significant event is likely to be localized, requiring some outside resources and support; and/or repair, cleanup, restoration, or preservation work.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Environmental Impact Score = Impact Factor x Weighted Factor***				

Continuity of Operations/Delivery of Services

There may be impacts lasting between 24 and 72 hours on San Mateo County's ability to meet the essential day-to-day operational demands and needs of the community in the event of a *single major* drought event. Drought can result in significant operational impacts on water utilities and the energy sector. Water utilities ensure a reliable supply of clean water to communities and contribute to various other sectors, including agriculture, energy, and manufacturing. Drought impacts on water utilities include, but are not limited to, the following:[145]

- Loss of water pressure and water supply.
- Poor water quality from the source, which would require additional treatment to meet standards for drinking water.
- Access to alternative and supplementary water sources may be unavailable due to high demand.
- Increased customer demand, cost, and reduced revenues.
- Compete for source water among water utilities and other stakeholders.

Subsequently, like a domino effect, impacts on water utilities ripple through other sectors that depend on them, such as the energy sector. For example, drought conditions generally reduce streamflow, thereby limiting the ability to cool nuclear power plants. Additionally, drought is often accompanied by extreme temperatures, which increase demand for residential and commercial cooling systems. These combined effects on water utilities and energy infrastructure can strain the power grid, potentially causing brownouts or blackouts in the community.[146] Additionally, drought conditions can place a significant strain on health and emergency services, as first responders may need to limit time spent outdoors, manage increased call volume due to heat-related illnesses, and contend with resource constraints (e.g., firefighting supplies).

[145] National Integrated Drought Information System. (n.d.). By Sector: Water Utilities. Retrieved from https://www.drought.gov/sectors/water-utilities.
[146] National Integrated Drought Information System. (n.d.). By Sector: Energy. Retrieved from https://www.drought.gov/sectors/energy.

Continuity of Operations/Delivery of Services Impact		Impact Factor	Weighted Factor	Score
Medium	Impact lasting between 24 and 72 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single significant event.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Continuity of Services/Delivery of Services Impact Score = Impact Factor x Weighted Factor***				

Future Development

Information on changes in development within San Mateo County is provided in **Chapter 3** (Community Profile) of this Assessment.

Future development trends will increase, but not significantly, the impacts of drought in San Mateo County. A potential future population increase in San Mateo County, which would lead to higher water and energy use, could exacerbate the effects of drought.

The County and its municipalities have adopted general plans and undertaken other planning activities that provide guidance on hazard mitigation and future development. General plans include policies that direct land use and address water supply and the protection of water resources. These plans provide the local municipal level with the capacity to reduce future development's vulnerability to drought impacts. In addition, water providers in the planning area have plans and programs in place to balance competing water needs.

Future Development Impact		Impact Factor	Weighted Factor	Score
Medium	Future development trends will increase the impacts of this hazard, but not significantly.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Future Development Impact Score = Impact Factor x Weighted Factor***				

Climate Change

Climate change trends will significantly increase the risks and impacts of droughts. In California and the western United States, observations of climate change have shown an increase in drought frequency and in the number of consecutive dry days. Climate change will not result in less frequency and intensity of precipitation in the County, while average annual temperatures may increase by as much as 2.0°F within 25 years. **Table 4-42** indicates the 25-year climate projections in San Mateo County.[147]

[147] Northeast Regional Climate Center. (n.d.). Neighborhoods at Risk: Climate Projections. Retrieved from https://nar.headwaterseconomics.org/.

Table 4-42. 25-Year Climate Projections for San Mateo County

Higher Emissions (RCP8.5)
San Mateo County is expected to experience a 68% increase in extremely hot days and a 2% increase in days with heavy precipitation within 25 years.
By 2051, San Mateo County is expected to experience 1 more days that reach above 95°F (from two (2) days to three (3) days per year).
Lower Emissions (RCP4.5)
San Mateo County is expected to experience a 45% increase in extremely hot days and a 10% increase in days with heavy precipitation within 25 years.
By 2051, San Mateo County is expected to experience 0.8 more days that reach above 95°F (from 1.9 days to 2.7 days per year).

California regularly experiences droughts, but climate change will likely lead to more frequent and more severe droughts across the State. Overall, precipitation levels are expected to stay similar or increase slightly across San Mateo County. However, more years with extreme precipitation levels, both high and low, are likely a result of climate change. More intense droughts are expected to harden soil and cause aquifer levels to drop due to reduced groundwater recharge. Additionally, when rainfall returns, more water will run off rather than infiltrate into the soil, potentially causing downstream flooding. Higher temperatures will further increase evaporation, worsening drought conditions.[148]

Climate change is already profoundly impacting California's water resources, as evidenced by changes in snowpack, sea level, and river flows. These changes are expected to continue, and more precipitation will likely fall as rain rather than snow, thereby decreasing snowpack levels. This potential change in weather patterns will pose additional challenges to water supply reliability.[149]

DWR states that climate change is responsible for the decrease in Sierra snowpack levels, which provide as much as a third of California's water supply by accumulating snow during wet winters and releasing it slowly during the spring and summer when demand is greatest. Warmer temperatures will cause snow to melt faster and earlier, making it more difficult to store and use. By the end of this century, the Sierra snowpack is projected to experience a 48% to 65% loss from the historical April 1st average. This loss of snowpack means less water will be available for water users in the State.[150]

Climate change is also expected to result in more variable weather patterns throughout the State. More variability can lead to longer and more severe droughts. In addition, rising sea levels will continue to threaten the Sacramento-San Joaquin Delta, the heart of the California water supply system and the source of water for 25 million Californians and millions of acres of prime farmland.[151]

148 San Mateo County. (2026). Safety Element (Draft).
149 California Department of Water Resources. (n.d.). Climate Change Basics. Retrieved from https://water.ca.gov/Water-Basics/Climate-Change-Basics.
150 California Department of Water Resources. (n.d.). Climate Change and Water. Retrieved from https://water.ca.gov/Programs/All-Programs/Climate-Change-Program/Climate-Change-and-Water.
151 Ibid.

Climate Change Impact		Impact Factor	Weighted Factor	Score
High	Climate Change trends will significantly increase the impacts of this hazard.	3	1	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Climate Change Impact Score = Impact Factor x Weighted Factor***				

Secondary Impacts

The following are cascading or indirect hazards that may follow the primary hazard event. These hazards can occur concurrently with or be triggered by the initial event and may exacerbate its overall impact.

- Reduced Water Quality and Supply
- Increasing Wildfire Risk
- Agricultural Impacts (reduced crop yields, livestock losses, reduced agricultural income)
- Poor Air Quality
- Extreme/Excessive Heat
- Reduction in Tourism and Recreation
- Flood
- Greenspace Impacts (e.g., tree mortality)

4.6.2.8. Issues

Drought presents a range of challenges that can impact a community's preparedness, response, recovery, and mitigation efforts. While not exhaustive, the following outlines key drought-related issues that the planning team identified that San Mateo County may encounter during such events.

- Alternative water supplies need to be identified and developed, as well as alternative strategies to allocate and distribute existing water sources.
- Alternative techniques (e.g., groundwater recharge, water recycling, local capture and reuse, desalination, and transfer) could stabilize and offset Sierra Nevada snowpack water supply shortfalls.
- Development of local or regional drought-level indicators to correspond with drought implementation plans or other water conservation measures.
- Drought in the County could increase and expand wildfire-prone areas and adversely affect the timber economy.
- Water planning should consider the impacts of additional drawdowns on groundwater supplies as pressure on surface water increases during drought.
- The effectiveness of long-term reliable water supply strategy projects, water conservation incentive projects, and water system capital improvement project upgrades should be monitored.
- More studies need to be done regarding overall water usage in the County and how it relates to the economy to prepare for a worst-case scenario drought.
- Planning must address the degree of future development in drought-prone areas.

- Water conservation should be actively promoted, even during non-drought periods.
- Frequent or prolonged droughts may limit the County's and community members' ability to recover from or prepare for more occurrences successfully.
- Extended periods of drought can lead to inadequate water supply (especially for those on private wells), which has compounding effects on public health, the energy sector, and the agricultural sector.
- Drought conditions increase water demand for agriculture and drinking water.
- Manufacturing and energy production may be required to reduce or stop production due to water supply issues as a result of a drought.
- Recreational and tourism activities may be affected due to drought and fire conditions impacting the County's economy.
- Drought conditions can place a significant strain on health and emergency services, as first responders may need to limit time outdoors, manage increased call volume related to heat-related illnesses, and contend with resource constraints.
- Droughts can be extended events that stretch over months or years, and may simultaneously occur with other hazards. This can strain a community's response and recovery efforts.
- Droughts can cause significant impacts to greenspace and ecosystem services, including increased tree mortality and/or reduced cooling effectiveness.

4.6.2.9. Risk Profile

FEMA Risk Index Score

The FEMA Drought Risk Index score and rating represent a community's relative risk for drought when compared to the rest of the United States. **Table 4-43** illustrates the Drought Risk Index rating and score for San Mateo County.

Table 4-43. Drought Total Risk Score *(FEMA National Risk Index)*

Rating	Score
Relatively High	92.1
Risk Index Values are calculated by combining the Social Vulnerability and Community Resilience components into a single Community Risk Factor, which is then multiplied by the Expected Annual Loss component (Expected Annual Loss x (Social Vulnerability / Community Resilience) = Risk Index).	

Overall Risk Score

Table 4-44 represents the Drought Total Risk Score for San Mateo County, based on the Risk Assessment Methodology, as defined in Section 4.3 of this Plan.

Table 4-44. Drought Total Risk Score

Hazard Event	Probability Factor	Sum of Weighted Extent Factors	Sum of Weighted Vulnerability Factors	Sum of Weighted Impact Factors	Consequence Score	Total Risk Score*
Drought	2	6	11	22	39	36

Extent: Sum of the weighted Extent factors.
Vulnerability: Sum of the weighted Vulnerability factors.
Impact: Sum of the weighted Impact factors.

Consequence Score: Extent + Vulnerability + Impact (Sum of all weighted factors).
Total Risk Score = Probability x Consequence
* Normalized to 100

Total Risk Score Legend

Classification	Probability	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 4	0 – 12	0 – 24	0 – 32
Medium (M)	2	7 – 12	5 – 10	13 – 26	25 – 48	33 – 66
High (H)	3	13 – 18	11 – 15	27 – 39	49 – 72	67 – 100

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.3. Earthquake

An earthquake is the rapid shaking of the Earth caused by the release of energy stored in the Earth's crust. The USGS defines an earthquake as a sudden slip on a fault, accompanied by ground shaking and radiated seismic energy; volcanic or magmatic activity; or other sudden stress changes in the Earth (e.g., a human-made explosion). Ground shaking refers to the vibration of the ground during an earthquake. In addition to the initial ground shaking, other earthquake hazards include building collapses, displacement or cracking, landslides, liquefaction, tsunamis, seiches, flooding resulting from damage to dams or levees, and fires from ruptured gas lines, downed power lines, and other sources. *Dam failure (Section 4.5.1), landslides (Section 4.5.5), tsunamis (Section 4.5.8), and flooding (Section 4.5.4) will be addressed separately in this Plan.* **Table 4-45** outlines some of the earthquake hazards.[152] Earthquakes cause both vertical and horizontal ground shaking, which varies in amplitude (the amount of displacement of the seismic waves) and frequency (the number of seismic waves per unit time), and usually lasts less than 30 seconds.[153]

Table 4-45. Earthquake Hazards

Hazard	Description
Ground Shaking	The movement of the Earth's surface is caused by earthquakes. Ground shaking is produced by waves generated by a sudden slip on a fault and travel through the Earth and along its surface.
Landslide	A movement of surface material down a slope.
Liquefaction	A process by which water-saturated sediment temporarily loses strength and acts as a fluid, like the wet sand near the water at the beach. Ground shaking from an earthquake can cause this effect. Liquefaction susceptibility is determined by geological history, depositional setting, and topographic position of the soil. Effects may occur along the shorelines of the ocean, rivers, and lakes, and they can also happen in low-lying areas away from the bodies of water in locations where the groundwater is near the Earth's surface.
Seiche	The sloshing of a closed body of water (e.g., a lake or bay), which may be caused by earthquake shaking.
Surface Faulting	Displacement that reaches the Earth's surface during a slip along a fault. Commonly occurs with shallow earthquakes with an epicenter less than 12.4 miles (20 kilometers).
Tectonic Deformation	A change in the original shape of a material caused by stress and strain.
Tsunami	A sea wave of local or distant origin that results from large-scale seafloor displacements associated with large earthquakes, major submarine slides, or exploding volcanic islands.

Earth has four (4) major layers – the inner core, outer core, mantle, and crust. The crust and the top of the mantle form a thin layer on the Earth's surface. However, this layer is not a single (1) piece; it is made up of many pieces, like a puzzle, covering the surface of the Earth, that are constantly moving around, sliding past one another, and bumping into each other. These are called tectonic plates, and their edges

[152] United States Geological Survey. (n.d.). Earthquake Hazards Program Glossary. Retrieved from https://www.usgs.gov/glossary/earthquake-hazards-program.
[153] United States Geological Survey. (n.d.). What are the Effects of Earthquakes? Retrieved from https://www.usgs.gov/programs/earthquake-hazards/what-are-effects-earthquakes.

are called plate boundaries. The plate boundaries are composed of numerous faults.[154] Most earthquakes occur at the boundaries where the Earth's tectonic plates meet (faults); less than 10% of earthquakes occur within plate interiors. As plates continue to move and plate boundaries change over time, weakened boundary regions become part of the plates' interiors. These zones of weakness within the continents can cause earthquakes in response to stress originating at the plate boundaries or in the deeper crust.[155]

California is seismically active because of the movement of the North American Plate to the east of the San Andreas Fault and the Pacific Plate to the west, which includes the State's coastal communities. The transform (parallel) movement of these tectonic plates against one another creates stresses that build as the rocks are gradually deformed. Rock deformation, or strain, is stored in the rock as elastic strain energy. When the rock's strength is exceeded, rupture occurs along a fault. The rocks on opposite sides of the fault slide past each other as they spring back into a relaxed position. The strain energy is released partly as heat and partly as elastic waves called seismic waves. The passage of these seismic waves causes ground shaking during earthquakes.

The sliding movement of Earth on either side of a fault is called the fault rupture. Fault rupture begins below the ground surface at the earthquake hypocenter, typically between three (3) and 10 miles below the ground surface in California. If an earthquake is large enough, the fault rupture will reach the ground surface, potentially destroying structures along its path.

The location where an earthquake begins is commonly described by its focal depth and the geographic position of its epicenter. The focal depth of an earthquake is the depth from the Earth's surface to the region where an earthquake's energy originates (i.e., the focus or hypocenter). The epicenter of an earthquake is the point on the Earth's surface directly above the hypocenter.[156] Earthquakes typically occur without warning, and their effects can extend to areas a great distance from the epicenter.

Sometimes earthquakes have foreshocks. These are minor earthquakes that occur in the same location before the larger earthquake. Scientists cannot determine whether an earthquake is a foreshock until the larger earthquake occurs. The largest, main earthquake is called the mainshock. Mainshocks always have aftershocks that follow. Aftershocks are smaller earthquakes that occur afterward in the same area as the mainshock. Depending on the size of the mainshock, aftershocks can continue for weeks, months, and even years after the mainshock.[157] In general, the larger the mainshock, the larger and more numerous the aftershocks, and the longer they will continue.

Regulatory Environment

The Alquist-Priolo Earthquake Fault Zoning Act was signed into California Law on December 22, 1972, to mitigate the hazard of surface faulting to structures for human occupancy. The Act was a direct result

[154] United States Geological Survey. (n.d.). The Science of Earthquakes. Retrieved from https://www.usgs.gov/programs/earthquake-hazards/science-earthquakes.
[155] United States Geological Survey. (n.d.). What are the Effects of Earthquakes? Retrieved from https://www.usgs.gov/programs/earthquake-hazards/what-are-effects-earthquakes.
[156] Ibid.
[157] United States Geological Survey. (n.d.). The Science of Earthquakes. Retrieved from https://www.usgs.gov/programs/earthquake-hazards/science-earthquakes.

of the significant damage to homes and businesses caused by the 1971 San Fernando Earthquake. It enforces the following to increase earthquake safety:[158]

- Directs the California Geological Survey (CGS) to create maps of known fault zones.
- Requires the sale of any home located within the fault zone designated on the maps to disclose that the property lies adjacent to a known fault.
- Prohibits new construction of homes within these zones unless geologic studies are performed to prove that the fault will not pose a hazard to new structures proposed in these zones.

The State provides extensive regulations on earthquake-related issues. A key regulatory body is the California Building Standards Commission (CBSC). It is authorized by the California Building Standards Law to administer the development, adoption, approval, publication, and implementation of California's building codes.

The California Building Standards Code, Title 24, serves as the basis for the design and construction of buildings in California. Improved safety, sustainability, consistency, new technologies, construction methods, and reliability are paramount in the development of building codes. California's building codes are published in their entirety every three (3) years. Intervening Code Adoption Cycles produce supplemental pages halfway through each triennial period (18 months). Amendments to California's building standards are subject to a lengthy and transparent public participation process throughout each code adoption cycle.

The California Seismic Safety Commission website provides a range of regulatory and advisory information on seismic safety.

4.6.3.1. Location

Earthquakes generally happen along faults, which are fractures or zones of fractures between two (2) blocks of rock. These faults enable the blocks to move relative to each other, with this movement happening quickly during an earthquake. Faults can vary greatly in length, from just a few millimeters to thousands of kilometers. Most faults produce repeated displacements or repeated earthquakes over long time periods. During an earthquake, the rock on one side of the fault suddenly slips with respect to the other. The fault surface can be horizontal, vertical, or some arbitrary angle in between. Geologists use the angle of the fault with respect to the surface (i.e., the dip) and the direction of slip along the fault to classify faults.

Faults are more likely to have future earthquakes if they have more rapid rates of movement, have had recent earthquakes along them, experience greater total displacements, and are aligned so that movement can relieve the accumulating tectonic stresses. Geologists classify faults by their relative hazards.

- **Active faults** are those that have ruptured to the ground surface during the Holocene period (about the last 11,000 years). These represent the highest hazard.

[158] Structural Engineers Association of Northern California. (1972). Events/Alquist-Priolo Earthquake Fault Zoning Act. Retrieved from https://legacy.seaonc.org/event/alquistprioloact/.

- **Potentially active faults** are those that displaced layers of rock from the Quaternary period (the last 1,800,000 years).

Determining if a fault is active or potentially active depends on geologic evidence, which may not be available for every fault. The majority of seismic hazards are associated with well-known active faults. However, inactive faults, where no displacement has been recorded, also have the potential to reactivate or experience displacement along a branch in the future. An example of a reactivated fault zone is the Foothills Fault Zone. The Zone was considered inactive until evidence of an earthquake (approximately 1.6 million years ago) was found near Spenceville, California. Then, in 1975, an earthquake occurred on another branch of the Zone near Oroville, California (now known as the Cleveland Hills Fault). The California State Mining and Geology Board indicates that increased earthquake activity throughout California may cause tectonic movement along currently inactive fault systems.

San Mateo County is in a region of high seismicity with numerous faults, as illustrated in **Figure 4-7**, which shows the geologic faults in the San Francisco Bay region.[159] There are three (3) primary faults that can produce significant earthquakes in the San Mateo County area – the San Andreas Fault (bisects the County), the Hayward Fault (across the Bay to the east), and the San Gregorio Fault (to the west).

San Andreas Fault

Estimated to be 28 million years old, the San Andreas Fault is an example of a transform boundary exposed on a continent. It spans 810 miles from the East Pacific Rise in the Gulf of California through the Mendocino Fracture Zone off the shore of Northern California. The Fault forms the tectonic boundary between the Pacific Plate and the North American Plate, and its motion is right-lateral strike-slip.

The San Andreas Fault is typically referenced in three (3) segments.

- The **southern segment** extends from its origin at the East Pacific Rise to Parkfield, California (Monterey County).
- The **central segment** extends from Parkfield to Hollister, California.
- The **northern segment** extends northwest from Hollister through San Mateo County to its junction with the Mendocino fracture zone and the Cascadia Subduction Zone in the Pacific Ocean.

Crossing the center of San Mateo County, the Fault passes through the population centers of Daly City and San Bruno, posing a considerable risk for surface fault rupture. The San Andreas Fault has a 21% chance of generating an earthquake of magnitude 6.7 or greater in the next 30 years. While the most recent local earthquake of magnitude 5.0 was in Daly City in 1957 (magnitude 5.3), the 1906 earthquake (magnitude 7.8) produced extreme ground shaking despite having an epicenter outside the County.

A similar earthquake or rupture along the Peninsula in the future would cause extremely violent ground shaking throughout San Mateo County. The risk is especially high in the heavily populated Bayside, which is underlain by alluvial deposits, bay mud, and artificial fill. Furthermore, the Bay margins are likely to experience liquefaction during a major earthquake.

[159] United States Geological Survey. (n.d.). Map of Known Active Geologic Faults in the San Francisco Bay Region. Retrieved from https://www.usgs.gov/media/images/map-known-active-geologic-faults-san-francisco-bay-region.

Hayward Fault

The Hayward Fault is a 45-mile-long right-lateral slip fault that parallels the San Andreas Fault in the East Bay. It extends through some of the Bay Area's most populated regions, including San Jose, Oakland, and Berkeley. Due to its heightened potential for activity and its proximity to critical facilities and dense urban centers, the fault is an increasing priority hazard for the Bay region.

There is a 31% chance that the Hayward Fault will generate an earthquake of magnitude 6.7 or greater in the next 30 years. Such an event would have regional implications for the entire Bay Area, as the Fault crosses numerous transportation and resource facilities, including major highways and the Hetch Hetchy Aqueduct. Specifically, a disruption of the Hetch Hetchy Water System could severely impair water service to San Mateo County.

San Gregorio Fault

The San Gregorio Fault is a northwest-trending, right-lateral slip deformation and the principal active fault west of the San Andreas in the Bay Area. Running from southern Monterey Bay through Bolinas Bay, its northern section intersects the San Andreas Fault offshore north of San Francisco. Within San Mateo County, it briefly crosses uninhabited land around Pillar Point at Half Moon Bay.

Despite being one of the least-studied fault lines, this Fault, due to its primary offshore location and proximity to the San Andreas and Hayward faults, poses a significant threat to San Mateo County. However, at 6%, its probability of generating a magnitude 6.7 or greater earthquake within the next 30 years is significantly lower than that of its neighboring faults.

Figure 4-7. Faults Located in the San Francisco Bay Region

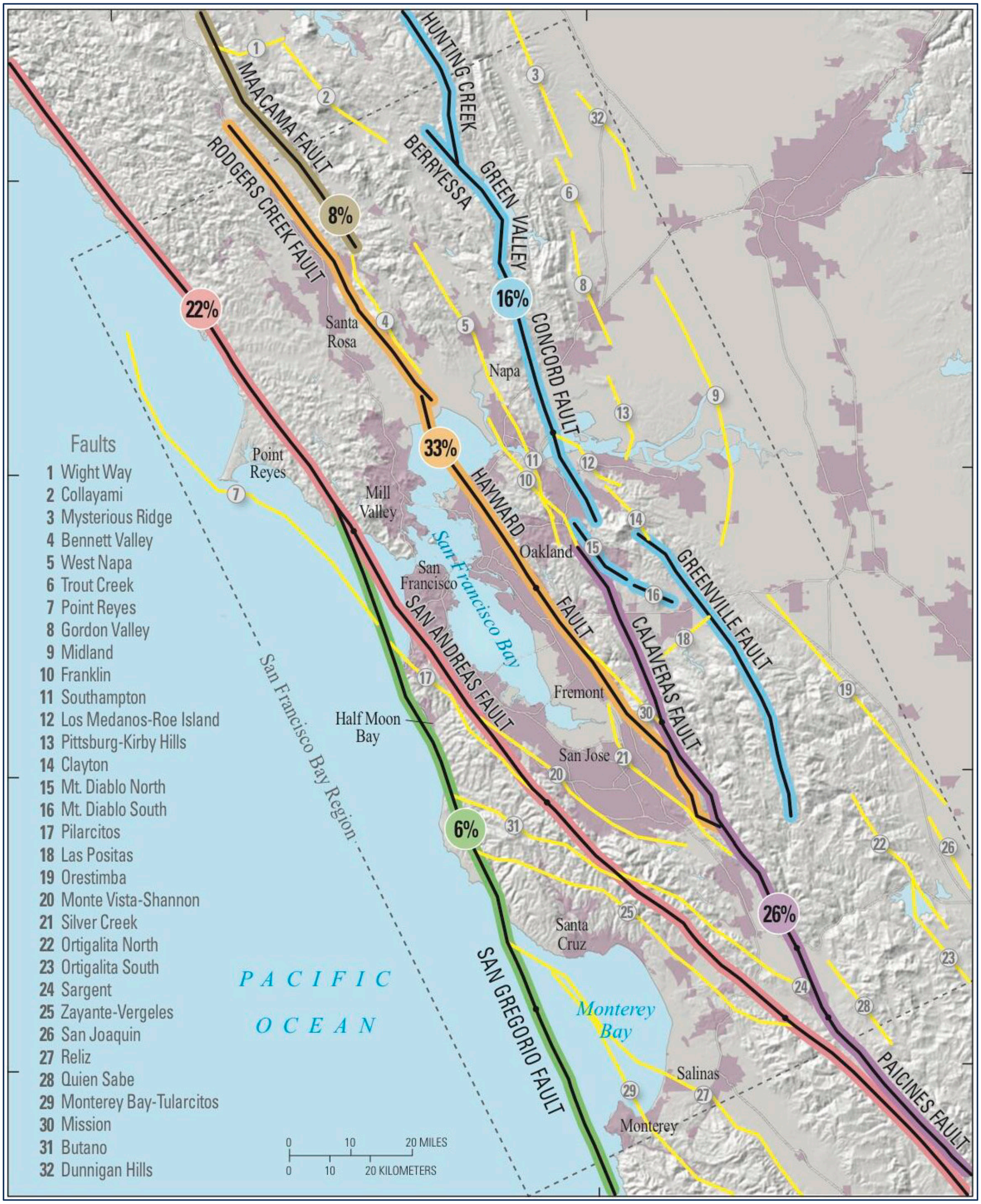


Table 4-46 lists additional faults within a five (5) mile radius of San Mateo County (i.e., in the Bay Area).

Table 4-46. Other Faults within a 50-Mile Radius of San Mateo County

Fault	Approximate Distance
Calaveras	17 miles from East Palo Alto
Greenville	23 miles from Menlo Park
Mount Diablo Thrust	27 miles from South San Francisco
Concord-Green Valley	30 miles from South San Francisco
Rogers Creek (Part of the Hayward Fault System)	35 miles from South San Francisco

Figure 4-8 illustrates earthquake events greater than Magnitude 4.3 within 20 miles of San Mateo County.

Figure 4-8. Earthquake History in the San Mateo County Area

[Map under development…]

The USGS Earthquake Map provides a real-time, customizable view of seismic activity worldwide, displaying essential details such as location, magnitude, and depth of recent events. It serves as a vital tool for public safety, helping users stay informed about active tectonic plate shifts and potential ground-shaking hazards.[160]

4.6.3.2. Extent/Severity

The extent of an earthquake is measured both in terms of its inherent magnitude and in terms of its local intensity. However, the two (2) terms are different and are often confused. Intensity is the measure of shaking at each location, and varies from place to place within the disturbed region, depending on the location of the observer with respect to the earthquake's epicenter. Magnitude refers to the size of the earthquake, which is related to the amount of seismic energy released at the hypocenter. It is based on the amplitude of the earthquake waves recorded by instruments with a common calibration. The magnitude of an earthquake is thus represented by a single, instrumentally determined value.[161]

Earthquake strength has traditionally been measured using the Richter Scale, developed by Charles Richter in 1935. The Richter Scale underwent numerous adjustments since its inception and was eventually replaced by the **Moment Magnitude Scale**. Although the general public often refers to both scales as the Richter Scale, geophysics and seismology use the Moment Magnitude Scale and report earthquake intensity on that scale. The Richter Scale has been superseded and is generally no longer used. Moment is the physical quantity proportional to the slip on the fault multiplied by the area of the fault surface that slips (related to the total energy released in an earthquake), and it can be estimated from seismographs. Subsequently, using a standard formula, the moment is converted to a magnitude-like measure comparable to other earthquake magnitudes. The result is called the moment magnitude

[160] United States Geological Survey. (2025). Latest Earthquakes (San Francisco Bay Region). Retrieved from https://earthquake.usgs.gov/earthquakes/map/?extent=37.02495,-123.4486&extent=38.38734,-120.4356.
[161] United States Geological Survey. (2021). The Severity of an Earthquake. Retrieved from https://pubs.usgs.gov/gip/earthq4/severitygip.html.

(Mw), which provides the most reliable estimate of earthquake size when compared to other magnitude scales.[162]

The effect of an earthquake on the Earth's surface is referred to as its intensity. An earthquake's intensity is measured using the **Modified Mercalli Intensity (MMI) Scale**. The MMI Scale is an observed measurement of the earthquake's intensity felt at the Earth's surface, and it varies depending on the observer's location at the earthquake's epicenter. The MMI Scale comprises 12 increasing levels, designated by Roman numerals, which range from imperceptible shaking to catastrophic destruction. Furthermore, the MMI can be used to map earthquake impacts. The MMI value assigned to a specific site after an earthquake provides a more meaningful measure of severity for the non-scientist than the magnitude, because intensity reflects the effects experienced at that location. **Table 4-47** correlates the MMI Scale with the Richter Scale and the effects of ground shaking.

Table 4-47. Modified Mercalli Intensity Scale vs. Moment Magnitude Scale

Intensity		Description/Damage	Moment Magnitude Scale *(approximate)*
I	Instrumental	Not felt.	1 – 2
II	Just Perceptible	Felt by only a few people, especially on the upper floors of tall buildings.	3
III	Slight	Felt by people lying down, seated on a hard surface, or in the upper stories of tall buildings.	3.5
IV	Perceptible	Felt indoors by many, by few outside; dishes and windows rattle.	4
V	Rather Strong	Generally felt by everyone; sleeping people may be awakened.	4.5
VI	Strong	Trees sway, chandeliers swing, bells ring, and there is some damage from falling objects.	5
VII	Very Strong	General alarm; walls and plaster crack.	5.5
VIII	Destructive	Felt in moving vehicles; chimneys collapse; poorly constructed buildings are seriously damaged.	6
IX	Ruinous	Some houses collapse; pipes break.	6.5
X	Disastrous	Obvious ground cracks, railroad tracks bent, and some landslides on steep hillsides.	7
XI	Very Disastrous	Few buildings survive; bridges are damaged or destroyed; all services are interrupted (e.g., electricity, water, sewage, railroads); and severe landslides occur.	7.5
XII	Catastrophic	Total destruction; objects thrown into the air; river courses and topography altered.	8

Earthquakes can trigger other types of ground failures, which may contribute to damage. These include landslides, dam failures, and liquefaction. In the last situation, shaking can mix groundwater and soil, liquefying and weakening the ground that supports buildings and severing utility lines. This is a

[162] United States Geological Survey. (n.d.). Moment Magnitude, Richter Scale – What are the Different Magnitude Scales, and Why are There so Many? Retrieved from https://www.usgs.gov/faqs/moment-magnitude-richter-scale-what-are-different-magnitude-scales-and-why-are-there-so-many.

particularly challenging problem in floodplains, where the water table is relatively high, and the soil is more susceptible to liquefaction.[163]

One of the most critical sources of information for accurate earthquake risk assessment is soil data. For example, soil along rivers and other bodies of water has higher water tables and higher sand content. The impact of an earthquake on structures and infrastructure is largely determined by ground shaking, distance from the epicenter, and liquefaction. Liquefaction, a secondary effect of an earthquake, occurs when soil loses its shear strength and behaves like a liquid, thereby damaging structures that rely on soil for support. Liquefaction generally occurs in soft, unconsolidated sedimentary soils.

National Earthquake Hazard Reduction Program Maps

The National Earthquake Hazards Reduction Program (NEHRP) defined six (6) site classifications based on the type of soil and rock in the area and their shear-wave velocity. NEHRP soil types A (hard rock), B (rock), and C (very dense soil and soft rock) typically can sustain low magnitude ground shaking without much effect. On the other hand, NEHRP soil types D (stiff soil), E (soft clay soil), and F (which may contain multiple soil types and require site-specific evaluation) are most affected by ground shaking, making these areas more susceptible to liquefaction.[164] **Table 4-48** outlines the NEHRP soil classification system.

Table 4-48. NEHRP Soil Classification System

Soil Class	Description	30 m Mean Shear Velocity *(m/s)*
A	Hard Rock	1,500
B	Firm to Hard Rock	760 – 1,500
C	Very Dense Soil and Soft Rock	360 – 760
D	Stiff Rock	180 – 360
E	Soft Clays	Less than 180
F	Special Study Soils (liquefiable soils, quick and highly sensitive clays, and collapsible, weakly cemented soils)	

Liquefaction Maps

Soil liquefaction maps are valuable tools for assessing potential earthquake damage. When the ground liquefies, saturated sandy or silty materials behave like a liquid, causing pipes to leak, roads and airport runways to buckle, and damage to building foundations. Generally, areas with NEHRP Soils D, E, and F are also susceptible to liquefaction. If a dry soil crust forms, excess water can sometimes rise to the surface through cracks in the confining layer, carrying liquefied sand and creating sand boils. **Figure 4-9** illustrates the liquefaction susceptibility within San Mateo County.

Figure 4-9. Liquefaction Susceptibility in San Mateo County

[Map under development…]

163 United States Geological Survey. (n.d.). What are the Effects of Earthquakes? Retrieved from: https://www.usgs.gov/programs/earthquake-hazards/what-are-effects-earthquakes.
164 Nolan, J. (2022). The Effects of Soil Type on Earthquake Damage. Retrieved from https://www1.wsrb.com/blog/the-effects-of-soil-type-on-earthquake-damage.

The California Earthquake Hazards Zone Application (EQ Zapp) is an online map that allows residents to conveniently verify whether a property is in an earthquake hazard zone. Earthquake hazard zones are defined as areas subject to three (3) distinct types of geologic ground failures – fault rupture, liquefaction, and earthquake-induced landslides. Although strong ground shaking is responsible for most earthquake-related damage, these zones identify areas where earthquake hazards other than structural shaking, specifically ground failures during an earthquake, are more likely. The zones trigger geologic and engineering investigations to identify and mitigate the ground failure hazard before construction begins, thereby enhancing the structure's resilience to potential shaking.[165]

Extent/Severity		Extent Factor	Weighted Factor	Score
High	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a high-intensity incident.	3	3	9
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Extent/Severity Score = Extent Factor x Weighted Factor***				

Catastrophic Potential

A catastrophic incident can be defined as any natural, human-caused, or technological disaster that results in extraordinary levels of casualties, damage, or disruption, severely affecting the population (including mass evacuations), infrastructure, environment, economy, national morale, or government functions in the area.[166] The catastrophic potential for an earthquake event is high in San Mateo County.

Catastrophic Potential		Extent Factor	Weighted Factor	Score
High	High potential that this hazard could be catastrophic.	3	3	9
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Catastrophic Score = Extent Factor x Weighted Factor***				

4.6.3.3. Warning Time

Earthquakes occur with little to no warning. Scientists cannot predict or forecast earthquakes. An earthquake early warning system uses seismological science and monitoring technologies to alert devices and people when earthquake-generated waves are expected to arrive at a location. Although it may not sound like much time (compared to other natural hazards), seconds to tens of seconds of advance warning can allow people and systems to take action and protect life and property from destructive shaking.[167]

In partnership with the University of California, Berkeley, and USGS ShakeAlert, Cal OES developed the Earthquake Warning California system. The system uses ground-motion sensors to detect earthquakes in progress and estimate their size, location, and impact. Once it detects a significant magnitude, the

[165] California Department of Conservation. (2024). EQ Zapp: California Earthquake Hazards Zone Application. Retrieved from https://www.conservation.ca.gov/cgs/geohazards/eq-zapp.
[166] Federal Emergency Management Agency. (2019). National Response Framework (Fourth Edition). Retrieved from https://www.fema.gov/sites/default/files/documents/NRF_FINALApproved_2011028.pdf.
[167] United States Geological Survey. (n.d.). What is the difference between earthquake early warning, earthquake forecasts, earthquake probabilities, and earthquake prediction? Retrieved from https://www.usgs.gov/faqs/what-difference-between-earthquake-early-warning-earthquake-forecasts-earthquake-probabilities.

MyShake App (registration is required), Wireless Emergency Alerts, or Android Alerts sends a warning to mobile phone users when shaking is imminent in the user's area. The speed of the alert varies depending on the individual's distance from the origin of the earthquake. Therefore, if the individual is closer to the earthquake's epicenter, the warning will arrive sooner than for someone farther away. **Table 4-49** outlines the alerting thresholds for the Earthquake Warning California system.[168]

Table 4-49. Earthquake Warning California Alerting Thresholds

Warning System	Threshold
Wireless Emergency Alerts	The Wireless Emergency Alerts are used in response to magnitude 5.0 or greater earthquakes and will alert people who will experience shaking level MMI IV (light) or greater.
MyShake App	The MyShake App is used in response to magnitude 4.5 or greater earthquakes and will alert people who will experience shaking level MMI III (weak) or greater.
Android Alerts	Android Alerts are used in response to magnitude 4.5 or greater earthquakes and will alert people who will experience shaking level MMI III (weak) or greater.

4.6.3.4. Probability and Frequency

The probability of occurrence for an earthquake in San Mateo County is medium because a *significant* event is likely to occur within 25 years. USGS determines earthquake probability through a combination of historical earthquake data, geological and seismological research, and advanced modeling techniques. This process involves analyzing past earthquakes to understand patterns of occurrence, fault activity, and the distribution of seismic activity across regions. By studying the behavior of tectonic plates, including their movement and the stress accumulation along faults, scientists can assess where earthquakes are more likely to occur.[169] Seismic activity was more frequent between 1830 and 1930 than it has been since. This leads some scientists to suspect that pressure is building up along the faults in the Bay Area, which could result in a large earthquake.

According to the USGS, there is a 72% probability that at least one (1) earthquake with a magnitude of 6.7 or greater will occur before 2043 and could cause widespread damage in the San Francisco Bay area.[170] In 2017, the Working Group on California Earthquake Probabilities (WGCEP) issued its third Uniform California Earthquake Rupture Forecast (UCERF3), which determined the likelihood of magnitude 6.7 and greater earthquakes by 2043. In the San Francisco Bay area, the probabilities are:[171]

- 100% probability of an earthquake measuring a magnitude of 5.0 or greater.
- 98% probability of an earthquake measuring a magnitude of 6.0 or greater.
- 72% probability of an earthquake measuring a magnitude of 6.7 or greater.
- 51% probability of an earthquake measuring a magnitude of 7.0 or greater.

[168] California Governor's Office of Emergency Services. (n.d.). Earthquake Warning California: Types of Alerts. Retrieved from https://earthquake.ca.gov/get-alerts/.
[169] California Department of Conservation. (n.d.). Earthquakes. Retrieved from https://www.conservation.ca.gov/cgs/earthquakes.
[170] United States Geological Survey. (2016). Earthquake Outlook for the San Francisco Bay Region (2014 – 2043). Retrieved from https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf.
[171] United States Geological Survey. (2015). UCERF3: A New Earthquake Forecast for California's Complex Fault System. Retrieved from https://pubs.usgs.gov/fs/2015/3009/pdf/fs2015-3009.pdf.

- 20% probability of an earthquake measuring a magnitude of 7.5 or greater.
- 4% probability of an earthquake measuring a magnitude of 8.0 or greater.

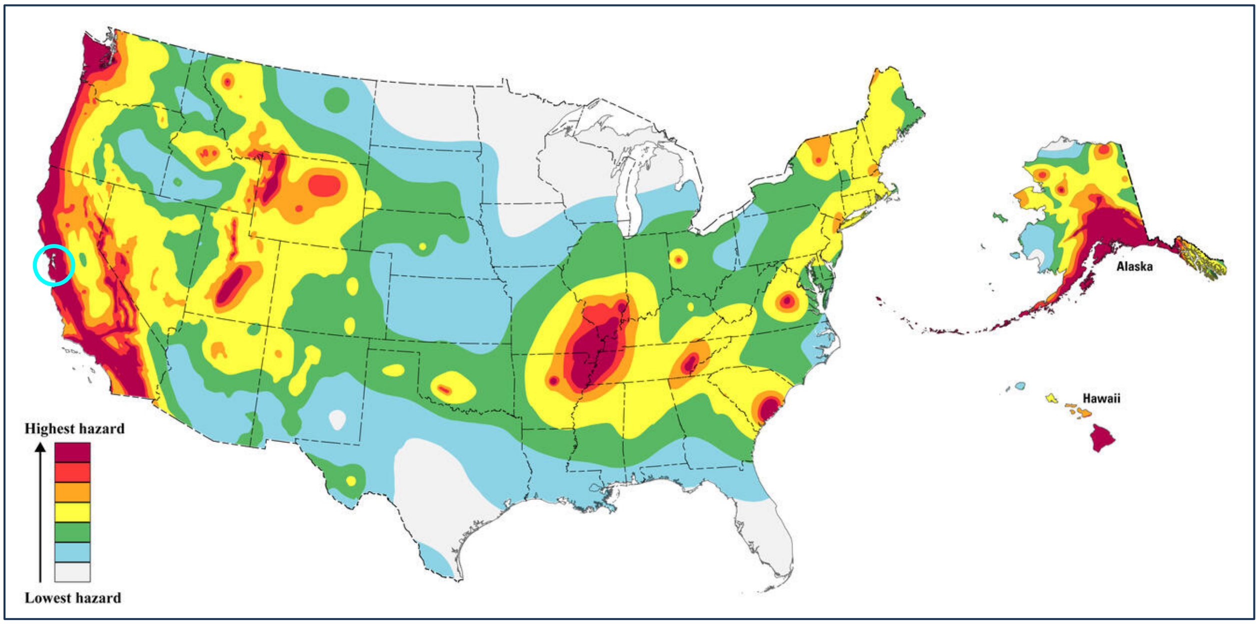
Probability of Occurrence		Probability Factor	Weighted Factor	Score
Medium	A significant hazard event is likely to occur within 25 years.	2	N/A	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology).				

National Seismic Hazard Map

The USGS National Seismic Hazard Maps reflect the best and most current understanding of earthquake hazard in an area and the distribution of damaging earthquake shaking across the United States. These maps also compare earthquake shaking hazard areas with other areas across the Country. Furthermore, these maps provide essential information for developing and updating seismic design requirements for building codes, insurance rates, earthquake loss studies, retrofit priorities, and land use planning. After a thorough review of the studies, professional engineering organizations update the seismic risk maps and seismic design requirements contained in building codes.[172]

Figure 4-10 illustrates the most recent USGS National Seismic Hazard Map (2023), which represents the likelihood of damaging earthquake shaking in the United States over the next 100 years. A "damaging earthquake shaking" in this map is equivalent to MMI VI or higher.[173]

Figure 4-10. USGS National Seismic Hazard Map



[172] United States Geological Survey, Earthquake Hazards Program. (2023). Hazards. Retrieved from https://www.usgs.gov/programs/earthquake-hazards/hazards.
[173] United States Geological Survey, Earthquake Hazards Program. (2022). Introduction to the National Seismic Hazard Maps. Retrieved from https://www.usgs.gov/programs/earthquake-hazards/science/introduction-national-seismic-hazard-maps.

The interactive USGS National Seismic Hazard Map illustrates peak ground accelerations having a 2% probability of being exceeded in 50 years, for a firm rock site. The map is based on the most recent USGS models (2023). The models are based on seismicity and fault-slip rates and account for the frequency of earthquakes of various magnitudes. Locally, the hazard may be greater than shown, because site geology may amplify ground motions.[174]

FEMA NRI Annualized Frequency

The earthquake annualized frequency value represents the modeled frequency of an earthquake hazard occurrence per year. A higher annualized frequency value results in higher EAL and Risk Index scores. **Table 4-50** outlines the annualized frequency of earthquakes in San Mateo County, based on FEMA NRI data.

Table 4-50. Earthquake Annualized Frequency *(FEMA National Risk Index)*

Events on Record *(2021 dataset)*	Annualized Frequency
n/a	0.14% chance per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.	

4.6.3.5. Past Events

Table 4-51 lists recent earthquakes with a magnitude of 5.0 or greater within 100 miles of San Mateo County.[175] The last significant seismic event (magnitude greater than 6.0) in the San Mateo vicinity was the magnitude 7.1 San Andreas Loma Prieta Earthquake in 1989, which originated 10 miles northeast of Santa Cruz. Other significant local earthquakes include the 1906 San Francisco earthquake and the 2014 Napa earthquake. Although the 1906 earthquake is most associated with the City of San Francisco, San Mateo County was also greatly affected.

Table 4-51. Recent Earthquakes Magnitude 5.0 or Greater (100-Mile Radius)

Date	Magnitude	Epicenter Location
October 25, 2022	5.1	9 miles ESE of Alum Rock, CA
August 24, 2014	6.0	6 miles SW of Napa, CA
October 31, 2007	5.5	4 miles NNE of East Foothills, CA
August 12, 1998	5.1	6 miles SW of Ridgemark, CA
April 18, 1990	5.1	2 miles E of Interlaken, CA
April 18, 1990	5.4	3 miles NNW of Aromas, CA
October 18, 1989	5.1	4 miles SW of Monte Sereno, CA
October 18, 1989	6.9	Near Loma Prieta Peak in the Santa Cruz Mountains
August 8, 1989	5.4	2 miles ESE of Lexington Hills, CA
June 27, 1988	5.3	5 miles ESE of Lexington Hills, CA
June 13, 1988	5.3	4 miles E of East Foothills, CA

[174] United States Geological Survey, Earthquake Hazards Program. (2023). USGS National Seismic Hazard Map (Simplified; 2% PGA. 50 years). Retrieved from https://www.arcgis.com/home/item.html?id=3cffcd969f044ca3a3099190b8bd9328.
[175] United States Geological Survey (USGS). (2021). Search Earthquake Catalog. Retrieved from https://earthquake.usgs.gov/earthquakes/search/.

Date	Magnitude	Epicenter Location
February 20, 1988	5.1	1 mile NE of Tres Pinos, CA
March 31, 1986	5.7	9 miles NE of East Foothills, CA
January 26, 1989	5.5	2 miles ENE of Tres Pinos, CA

4.6.3.6. Vulnerability

Population Exposed

30% or more of the population in San Mateo County is exposed to earthquakes. The entire population of the planning area is potentially exposed to direct and indirect impacts from earthquakes. Whether directly or indirectly impacted, the entire population will need to address the consequences of earthquakes to some extent. An earthquake affects community safety, health, and well-being by potentially causing injury or death from debris, infrastructure failures, and other hazards.

There is a strong correlation between structural building damage and exposure to an earthquake event. The degree of exposure depends on several factors, including the age and type of construction of a structure, the soil type(s) on which it is located, and the intensity of the earthquake. Whether directly or indirectly impacted, residents could face business closures, road closures that isolate populations, and the loss of function of critical facilities and infrastructure. Further, the time of day also exposes different sectors of the community to the hazard. For example, if an earthquake were to occur on a weekday, during work hours, more people would be at work and school. Additionally, underserved populations (e.g., low-income individuals, children, the elderly, those with access and functional needs, and individuals with limited English proficiency) face unique vulnerabilities during an earthquake. **Table 4-52** summarizes the underserved population in San Mateo County.

Table 4-52. Underserved Population in San Mateo County

Category	Estimate	Percent
Population Below Poverty Level[176]	49,359	6.7%
Income Below $25,000 (Households)[177]	18,773	7.1%
Spanish Spoken at Home[178]	124,233	17.6%
Speak English Less Than "Very well"[179]	120,715	17.1%
Language Other Than English[180]	322,325	45.8%
Foreign Born[181]	265,258	35.7%

[176] United States Census Bureau. (2024). S1701: Poverty Status in the Past 12 Months (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S1701?g=050XX00US06081.
[177] United States Census Bureau. (2024). S1901: Income in the Past 12 Months (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S1901?g=050XX00US06081.
[178] United States Census Bureau. (2024). S1601: Language Spoken at Home (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S1601?g=050XX00US06081.
[179] Ibid.
[180] Ibid.
[181] United States Census Bureau. (2024). DP02: Selected Social Characteristics in the United States (2024: ACS 5-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP5Y2024.DP02?g=050XX00US06081.

Category	Estimate	Percent
Household Without a Vehicle[182]	11,869	3.1%
65 Years and Over[183]	132,242	17.8%
Senior (65 Years and Over) Living Alone[184]	8,355	3.2%

Population Exposure		Vulnerability Factor	Weighted Factor	Score
High	30% or more of the population is exposed to the hazard.	3	3	9
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population Exposure Score = Extent Factor x Weighted Factor***				

Property Exposed

25% or more of the total assessed property, infrastructure, and resources value is exposed to earthquakes in San Mateo County. Essentially, all of San Mateo County's property and infrastructure is exposed to an earthquake event. According to the San Mateo County Assessor records, the total replacement value of buildings as of 2025 is over $341.1 billion.[185]

The greatest potential danger is the collapse of older residential units constructed of reinforced masonry. Understanding the distribution of housing structures by age helps identify older and potentially more vulnerable buildings. Of the 287,184 housing units in San Mateo County, approximately 56.5% were built before 1970, prior to substantial improvements in building codes and construction practices. Approximately 17.0% of the planning area's housing units were constructed after the Uniform Building Code was amended in 1994 to include seismic safety provisions. Housing units built before 1933, when there were no building permits, inspections, or seismic standards, account for approximately 8.6%. Many of the housing units in the planning area are detached, single-family residences of wood construction, which generally perform well during earthquake events. **Table 4-53** shows the age of housing units in San Mateo County.[186]

Table 4-53. Physical Housing Characteristics in San Mateo County

Structure Built	Estimate	Percent of Total Housing Units	Significance of Time Frame
2020 or later	2,945	1.0%	Seismic code is currently enforced.
2010 to 2019	15,596	5.4%	Seismic code is currently enforced.
2000 to 2009	16,383	5.7%	Seismic code is currently enforced.

182 United States Census Bureau. (2024). S0801: Commuting Characteristics by Sex (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S0801?g=050XX00US06081.
183 United States Census Bureau. (2024). DP05: ACS Demographics and Housing Estimates (2024: ACS 5-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP5Y2024.DP05?g=050XX00US06081.
184 United States Census Bureau. (2024). DP02: Selected Social Characteristics in the United States (2024: ACS 5-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP5Y2024.DP02?g=050XX00US06081.
185 San Mateo County Office of the Assessor. (2025). San Mateo County's 2025-26 Local Assessment Roll Reaches Record High After 15th Consecutive Year of Growth Increases by 4.80% to $341.1 Billion. Retrieved from https://smcacre.gov/assessor/news/san-mateo-countys-2025-26-local-assessment-roll-reaches-record-high-after-15th.
186 United States Census Bureau. (2024). DP04: Selected Housing Characteristics (2024: ACS 5-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP5Y2024.DP04?g=050XX00US06081.

Structure Built	Estimate	Percent of Total Housing Units	Significance of Time Frame
1990 to 1999	16,299	5.7%	In 1994, the Uniform Building Code was amended to include provisions for seismic safety.
1980 to 1989	27,820	9.7%	--
1970 to 1979	45,997	16.0%	In 1975, significant improvements were made to lateral force requirements.
1960 to 1969	45,879	16.0%	In 1960, the Structural Engineers Association of California published guidelines on recommended earthquake provisions.
1950 to 1959	61,910	21.6%	--
1940 to 1949	29,575	10.3%	In 1940, the first strong-motion recording was made.
1939 or earlier	24,780	8.6%	Before 1933, there were no explicit earthquake requirements in building codes. State Law did not require local governments to have building officials or issue building permits.

***Note:** Number and percent estimates are approximations, as housing unit age information does not correspond directly with the time periods indicated. Additionally, there are margins of error associated with the United States Census Bureau estimates.*

All critical facilities in the planning area are exposed to earthquake hazards. Hazardous materials releases can occur during earthquakes, either from fixed facilities or from transportation-related incidents. Transportation corridors can be disrupted during an earthquake, leading to the release of materials to the surrounding environment. Facilities that store hazardous materials are of particular concern because of the potential for isolating the surrounding neighborhoods. During an earthquake, structures storing these materials could rupture, releasing their contents into the surrounding area or an adjacent waterway, with disastrous environmental consequences.

The following major roads in the planning area intersect moderate to very high liquefiable soils and are therefore exposed to earthquakes.

- Interstate 280
- State Route 1 (Pacific Coast Highway)
- State Route 82
- State Route 84
- State Route 92

Soft-story buildings are multi-story buildings with one (1) or more floors that are “soft” because of structural design. If a building has a floor that is 70% less stiff than the floor above it, it is considered a soft-story building. This soft story creates a significant weakness in an earthquake. Since soft stories are typically associated with retail spaces and parking garages, they are often on the lower stories of a building. When these structures collapse, they can bring down the entire building, causing severe structural damage that may render the structure unusable.

These floors can be especially dangerous in earthquakes because they cannot withstand the lateral forces induced by a building's swaying. As a result, the soft-story building may fail, leading to a soft-story collapse. Soft-story collapse is a leading cause of earthquake damage to private residences.

Exposure rates and vulnerability analyses associated with soft-story construction in the planning area are currently unknown. ABAG and other Bay Area agencies have programs that generate this type of data, but it is unknown when such data will be available for San Mateo County. This type of data will need to be generated to support future risk assessments of the earthquake hazard.

Unreinforced masonry buildings are constructed from materials such as adobe, brick, hollow clay tiles, or other masonry materials and do not contain an internal reinforcing structure (e.g., rebar in concrete or steel bracing for brick). These types of buildings pose a significant danger during an earthquake because the mortar holding the masonry together is typically not strong enough to withstand significant earthquakes. Additionally, the brittle composition of these houses can cause them to break apart and fall away, or buckle, potentially resulting in complete collapse.

In San Mateo County, unreinforced masonry buildings are generally brick structures constructed before modern earthquake building codes and design standards were enacted. The State of California enacted a law in 1986 that required all local governments in Seismic Zone 4 (nearest to active earthquake faults) to inventory unreinforced masonry buildings. The Law encourages local governments to adopt local mandatory strengthening programs, delineate seismic retrofit standards, and implement measures to reduce the number of people in unreinforced masonry buildings.

According to ABAG, housing units in unreinforced masonry buildings account for only 1% of the total Bay Area housing stock and 2.9% of the total Bay Area multi-family stock.

Property Exposure		Vulnerability Factor	Weighted Factor	Score
High	25% or more of the total assessed property value is exposed to the hazard.	3	1	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property Exposure Score = Extent Factor x Weighted Factor***				

Changes in Development

Information on changes in development within San Mateo County is provided in **Chapter 3** (Community Profile) of this Assessment.

The changes in development have increased San Mateo County's exposure to earthquakes between 5% and 9%. Earthquake events significantly influence development and future planning strategies, primarily by enhancing resilience and safety in earthquake-prone areas. In the aftermath of a significant event, there is often a reassessment of building codes and construction practices to reduce the vulnerability of structures to future earthquakes. This includes adopting more stringent engineering standards, using earthquake-resistant materials, and incorporating innovative design techniques to enable buildings and infrastructure to withstand seismic forces. Such measures are crucial in minimizing physical damage and ensuring the safety of occupants in the event of subsequent earthquakes. However, older structures may not have been built to current codes, increasing their vulnerability to damage.

Changes in Development		Vulnerability Factor	Weighted Factor	Score
Medium	Changes in development have increased the community's exposure to the hazard between 5% and 9%.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Changes in Development Score = Extent Factor x Weighted Factor***				

4.6.3.7. Impacts

Public Comment Note: *Across the subsections within Section 4.6.3.7 (Impacts), certain tables (4-54 through 4-60) and narrative text contain placeholders such as "###" and "$#.# billion". These indicators represent specialized risk-modeling data from FEMA's Hazus software that is currently undergoing final verification. All placeholder text will be updated once verification is completed. The absence of this information does not alter the proposed mitigation actions, assessment, or the capabilities evaluated in this document.*

Population and Life Safety

A population that is exposed to an earthquake is likely to experience significant adverse impacts (e.g., fatalities and severe injuries). The San Mateo County population can experience direct and indirect impacts from an earthquake. An earthquake impacts the County's population and public safety by potentially causing injury or death from debris, structural collapses, infrastructure failures, and other hazards. The entire population of San Mateo County falls within areas with the potential for violent or extreme ground shaking. Earthquakes can cause structural damage to buildings and residences, potentially displacing residents and businesses if the buildings become unsafe to occupy. Furthermore, infrastructure (e.g., utility lines, communication networks, transportation systems) can be impacted by earthquakes, disrupting daily life and emergency services. Earthquake events can have a long-lasting impact on the public's mental health (e.g., trauma, anxiety). Indirect injuries and casualties may result from fires and gas leaks caused by the earthquake, as well as possible delays in accessing medical services.

Hazus estimated the number of households expected to be displaced by the earthquake and the number of displaced people who would require accommodation in temporary public shelters. The model estimates ### households will be displaced due to the earthquake. Of these, ### people (out of a total population of ###) will seek temporary shelter in public shelters.

Population and Life Safety Impact		Impact Factor	Weighted Factor	Score
High	Populations exposed to this hazard are likely to experience significant adverse impacts, such as fatalities and severe injuries.	3	3	9
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population and Life Safety Impact Score = Impact Factor x Weighted Factor***				

Underserved Population

The underserved population exposed to earthquakes in San Mateo County is likely to experience significant adverse/disproportionate impacts (e.g., fatalities and severe injuries). These groups include, but are not limited to, low-income households, individuals aged 65 and older, children, and individuals with access and functional needs. The low-income population lacks the financial resources to enhance their homes (especially older homes) to prevent or mitigate earthquake damage, and is less likely to have insurance to help compensate for losses resulting from such damage. The elderly and younger populations may have greater difficulty taking appropriate precautions during and after an earthquake without additional assistance. If an earthquake occurs during school hours, children will be separated from their parents or caregivers, and depending on the earthquake's severity, family reunification may take time. Additionally, the elderly and individuals with access and functional needs may be more socially isolated and are more likely to need special medical attention, which may not be available immediately after an earthquake.

The San Mateo County population is aging, with the greatest increase among individuals aged 55 and older. However, there are also increases among the 18 to 34 years old age group, likely driven by an influx of younger workers.[187]

Approximately 9.4% of the San Mateo County population has a disability (i.e., hearing, vision, cognitive, ambulatory, self-care, or independent living difficulty). In San Mateo County, the most prevalent type of disability is independent living difficulty (difficulty doing errands alone, such as visiting a doctor's office or shopping), followed by ambulatory difficulty (serious difficulty walking or climbing stairs). As age increases, the percentage of individuals in each age group with a disability increases. For residents who are 75 years and over, 43.1% have a disability. The 65 to 74 years age group constitutes the second-highest number of disabilities with 17.2%. Disability and poverty are closely tied due to employment limitations.[188]

Many senior-headed households have special needs due to their relatively low incomes, disabilities or limitations, and dependency needs. Specifically, many people aged 65 years and older live alone. In San Mateo County, 132,242 residents are 65 years and older, representing 17.8% of the population, and approximately 6.7% live below the poverty level.[189,190]

Underserved Population Impact		Impact Factor	Weighted Factor	Score
High	Underserved populations exposed to the hazard are likely to experience significant adverse/disproportionate impacts, such as fatalities and severe injuries.	3	3	9
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Underserved Population Impact Score = Impact Factor x Weighted Factor***				

Property, Facilities, and Critical Infrastructure

More than $5 million in property damage is expected from a *single major* earthquake event, or damages are expected to occur to 15% or more of the property value within San Mateo County. Earthquakes can cause significant damage to property, facilities, and critical infrastructure, particularly in urban areas. Major earthquakes can cause complete or partial structural collapses of buildings, bridges, overpasses,

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187 San Mateo County. (2025). 2023-2031 Housing Element of the General Plan. Retrieved from https://www.smcgov.org/planning/san-mateo-county-housing-element-update.
188 United States Census Bureau. (2024). S1810: Disability Characteristics (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S1810?g=050XX00US06081.
189 United States Census Bureau. (2024). S0101: Age and Sex (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S0101?g=050XX00US06081.
190 United States Census Bureau. (2024). S1701: Poverty Status in the Past 12 Months. Retrieved from https://data.census.gov/table/ACSST5Y2024.S1701?g=050XX00US06081.

and other critical infrastructure. However, even minor earthquakes can cause damage to household goods, fallen objects, merchandise, other building contents, and infrastructure.

Roads may sustain severe damage in an earthquake. Maintaining access to main roads is vital for safety, lifesaving efforts, and disaster response and recovery. Disruptions in transportation systems are of particular concern to coastal community members, as major events can isolate them from critical assistance. Additionally, Bay Area Rapid Transit (BART) provides transportation service to the northern portion of San Mateo County from South San Francisco to Millbrae and the San Francisco International Airport. Much of the BART transportation infrastructure in San Mateo County is underground. BART tunnels may collapse during a high-magnitude event, leading to loss of life and the potential release of hazardous materials.

Earthquake events can significantly impact roads and bridges, many of which are the only means of access to specific neighborhoods. Because softer soil generally follows floodplain boundaries, bridges that cross watercourses should be considered vulnerable. Another key factor in the degree of vulnerability is the age of facilities and infrastructure, which correlates with standards in place at the time of construction.

Water and sewer infrastructure would likely suffer considerable damage in the event of an earthquake. This factor is difficult to analyze based on infrastructure alone, and because water and sewer infrastructure are typically linear easements that are difficult to assess thoroughly in Hazus. Without further analysis of individual system components, it should be assumed that these systems are exposed to breakage and failure. Additionally, hazardous material releases from fixed facilities and transportation-related releases can occur during an earthquake.

Building damage resulting from the 1,000-year probabilistic earthquake analysis was estimated using Hazus. In addition, annualized losses were calculated. Hazus estimates that there are ### buildings in the region, with an aggregate replacement cost of $#.# billion. **Table 4-54** presents a general distribution of building values in San Mateo County. In terms of building construction types found in the County, wood-frame construction accounts for ##% of the building inventory, with the remainder distributed among other general building types (i.e., steel, concrete, precast, reinforced masonry, unreinforced masonry, manufactured housing).

Table 4-54. San Mateo County Population and Building Value Data

Population	Residential Building Value	Non-Residential Building Value	Total

Hazus estimates that approximately ### buildings will be at least moderately damaged, which is over ##% of the buildings in San Mateo County. An estimated ## buildings are estimated to be damaged beyond repair. **Table 4-55** summarizes the estimated numbers of buildings damaged by general occupancy in the County.

Table 4-55. Expected Building Damage by Occupancy

Building Occupancy	None		Slight		Moderate		Extensive		Complete	
	Count	%	*Count*	%	*Count*	%	*Count*	%	*Count*	%
Agriculture										
Commercial										
Education										
Government										
Industrial										
Other Residential										
Religion										
Single Family										
Total										

Table 4-56 summarizes the expected damage by general building type.

Table 4-56. Expected Building Damage by Building Type

Building Occupancy	None		Slight		Moderate		Extensive		Complete	
	Count	%	*Count*	%	*Count*	%	*Count*	%	*Count*	%
Wood										
Steel										
Concrete										
Precast										
Reinforced Masonry										
Unreinforced Masonry										
Manufactured Housing										
Total										

Hazus classifies critical facilities into two (2) groups – essential facilities (hospitals, medical clinics, schools, fire stations, police stations, and emergency operations centers) and high potential loss facilities (dams, levees, military installations, nuclear power plants, and hazardous materials sites). For essential facilities, there are ### hospitals in the County with a total bed capacity of ###. There are ### schools, ### fire stations, ### police stations, and ### emergency operation facilities. Regarding high potential loss facilities, [Hazus Report Pending]

The Hazus model estimates the time to restore critical facilities to fully functional use. Before the earthquake, San Mateo County had ### hospital beds available for use. On the day of the earthquake, Hazus estimates that ### hospital beds (##%) are available for use by patients already in the hospital and those injured by the earthquake. After one (1) week, ##% of the beds will be back in service, and ##%

will be operational after 30 days. **Table 4-57** summarizes the expected damage to essential facilities in San Mateo County. ### essential facilities are expected to have functionality greater than 50% on day one (1) after the earthquake event.

Table 4-57. Expected Damage to Essential Facilities

Classification	Total	Number of Facilities		
		At Least Moderate Damage *(greater than 50% damage)*	Complete Damage *(greater than 50% damage)*	With Functionality *(greater than 50% on day 1)*
Hospitals				
Schools				
Emergency Operations Center				
Police Stations				
Fire Stations				

Hazus divides the lifeline inventory between transportation and utility lifeline systems. There are seven (7) transportation systems (highways, railways, light rail, buses, ports, ferries, and airports) and six (6) utility systems (potable water, wastewater, natural gas, crude and refined oil, electric power, and communications). Hazus estimates that the total value of the lifeline inventory (transportation and utility) is over $###, which includes ##.# miles of highways, ### bridges, and ##.# miles of pipeline (i.e., potable water, wastewater, natural gas, and oil). **Table 4-58** summarizes the expected damage to utility systems in San Mateo County.

Table 4-58. Expected Damage to Utility Systems

System	Total	Number of Facilities			
		With At Least Moderate Damage	With Complete Damage	With Functionality Greater the 50%	
				After Day 1	*After Day 7*
Portable Water					
Wastewater					
Natural Gas					
Oil Systems					
Electrical Power					
Communication					

Table 4-59 summarizes damage estimates to the transportation system.

Table 4-59. Expected Damage to Transportation System

System	Component	Number of Locations				
		Locations/ Segments	With At Least Moderate Damage	With Complete Damage	With Functionality Greater Than 50%	
					After Day 1	*After Day 7*
Highway	Segments					
	Bridges					
	Tunnels					
Railways	Segments					
	Bridges					
	Tunnels					
Light Rail	Segments					
	Bridges					
	Tunnels					
Bus	Facilities					
Ferry	Facilities					
Port	Facilities					
Airport	Facilities					
	Runways					

Property, Facilities, and Critical Infrastructure Impact		Impact Factor	Weighted Factor	Score
High	More than $5 million in property, facilities, and infrastructure damage is expected from a single significant event, or damages are expected to occur to 15% or more of the property value within the jurisdiction.	3	2	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property, Facilities, and Critical Infrastructure Impact Score = Impact Factor x Weighted Factor***				

Economy

A single *significant* earthquake event in San Mateo County is likely to result in a total economic impact greater than $10 million. Earthquake events can have profound and multifaceted economic impacts, affecting communities, businesses, and all levels of government. Initially, earthquakes cause direct damage to infrastructure (e.g., buildings, roads, bridges), resulting in repair and reconstruction costs. These costs not only strain public budgets but also divert resources from other vital community needs. Furthermore, businesses experience significant disruptions, with some forced to temporarily or permanently cease operations, resulting in lost income, revenue, employment, and productivity. The ripple effects extend to the broader economy, as supply chains are disrupted, and consumer spending patterns shift in the aftermath of the disaster. Efforts to rebuild and recover from an earthquake often require substantial investment, which can stimulate economic activity in construction and related sectors but also highlight the need for improved resilience and preparedness strategies. There is no impact on one (1) specific industry, but the local and regional economy can be severely impacted if individuals are unable to work or spend due to the severity of the incident.

Earthquakes also impact the economy, including loss of business function, damage to inventory (e.g., buildings, transportation, and utility systems), relocation costs, wage loss, and rental loss due to repair and replacement of buildings. Hazus estimates building-related economic losses, including income losses (wage, capital-related, rental, and relocation losses) and capital stock losses (structural, non-structural, content, and inventory losses).

Hazus estimates that total building-related losses were $###, where ##% of the losses were related to business interruption in San Mateo County. The analysis concluded that the largest loss was sustained by the residential occupancies, which accounted for over ##% of the total loss. **Table 4-60** summarizes the building-related economic loss estimates.

Table 4-60. Building-Related Economic Loss Estimates ***(Millions of Dollars)***

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses	Wage						
	Capital-Related						
	Rental						
	Relocation						
	Subtotal						
Capital Stock Losses	Structural						
	Non Structural						
	Content						
	Inventory						
	Subtotal						
Total							

Hazus estimates the amount of debris that the earthquake event will generate. Debris estimates were divided into two (2) categories – brick/wood and reinforced concrete/steel. The distinction is made because of the different types of materials handling equipment required to manage debris.

The analysis estimated that a total of ### tons of debris will be generated. Of the total amount, ##% is comprised of brick/wood, and the remainder will be reinforced concrete/steel. If the debris tonnage is converted to an estimated number of truckloads, it will require ### truckloads (25 tons/truck) to remove the debris.

Economic Impact		Impact Factor	Weighted Factor	Score
High	Total economic impact is likely to be greater than $10 million.	3	1	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Economic Impact Score = Impact Factor x Weighted Factor***				

FEMA NRI Expected Annual Loss Estimates

An earthquake NRI EAL score and rating represent a community's relative level of expected building and population loss each year due to earthquakes when compared to the rest of the United States. The EAL score is positively associated with a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-61** outlines the earthquake EAL for San Mateo County.

Table 4-61. Earthquake Expected Annual Loss *(FEMA National Risk Index)*

Population	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Expected Annual Loss Rating
11.6	$158.2 Million	$339.1 Million	n/a	$497.3 Million	99.7	Very High

Population exposure is defined as the estimated number of people determined to be exposed to a hazard according to a hazard type-specific methodology.

Expected Annual Loss scores are calculated using an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).

Environment

Environmental impact from a single *significant* earthquake event is likely to be substantial, requiring extensive outside resources and support; and/or repair, cleanup, restoration, or preservation work. Secondary hazards are likely to have among the most damaging impacts on the environment. Environmental impacts include ground failure (e.g., liquefaction), seiches, cracks, and displacements in the Earth's surface, hazardous material releases, water contamination, and air pollution. Streams may be rerouted following an earthquake, which can change water quality and impact habitats and feeding areas. Furthermore, streams supplied by groundwater wells might dry up due to alterations in the underlying geology.

Earthquake-induced landslides can significantly damage the surrounding habitat. Furthermore, hazardous material releases can occur during earthquakes due to facility damage or transportation-related incidents. Facility structures that store hazardous materials could rupture, releasing contaminants into the surrounding area or an adjacent waterway and causing serious environmental consequences. Transportation corridors can also be disrupted, leading to the release of materials into the surrounding environment.

Environment Impact		Impact Factor	Weighted Factor	Score
High	Environmental impact from a single significant event is likely to be substantial, requiring extensive outside resources and support; and/or repair, cleanup, restoration, and/or preservation work.	3	1	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Environmental Impact Score = Impact Factor x Weighted Factor***				

Continuity of Operations/Delivery of Services

There may be impacts lasting more than 72 hours on San Mateo County's ability to meet the essential day-to-day operational demands and needs of the community in the event of a *single major* earthquake. Significant impacts on critical infrastructure and facilities could limit the County's ability to maintain normal operations, while emergency medical services may become overwhelmed, resulting in critical response delays. Beyond the immediate disruption of utilities (e.g., power, communication, gas), the failure of transportation networks, including bridges and rail lines, could isolate neighborhoods and impede the arrival of aid. Furthermore, the potential for widespread damage to older, non-retrofitted housing could lead to large-scale displacements, creating a long-term humanitarian challenge that extends far beyond the initial seismic event.

Continuity of Operations/Delivery of Services Impact		Impact Factor	Weighted Factor	Score
High	Impact lasting more than 72 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single significant event.	3	1	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Continuity of Services/Delivery of Services Impact Score = Impact Factor x Weighted Factor***				

Future Development

Information on changes in development within San Mateo County is provided in **Chapter 3** (Community Profile) of this Assessment.

Future development trends will increase, but not significantly, the impacts of earthquakes in San Mateo County. Future planning strategies increase the jurisdiction’s resilience to earthquakes. These include, but are not limited to, building codes, construction practices, and more stringent engineering standards (e.g., earthquake-resistant materials, innovative design techniques) that reduce the vulnerability of buildings and infrastructure during earthquakes. Therefore, although new development may continue throughout San Mateo County, new buildings will be required to meet specific standards (i.e., building codes) to ensure they are constructed to resist seismic forces and minimize damage or collapse during an earthquake.

The San Mateo County population could increase by approximately 2% by 2035.[191] As the population grows, it is critical that the services supporting these communities (e.g., water, sewer, power, roads, hospitals, and public safety agencies) can maintain or quickly resume functionality after a disaster. Land use in San Mateo County will be directed by general plans adopted under California's General Planning Law. San Mateo County and each municipality have adopted their own General Plan. The safety elements of each general plan establish standards for protecting the community from earthquakes. Development in San Mateo County will be regulated through building standards and performance measures to reduce risk. Geologic hazard zones are strictly regulated under California's General Planning Law. Additionally, the International Building Code provides standards to mitigate seismic risks.

San Mateo County and participating cities strictly enforce all seismic building codes and design standards to prevent loss of life and property caused by earthquakes. Municipal planning partners are encouraged to establish general plans that include policies directing land use and addressing seismic safety. These plans provide the local municipal level with the capacity to protect future development from earthquake impacts. Public education, cooperation with the development community, and individual preparedness are essential as the planning area welcomes new community members and businesses.

Future Development Impact		Impact Factor	Weighted Factor	Score
Medium	Future development trends will increase the impacts of this hazard, but not significantly.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Future Development Impact Score = Impact Factor x Weighted Factor***				

Climate Change

Climate change trends will not increase the risks and impacts of earthquakes. The relationship between climate change and its impacts on earthquakes is indirect, as earthquakes are primarily driven by geophysical processes involving tectonic plate motion beneath Earth's surface and are independent of the atmospheric conditions influenced by climate change. However, climate change can increase the risk of earthquake cascading hazards (e.g., landslides, tsunamis, flooding). *Refer to the Flooding (Section 4.5.4), Landslide (Section 4.5.5), and Tsunamis (Section 4.5.8) sections of this Plan to learn more about climate change impacts on these hazards.*

Climate Change Impact		Impact Factor	Weighted Factor	Score
No Impact	Climate change trends will not increase the impacts of this hazard.	0	1	0
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Climate Change Impact Score = Impact Factor x Weighted Factor***				

Secondary Impacts

The following are cascading or indirect hazards that may follow the primary hazard event. These hazards can occur concurrently with or be triggered by the initial event and may exacerbate its overall impact.

[191] California Department of Finance. (2025). Projections. Retrieved from https://dof.ca.gov/forecasting/demographics/projections/.

- Liquefaction
- Tsunami
- Hazardous Materials Releases
- Dam and Levee Failure
- Structural Collapse
- Fire
- Oil and Gas Pipeline Failures
- Nuclear Power Utility Disruption
- Waste and Wastewater Disruption
- Seiches

4.6.3.8. Issues

Earthquakes present a range of challenges that can impact a community's preparedness, response, recovery, and mitigation efforts. While not exhaustive, the following outlines key earthquake-related issues that the planning team identified that San Mateo County may encounter during such events.

- More information is needed to better understand the exposure and performance of soft-story construction within the County.
- It is estimated that over 55% of San Mateo County's building stock was built prior to 1975, when seismic provisions became uniformly applied through building code applications. Therefore, many structures may require seismic retrofits to withstand a moderate earthquake. Residential retrofit programs (e.g., Earthquake Brace Bolt (EBB) Seismic Retrofit) may be able to assist in the costs of these efforts.
- Based on the modeling of critical facility performance performed for this Plan, a high number of facilities in San Mateo County are expected to suffer complete or extensive damage from scenario events. These facilities are prime candidates for structural retrofits.
- Critical facility owners should be encouraged to create or enhance continuity of operations plans using the information on risk and vulnerability contained in this LHMP.
- Geotechnical standards should be established that consider the probable impacts from earthquakes in the design and construction of new or enhanced facilities.
- There are a large number of earthen dams within San Mateo County. Dam failure warning, evacuation plans, and procedures should be reviewed and updated to reflect the dams' earthquake risk in the region. County levees should also be included in any earthquake risk assessments.
- Earthquakes could trigger other natural hazard events such as floods, fires, and landslides, which could severely damage property, facilities, and critical infrastructure.
- A worst-case scenario would be the occurrence of a large earthquake during a flood or high-water event. Levees would fail at multiple locations, increasing the impact of the individual events.
- Community members are expected to be self-sufficient for up to three (3) days after a major earthquake without government response agencies, utilities, private-sector services, and infrastructure components. Education programs are currently in place to facilitate the

development of earthquake preparedness at the individual, family, neighborhood, and business levels. The government alone cannot fully prepare the region. It takes individuals, families, and communities collaborating to be truly prepared for a major earthquake.

- After a major earthquake, San Mateo County is likely to experience disruptions in the flow of goods and services resulting from the destruction of major transportation infrastructure across the broader region.
- Limited warning time gives residents minimal time to react.
- Damage to communication systems (e.g., power lines, cell towers) can leave residents isolated and unable to communicate with first responders.
- High rises tend to sway more during earthquakes, causing those on higher floors to experience more noticeable shaking than those on the ground, potentially inducing panic.
- Pedestrian risk from high-rise falling debris.

4.6.3.9. Risk Profile

FEMA Risk Index Score

The FEMA Earthquake Risk Index score and rating represent a community's relative risk for earthquakes when compared to the rest of the United States. **Table 4-62** illustrates the Earthquake Risk Index rating and score for San Mateo County.

Table 4-62. Earthquake Total Risk Score *(FEMA National Risk Index)*

Rating	Score
Relatively High	99.7
Risk Index Values are calculated by combining the Social Vulnerability and Community Resilience components into a single Community Risk Factor, which is then multiplied by the Expected Annual Loss component (Expected Annual Loss x (Social Vulnerability / Community Resilience) = Risk Index).	

Overall Risk Score

Table 4-63 represents the Earthquake Total Risk Score for San Mateo County, based on the Risk Assessment Methodology, as defined in Section 4.3 of this Plan.

Table 4-63. Earthquake Total Risk Score

Hazard Event	Probability Factor	Sum of Weighted Extent Factors	Sum of Weighted Vulnerability Factors	Sum of Weighted Impact Factors	Consequence Score	Total Risk Score*
Earthquake	2	18	14	35	67	62

Extent: Sum of the weighted Extent factors.
Vulnerability: Sum of the weighted Vulnerability factors.
Impact: Sum of the weighted Impact factors.

Consequence Score: Extent + Vulnerability + Impact (Sum of all weighted factors).
Total Risk Score = Probability x Consequence
* Normalized to 100

Total Risk Score Legend

Classification	Probability	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 4	0 – 12	0 – 24	0 – 32
Medium (M)	2	7 – 12	5 – 10	13 – 26	25 – 48	33 – 66
High (H)	3	13 – 18	11 – 15	27 – 39	49 – 72	67 – 100

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.4. Flood

Floods are the most common and widespread of all weather-related natural disasters, resulting in more deaths each year than tornadoes, hurricanes, and lightning. In San Mateo County, they are among the most damaging natural hazards. A flood is defined as an overflowing of water onto dry land, which occurs when the existing channel of a stream, river, canyon, or other watercourses cannot contain excess runoff from rainfall or snowmelt. This can include creeks and streams overtopping their banks, heavy rainfall that surpasses the capacity of storm drains, and very high tides or coastal storm surge. It can also occur because of dam failure, water or wastewater infrastructure failure, or tsunamis. *Refer to Section 4.5.1 and Section 4.5.8 for more information about dam failures and tsunamis, respectively.*[192,193]

In San Mateo County, flooding is driven by a unique combination of climate, geology, and hydrology, which is further exacerbated by ongoing development. Located in a peninsula, the County spans diverse regions that produce varied weather patterns; while the County averages 22 inches of rainfall annually, localized totals vary significantly. Flooding is most frequent between October and April when Pacific storms bring heavy rainfall to the area. When these storms persist over several days and fall on saturated soil, major flooding often results.[194]

Both developed and undeveloped areas of the County are vulnerable due to extensive urbanization, high tides, and infrastructure resilience (e.g., levees, pump stations, and stormwater channels). A majority of these flood-prone areas are specifically subject to flooding from heavy rainfall and resulting stream overflows.[195]

Riverine Flooding

Occurs when water levels rise over the top of river (or creek) banks. This can be due to multiple different causes, either alone or in combination, including persistent heavy rainfall over the same area for an extended period, landfalling tropical systems, snowmelt, or ice jams.[196] Natural processes of riverine flooding add sediment and nutrients to fertile floodplain areas. Flooding in large river systems typically results from large-scale weather systems that generate prolonged rainfall over a wide geographic area, causing flooding in hundreds of smaller streams, which then drain into the major rivers. Two (2) types of flood hazards are generally associated with riverine flooding:

- **Inundation** occurs when floodwater is present, and debris flows through an area not normally covered by water. These events cause minor to severe damage, depending on velocity and depth of flows, duration of the flood event, quantity of logs and other debris carried by the flows, and amount and type of development and personal property along the floodwater's path.
- **Channel migration** is when erosion of banks and soils worn away by flowing water, combined with sediment deposition, causes migration or lateral movement of a river channel across a

[192] National Oceanic and Atmospheric Administration, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Flood Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/floods/.
[193] San Mateo County. (2026). Safety Element (Draft).
[194] San Mateo County Planning and Building Department. (n.d.). Minimize Flood Damage. Retrieved from https://www.smcgov.org/planning/minimize-flood-damage.
[195] San Mateo County. (2026). Safety Element (Draft).
[196] National Oceanic and Atmospheric Administration, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Flood Types. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/floods/types/.

floodplain. A channel can also abruptly change location (i.e., avulsion); a shift in channel location over a large distance can occur within a single flood event.

Urban/Flash Flooding

For the purposes of this Plan, urban and flash flooding will be analyzed together, as urbanization can significantly increase the frequency, intensity, and impacts of both.

Flash flooding occurs during heavy or excessive rainfall over a short period, generally less than six (6) hours. These types of floods are usually characterized by raging torrents that form after heavy rainfall and rip through riverbeds, urban streets, or mountain canyons. They can occur within minutes or a few hours of excessive rainfall. Also, they can occur even if no rain has fallen, for instance, after a levee or dam has failed, or after a sudden release of water by a debris or ice jam.[197] In urban areas, flash flooding is an increasingly serious problem due to the removal of vegetation and the replacement of ground cover with impermeable surfaces (e.g., roads, driveways, parking lots). The greatest risk from flash floods is their occurrence with little to no warning.

Urban flooding is a separate phenomenon from coastal and riverine flooding. It is characterized by its frequency, more localized, costly, and systemic impacts on communities, regardless of whether or not a community is located within formally designated floodplains or near any body of water. Urban flooding is caused by excessive runoff in developed areas, where water has nowhere else to go.[198]

Stormwater flooding results from local drainage issues and high groundwater levels. Locally, heavy rainfall, especially during high lunar tide events, may induce flooding in areas outside delineated floodplains or along recognizable channels due to inadequate storm system outfalls that fail to provide gravity drainage into the adjacent body of water. If local conditions cannot accommodate intense precipitation through infiltration and surface runoff, water may accumulate, leading to flooding. Flooding issues of this nature generally occur in areas with flat gradients and increase with urbanization, which speeds the accumulation of floodwaters due to impervious surfaces. Shallow street flooding can occur unless channels are improved to accommodate increased flows.

Urban drainage flooding is caused by increased water runoff from urban development and inadequate drainage systems. Drainage systems are designed to remove surface water from developed areas as quickly as possible to prevent localized flooding on streets and within other urban areas. These systems use a closed conveyance system that channels water away from an urban area to surrounding streams, bypassing natural processes such as filtration through the ground, containment, and evaporation of excess water. Because drainage systems reduce the time it takes surface water to reach surrounding streams, flooding in those streams can occur more quickly and reach greater depths than before development in that area.

Coastal Flooding

Coastal floods are characterized by the inundation of normally dry lands by ocean waters. Storm surge associated with severe storms, tsunamis, or extreme high tide events can result in shallow flooding of

[197] Ibid.
[198] University of Maryland and Texas A&M University. (2018). The Growing Threat of Urban Flooding: A National Challenge. Retrieved from https://cdr.umd.edu/sites/cdr.umd.edu/files/resource_documents/COMPRESSEDurban-flooding-report-online-compressed-0319.pdf.

low-lying coastal areas. Storm surge floods typically result in coastal erosion, salinization of freshwater sources, and contamination of water supplies. These floods are also responsible for significant agricultural losses, loss of life, and damage to public and private structures and infrastructure. The San Mateo County coastline extends 55 miles and is home to both residential and agricultural communities. The Pacific Ocean is the most likely source of coastal flooding in the County, although flooding from the San Francisco Bay is also a possibility during significant events.

San Mateo County has mitigated some of its vulnerability to coastal flooding through a series of levees originally installed for salt evaporation ponds in the southeastern part of the County and for flood protection in the north and central parts of the County. These levees were not designed to withstand floods of magnitude greater than the 1% annual chance.

4.6.4.1. Location

A floodplain is the area adjacent to a river, creek, lake, or the ocean that becomes inundated during a flood. Riverine floodplains may be broad, as when a river crosses an extensive flat landscape, or narrow, as when a river is confined in a canyon.

When floodwaters recede after a flood event, they leave behind layers of rock and mud. These gradually build up to create a new floor of the floodplain. Floodplains generally contain unconsolidated sediments (accumulations of sand, gravel, loam, silt, and/or clay), often extending below the bed of the stream. These sediments provide a natural filtering system, with water percolating back into the ground and replenishing groundwater. These are often important aquifers, with the water drawn from them being filtered more than the water in the stream. Fertile, flat reclaimed floodplain lands are commonly used for agriculture, commerce, and residential development.

Connections between a river and its floodplain are most apparent during and after major flood events. These areas form a complex physical and biological system that not only supports a variety of natural resources but also provides natural flood and erosion control. When a river is separated from its floodplain by levees and other flood-control facilities, natural, built-in benefits can be lost, altered, or significantly reduced.

Floodplain is synonymous with the 100-year floodplain. A 100-year floodplain does not mean that a flood will occur once every 100 years; it is defined as an area with 1% chance of flooding in any given year. Therefore, the 100-year flood could happen more than once within a relatively short period. Additionally, areas within the 100-year floodplain can flood in smaller storms. These areas are identified on the Flood Insurance Rate Map (FIRM) as an SFHA, the standard term used by most federal and state agencies, as well as the NFIP.[199]

Special Flood Hazard Areas

The FIRMs show areas of high, moderate, and low flood risk using a series of zones (i.e., flood zones). Communities use these maps to establish minimum building requirements for coastal areas and floodplains, while lenders use them to determine flood insurance requirements. These maps highlight areas with a 1% annual chance of flooding, commonly known as 100-year floodplains, and are shown as

[199] Federal Emergency Management Agency. (2020). Flood Zones. Retrieved from https://www.fema.gov/glossary/flood-zones.

SFHAs. Additionally, FIRMs identify 500-year floodplains, which are areas with a 0.2% annual chance of flooding. **Table 4-64** outlines the categories of flood risk areas as defined by FEMA FIRMs.[200]

Table 4-64. Flood Risk Categories and Descriptions

Type	Flood Risk	Description	Designated Flood Zone
Special Flood Hazard Areas	High	At least a 1% chance of flooding each year (sometimes referred to as the "100-year" floodplain).	A or V
Non-Special Flood Hazard Areas	Moderate to Low	At least a 0.2%, but less than a 1%, chance of flooding each year (sometimes referred to as the "500-year" floodplain). Areas where the risk is reduced, but not completely removed. Although flood insurance is not federally required in these areas, it is recommended for all property owners and renters because these areas remain at risk of flooding. More than 20% of NFIP claims are submitted in these zones, accounting for one-third of federal disaster assistance for flooding.	B, C, or X (including shaded or unshaded)
Undetermined	Unknown	Areas on some FIRMs with possible but undetermined flood hazards or where flood risk has not been studied. For instance, pluvial flooding may not be marked on these maps within a flood hazard area.	D

Coastal SFHAs are a concern to San Mateo County, particularly along the areas of the coastline at or slightly above sea level. FIRMs depict two (2) coastal flood hazard zones:

- **Zone VE:** Used on flood maps to indicate areas where wave action and fast-moving water can cause extensive damage during the base flood event, with wave heights of three (3) feet or higher. FEMA's NFIP requires stricter floodplain management and construction requirements for structures in these zones to account for these hazards.
- **Zone AE:** Flood elevation includes wave heights less than three (3) feet.

Decades of post-storm observations have shown FEMA that waves as small as 1.5 feet can significantly damage buildings not built to withstand wave hazards. FEMA developed the Limit of Moderate Wave Action (LiMWA) (**Figure 4-11**) to show communities where waves greater than 1.5 feet high may cause damage. Where available, the LiMWA line on coastal flood maps marks the inland limit of the Coastal A Zone.[201] Including the LiMWA area in FIRMs enables communities and individuals to better understand flood risks to their properties. This area is subject to flood hazards, including floating debris and high-velocity flow, that can erode and scour building foundations and, in extreme cases, cause foundation failure.

The current effective FIRMs for the County of San Mateo do not delineate LiMWA areas. Future map updates will include this information and should be used to develop additional coastal flooding mitigation measures.

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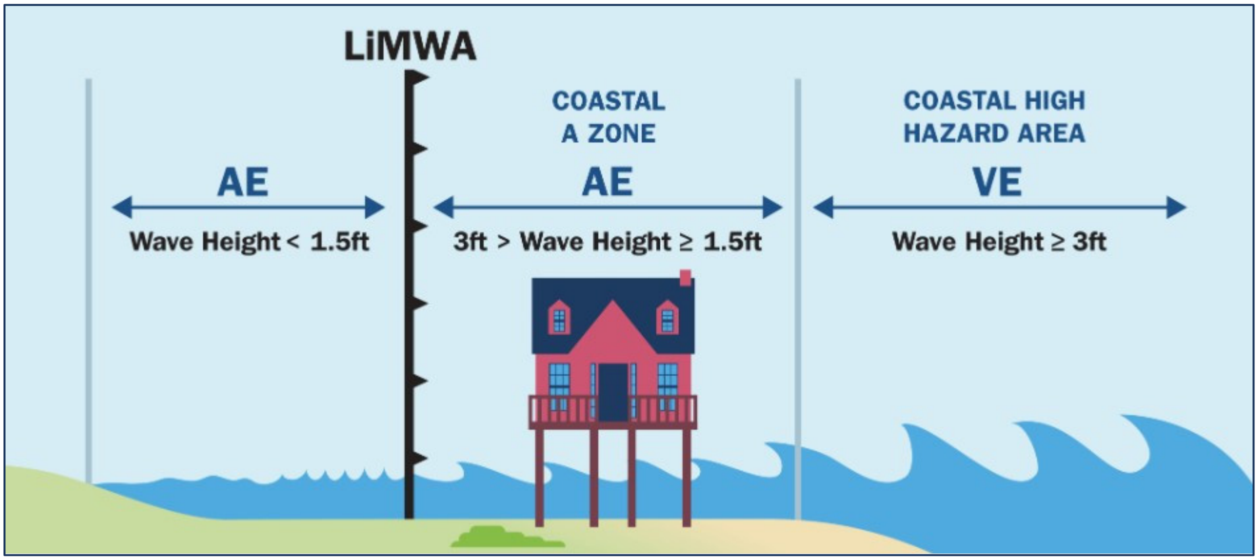
[200] Federal Emergency Management Agency. (2023). FEMA Flood Maps and Zones Explained. Retrieved from https://www.fema.gov/blog/fema-flood-maps-and-zones-explained.
[201] Federal Emergency Management Agency. (2023). Implementing the Limit of Moderate Wave Action in Coastal Communities. Retrieved from https://www.fema.gov/case-study/implementing-limit-moderate-wave-action-coastal-communities.

Figure 4-11. Limit of Moderate Wave Action



The FEMA-designated flood hazard areas in the interior of the County occur primarily along creeks, rivers, and lakes, such as Crystal Spring Reservoir, San Andreas Lake, Denniston Creek, and San Gregorio Creek. However, the flood hazard zones expand where the creeks drain into either the San Francisco Bay or the Pacific Ocean. The coastal and Bayshore floodplains include several segments of State Route 1 and US Highway 101, most of the developed areas of Pescadero, the Unincorporated Harbor/Industrial area between Belmont and San Carlos, large sections of other key roadways such as Pescadero Creek Road, and multiple State beaches. Coastal and Bayshore floodplains are projected to expand as sea levels rise and the tide regularly moves farther inland, eventually permanently flooding many developed low-lying coastal areas. **Figure 4-12** illustrates the San Mateo County SFHA, including each Flood Zone, the 500-year floodplain.

Figure 4-12. San Mateo County Special Flood Hazard Area

[Map under development…]

Natural stream channels in rural parts of San Mateo County typically can accommodate average rainfall amounts and mild storm systems; however, severe floods occur in years of abnormally high rainfall or unusually severe storms. During periods of severe flooding, high-velocity floodwaters carry debris over long distances, block stream channels, and cause severe localized flooding. To control these floodwaters when they reach more urban areas, the County and its municipalities have developed various flood control districts and flood improvements, such as culverts, bridges, levees, channel alterations, and underground storm drains.

In 2019, the FEMA Flood Insurance Study (FIS) for San Mateo County was revised to include information on the existence and severity of flood hazards across the entire geographic area of the County. There are 79 creeks, channels, and bodies of water that are considered sources of flooding in San Mateo County. **Table 4-65** lists the principal flooding sources for San Mateo County as identified on the FEMA flood maps. **Table 4-66** provides a description of the principal flood problems noted for San Mateo County by the flooding source.[202]

Table 4-65. San Mateo County Flooding Sources

Alpine Creek	Denniston Creek	Montara Creek	San Gregorio Creek
Belmont Creek	El Granada Creek	Pacific Ocean	San Vicente Creek
Butano Creek	Holly Street Channel	Pescadero Creek	Woodhams Creek
Colma Creek	La Honda Creek	San Bruno Channel	
Crystal Springs Channel	Lomita Channel	San Francisquito Creek	

Over 20 creeks, channels, and water bodies, including those identified as principal flooding sources, were assessed as part of the County's FIS. In addition to the waterways listed in **Table 4-65**, the FIS identified areas at risk for potential tsunami inundation. The cities of Half Moon Bay and Pacifica are both associated with potential tsunami issues. *Refer to Section 4.5.8 for more information on the tsunamis.*

Investigation of San Mateo County's vulnerability to flooding can also include assessments of watershed locations. Every watershed has unique qualities that affect its response to rainfall. San Mateo County contains 34 watersheds, all of which are relatively small and drain into either the Pacific Ocean or San Francisco Bay. Except for Crystal Springs and San Francisquito, which both drain into the San Francisco Bay, all the rural watersheds drain into the Pacific Ocean.

Table 4-66. Principal Flood Problems in San Mateo County

Flooding Source	Description
All Sources	Past records and hydraulic analysis indicate that flooding will be predominantly shallow along streams on the bayside of San Mateo County. Spills from the respective channels flow independently through the urbanized areas, usually following the streets, and result in flood depths of less than one (1) foot. Occasionally, railroad or highway embankments act as barriers, resulting in deeper ponding or sheetflow flooding. Flooding on the oceanside of the County is predominantly confined to well-defined riverine valleys, with flood surface extending uniformly across the floodplain.
Colma Creek	The Daly City storm drain terminates in a junction structure near the intersection of F Street and El Camino Real. Because the downstream storm drain has only one-half the waterway area of the upstream storm drain, the excess flow is forced from the storm drain through a side channel into the Colma Mobile Home Park on the northwestern side of the intersection, where it ponds.

[202] Federal Emergency Management Agency. (2019). FEMA Flood Insurance Study: San Mateo County, California and Incorporated Areas (Volume 1). Retrieved from https://map1.msc.fema.gov/data/06/S/PDF/06081CV001D.pdf?LOC=11e394c553a8e30e6fb4d190822123cb.

Flooding Source	Description
San Bruno, Crystal Springs, and Lomita Channels	The shallow flooding zones between the Bayshore Freeway and the mainline of the railroad are the result of overland flows from the San Bruno Channel and Crystal Springs Channel. These flows merge behind the railroad embankment and eventually cross the railroad tracks as independent flows. Approximately 220 cubic feet per second (cfs) flow into the area north and west of the Crystal Springs Channel and are then pumped into the channel at a rate of approximately 35 cfs. The Crystal Springs Channel itself has a capacity of 200 cfs and is adequate for the flows reaching it. Approximately 740 cfs flow into the area south of the Crystal Springs Channel and west of the Bayshore Freeway. This flow moves southward until it reaches the Lomita Channel, where it is then pumped into the Millbrae (High Line) Canal and flows into San Francisco Bay. The Crystal Springs Channel and the Belle Air storm drain (750-cfs flow) merge at San Bruno Avenue and flow northeasterly to San Francisco Bay in the San Bruno Channel (1,000-cfs flow). The shallow flooding zone adjacent to the San Bruno Channel is caused by local runoff.
Belmont Creek and Holly Street Channel	Overflows from Belmont Creek in the City of Belmont flow generally toward San Francisco Bay. This overland flow can take myriad routes, and the entire area on the bay side of the railroad tracks is subject to shallow flooding. At the railroad, the overland flow is split, and the greater part is diverted to the east. Additional overflow occurs near Harbor Street and Old County Road at a railroad loading spur. The Bayshore Freeway and the Holly Street off-ramp form a barrier to the easterly flow, causing shallow ponding in the Industrial Way area. This ponding has been significantly reduced by recently completed drainage projects.
San Francisquito Creek	The San Francisquito Creek overflows at two (2) locations within the City of Menlo Park. The overflow flows eastward toward the bay along streets that lead away from the Creek channel. At the Bayshore Freeway, this shallow flooding spills into the County area and continues toward the Bay. There are no other spills from San Francisquito Creek into the County area. However, tidal flooding from the Bay during a 1% chance flood event can possibly overtop the levee system in the City of East Palo Alto and cause flooding in the residential area adjacent to San Francisquito Creek. Flooding in this area is due to inadequate or nonexistent stormwater facilities, trapping local stormwater.
Montara Creek	Montara Creek is generally confined to its channel, with overtopping occurring at most culvert crossings. The culvert at Harte Street is heavily silted, forcing water out of the channel and over the road; a few residences are affected. The embankment along State Highway 1 forms a dam, causing deep flooding; however, no existing structures are affected.
San Vicente Creek	San Vicente Creek overflows to the north at Etheldore Street, causing shallow flooding through several existing structures adjacent to State Highway 1 before the overflow returns to the channel along Cypress Avenue. Additional flooding occurs near the oceanfront due to inadequate culvert capacity.
Denniston Creek	Denniston Creek is contained within a well-defined channel until it reaches State Highway 1, where limited culvert capacity results in shallow overflow and ponding southward behind the highway to a low point near Sonora Avenue, where it flows overland to the ocean. The channel through the developed part of Princeton is overgrown, and culverts are of limited capacity; however, the resulting flooding is minimal.

Flooding Source	Description
El Granada Creek	El Granada Creek consists of a very shallow channel through the most developed oceanside area of the County. In numerous locations, undersized culverts have been installed in the channel, causing widespread flooding of roads and residences in the vicinity of the Creek. This flooding is contained by the remnants of the natural floodplain through the community.
Woodhams, La Honda, Alpine, and San Gregorio Creeks	All creeks in the La Honda community flow in well-defined, often steep channels. Flooding occurs across various stream terraces that are adjacent to culverts or channel restrictions. On San Gregorio Creek, a combination of meandering channel and numerous private bridges creates similar terrace flooding situations.
Pescadero and Butano Creeks	Pescadero and Butano Creeks are located in a classic river valley formed by the joining of two (2) large drainages. Each creek has a well-defined channel that meanders through a broad floodplain bounded by hills on either side of the valley. This broad floodplain has little gradient and, therefore, is inundated by overflows from Pescadero Creek and the joining flows of Butano Creek. Most of the Town of Pescadero is built in this floodplain and is inundated during floods.
Pacific Ocean	Flooding from the Pacific Ocean at Miramar and Martins beaches is typically associated with the simultaneous occurrence of very high tides, large waves, and storm swells during the winter months. As a result, oceanfront development has not been compatible with the shoreline's natural instability and the intense winter weather. Tsunamis are among the most destructive natural water waves. As tsunami waves approach shallow coastal waters, wave refraction, shoaling, and bay resonance amplify the wave heights. Storm centers from the southwest produce the type of storm pattern most responsible for serious coastal flooding. The strong winds and high tides that create storm surges are also accompanied by heavy rainfall. In some instances, high tides back up river flow, causing flooding at river mouths.

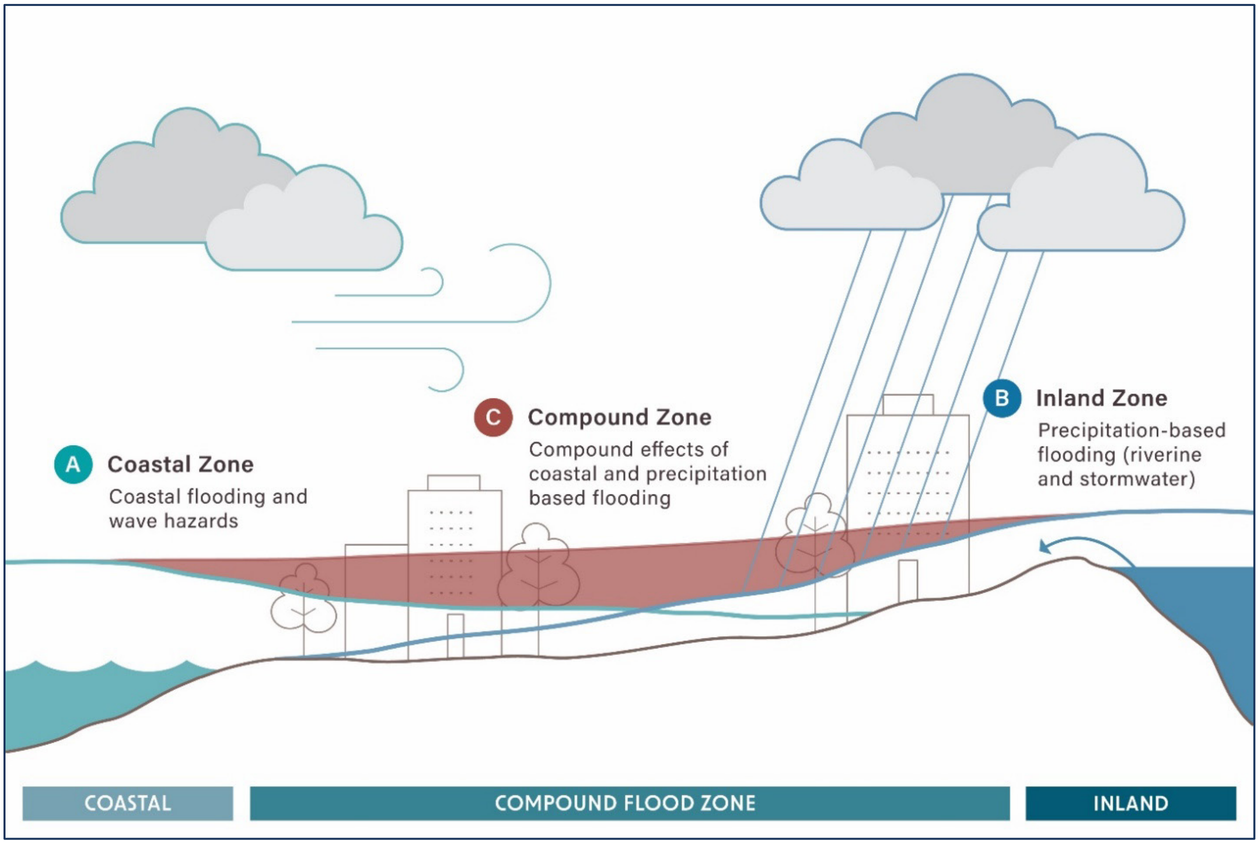
Professional users and those interested in more advanced FIRM features can access the National Flood Hazard Layer (NFHL). The NFHL is a geospatial database containing current, effective flood hazard data. FEMA provides the flood hazard data to support the NFIP.

Compound Flooding in Coastal Regions

In low-lying coastal areas, compound flood events are commonly due to the joint occurrence of heavy precipitation, high river flows, elevated groundwater levels, soil saturation, and elevated coastal water levels. **Figure 4-13** illustrates the conceptual area at greatest risk of compound flooding, comprised of both coastal and precipitation-based flood hazards. The flood risks in the "coastal transition zone" will be underestimated in the absence of a combined flood analysis. Although the County has a reasonable approximation of current and future coastal flood hazards on both coasts through the recent FEMA FIRM updates, the USGS Coastal Storm Modeling System (CoSMos) modeling and mapping, the Adapting to Rising Tides modeling and mapping, and two (2) future condition shallow groundwater analysis and mapping efforts, there is limited modeling and mapping of riverine and stormwater flood hazards available. This represents a significant data gap in achieving climate resilience to compound flood hazards.[203]

[203] San Mateo County. (2026). Safety Element (Draft).

Figure 4-13. Compound Flood Zone



4.6.4.2. Extent/Severity

Riverine Flooding: The extent of riverine flooding depends on precipitation intensity, volume, and duration, terrain and soil conditions at the time of the event, and river capacity. The deeper and faster the flood flows, the more damage it can cause. Shallow flooding with high velocity can cause as much damage as deep flooding with low velocity, especially when a channel migrates across a broad floodplain, redirecting high-velocity flows and transporting debris and sediment. Flood severity is often evaluated by examining peak discharges. Peak flows used by FEMA to map floodplains within the planning area are listed in **Table 4-67**.

Table 4-67. Summary of Peak Discharges in San Mateo County

Source/Location	Drainage Area *(square miles)*	Peak Discharge *(cubic feet/second)*			
		10% Annual Chance	***2% Annual Chance***	***1% Annual Chance***	***0.2% Annual Chance***
16th Avenue Drainage					
Southern Pacific Railroad Crossing	Data Not Available	Data Not Available	Data Not Available	490	Data Not Available
US Highway 101	Data Not Available	Data Not Available	Data Not Available	800	Data Not Available

Source/Location	Drainage Area *(square miles)*	Peak Discharge *(cubic feet/second)*			
		10% Annual Chance	***2% Annual Chance***	***1% Annual Chance***	***0.2% Annual Chance***
19th Avenue Drainage Channel					
South Pacific Railroad Crossing	Data Not Available	Data Not Available	Data Not Available	1,310	Data Not Available
Delaware Street	Data Not Available	Data Not Available	Data Not Available	1,330	Data Not Available
Bermuda Drive	Data Not Available	Data Not Available	Data Not Available	1,450	Data Not Available
US Highway 101	Data Not Available	Data Not Available	Data Not Available	1,500	Data Not Available
Atherton Creek					
Railroad	5.0	350	350	350	350
Belmont Creek					
El Camino Real	2.5	570	1,000	1,200	1,400
US Highway 101	2.8	660	1,200	1,400	1,600
Colma Creek					
F Street	1.7	800	1,200	1,400	1,600
Below Hickey Boulevard Tributary	6.0	1,700	2,900	3,400	4,100
USGS Gage in Orange Park	10.9	2,400	4,100	4,700	5,700
Below Spruce Branch	12.7	2,500	4,400	5,000	6,100
San Francisco Bay	16.0	2,900	5,100	5,800	7,000
Cordilleras Creek					
Alameda de las Pulgas	2.6	400	730	890	1,300
Stanford Lane	3.1	460	900	1,120	1,700
El Camino Real	3.3	470	940	1,170	1,800
Old County Road	3.3	470	620	680	1,190
Bayshore Freeway	3.6	525	700	850	1,490
Denniston Creek					
Reservoir	3.2	700	1,200	1,400	1,800
Near Sheltercove Drive	3.8	780	1,300	1,600	2,000
Half Moon Bay	4.0	800	1,400	1,600	2,100
Easton Creek					
Railroad	0.8	260	410	470	540

Source/Location	Drainage Area *(square miles)*	Peak Discharge *(cubic feet/second)*			
		10% Annual Chance	*2% Annual Chance*	*1% Annual Chance*	*0.2% Annual Chance*
El Granada Creek					
Reservoir	0.5	160	2250	290	370
Half Moon Bay	0.6	190	300	340	440
Holly Street Channel					
US Highway 101	0.4	240	370	420	420
Industrial Branch					
Colma Creek	1.5	490	720	800	970
La Honda Creek					
Upstream of Confluence with Woodhams Creek	10.0	1,800	3,100	3,600	4,800
Downstream of Confluence with Woodhams Creek	10.9	1,900	3,300	3,800	5,200
Confluence with San Gregorio Creek	11.8	2,100	3,500	4,200	5,500
Laurel Creek					
Alameda de las Pulgas	Data Not Available	Data Not Available	Data Not Available	970	Data Not Available
Otay	Data Not Available	Data Not Available	Data Not Available	1,130	Data Not Available
George Hall School	Data Not Available	Data Not Available	Data Not Available	1,420	Data Not Available
US Highway 101	Data Not Available	Data Not Available	Data Not Available	1,950	Data Not Available
Lomita Channel					
Railroad	--	--	--	--	--
Mills Creek					
Railroad	0.5	190	290	330	370
Mills Creek and Easton Creek					
US Highway 101	2.5	750	840	840	840
Montara Creek					
Riviera Street	0.8	220	360	420	560
Harte Street	1.3	310	530	620	830
Pacific Ocean	1.7	380	640	760	1,000
Navigable Slough					
Colma Creek	0.4	200	270	300	300

Source/Location	Drainage Area *(square miles)*	Peak Discharge *(cubic feet/second)*			
		10% Annual Chance	*2% Annual Chance*	*1% Annual Chance*	*0.2% Annual Chance*
Pescadero Creek					
Pescadero Road East of Town	53.3	7,700	13,900	16,700	20,000
Pacific Ocean	81.3	11,000	20,000	24,000	29,000
Ralston Creek and Burlingame Creek					
Railroad	1.7	500	800	930	1,100
Redwood Creek					
El Camino Real	5.2	1,200	2,110	2,500	3,200
Broadway	8.8	1,800	3,200	3,800	4,800
Bayshore Freeway	9.3	1,900	3,300	4,000	5,000
Sanchez Creek					
Railroad	1.7	500	800	930	1,100
Sanchez Creek, Ralston Creek, and Burlingame Creek					
US Highway 101	4.7	1,100	1,600	1,600	1,600
San Francisquito Creek					
El Camino Real	40.6	4,350	7,050	8,280	9,850
Upstream of Middlefield Road	41.6	4,350	7,100	8,330	Data Not Available
Downstream of Middlefield Road	41.6	Data Not Available	Data Not Available	6,965	Data Not Available
Downstream of Pope Street	41.6	Data Not Available	Data Not Available	6,250	Data Not Available
US Highway 101	41.7	4,400	6,020	6,060	6,300
San Francisquito Creek – Overflow					
Middlefield Road	Data Not Available	Data Not Available	Data Not Available	640	Data Not Available
Pope Street	Data Not Available	Data Not Available	Data Not Available	730	Data Not Available
Combined Middlefield Road and Pope Street Overflows	Data Not Available	Data Not Available	Data Not Available	1,154	Data Not Available
South of Highway 101	Data Not Available	Data Not Available	Data Not Available	1,154	Data Not Available
North of Highway 101	Data Not Available	Data Not Available	Data Not Available	570	Data Not Available
San Gregorio Creek					
Upstream Limit of FEMA's FIS	9.3	1,800	3,000	3,500	4,500
Upstream of Confluence with La Honda Creek	9.5	1,800	3,000	3,600	4,600

Source/Location	Drainage Area (square miles)	Peak Discharge (cubic feet/second)			
		10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Downstream of Confluence with La Honda Creek	21.3	3,300	4,800	6,900	9,300
Downstream of State Highway 84	21.8	3,300	4,600	6,900	9,300
Downstream Limit of FEMA's FIS	22.4	3,500	6,100	7,200	9,700
San Mateo Creek					
At Mouth (City of San Mateo)	Data Not Available	Data Not Available	Data Not Available	1,017	Data Not Available
Downstream Side of S. Humboldt Street and E. Third Avenue	Data Not Available	Data Not Available	Data Not Available	1,493	Data Not Available
400 Feet Downstream of Crystal Springs Road	33.3	Data Not Available	Data Not Available	2,124	Data Not Available
San Vicente Creek					
Upper Limit of FEMA FIS	1.4	340	570	660	880
Etheldore Street	1.7	400	670	780	1,000
Pacific Ocean	1.9	430	720	810	1,100
Spruce Branch					
Colma Creek	1.5	540	770	810	830
Woodhams Creek					
Esmeralda Terrace	0.7	220	340	390	480
Confluence with La Honda Creek	0.9	270	520	480	600

When a river nears, or is expected to near, flood stage, the NWS River Forecast Centers issue stage (water level) forecasts for multiple gauge locations based upon the observed and forecast rainfall and/or snowmelt in the upcoming one (1) to two (2) days. These forecasts can help convey the severity of potential flooding using flood impact categories based on property damage and public threat. The four (4) flood impact categories used by the NWS are listed in **Table 4-68**.[204,205]

Table 4-68. NWS River Flood Impact Categories

Type	Description
Action Stage	There may be increased monitoring of river levels as the water approaches flood stage. This stage is often near the bankfull level (i.e., when water begins to overflow the lowest natural banks) and is established in collaboration with local communities. Impacts consistent with this category may include restrictions on river use, staffing EOCs, moving property to higher ground, or deploying flood protection equipment.

[204] National Oceanic and Atmospheric Administration, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Frequently Asked Questions About Floods. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/floods/faq/.
[205] National Weather Service. (n.d.). Hydrology Terms and Definitions. Retrieved from https://www.weather.gov/lot/hydrology_definitions.

Type	Description
Minor Flooding	Minimal or no property damage, but some public safety threats are possible. This stage is usually synonymous with "flood stage", and it is established in collaboration with local communities to coincide with the onset of significant flooding. Impacts consistent with this category may include inundation of minor roads, heavily used trails, athletic fields, utility sheds, or boathouses.
Moderate Flooding	Some inundations of structures and roads near streams are possible. Evacuations of people and/or moving property to higher ground may be necessary. This stage is established in collaboration with local communities to coincide with the onset of more impactful, rare flooding. Impacts consistent with this category may include flooding of a few residences at ground level and inundation of major roadways, park structures, and waterfront commercial facilities.
Major Flooding	Extensive inundation of structures and roads is possible. Significant evacuations of people and/or transfer of property to higher elevations may be necessary. This stage is established in collaboration with local communities to coincide with the onset of the most significant flood impacts, which occur only rarely. Impacts consistent with this category may include inundation of numerous residences, expressways, interstates, police departments, fire departments, or other critical infrastructure, as well as commercial business districts.

Extent/Severity		Extent Factor	Weighted Factor	Score
Medium	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a medium-intensity incident.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Extent/Severity Score = Extent Factor x Weighted Factor***				

Urban/Flash Flooding: The extent of urban/flash flooding depends on the amount of water that accumulates over time, and the land's ability to manage water, along with infiltration rates, are significant factors. Strong thunderstorms can also produce heavy flooding in a short period of time. When it rains, the soil acts like a sponge, and when the land is saturated, infiltration rates decrease, causing any additional water to flow as runoff. Alternatively, in areas where soil has been replaced with buildings and pavement, infiltration is prevented, and runoff is significantly increased. In some situations, rainfall rates can be so high that they exceed the infiltration capacity of even dry soils. Flash floods are often localized, especially in urban areas, with peak impacts usually occurring close to and shortly after the highest rainfall rates.

In limited circumstances, flood mapping can be used to determine the extent of urban/flash flood risk. This would typically be on small waterways such as ditches and creeks where a flood insurance study has been completed for FEMA FIRMs.

Extent/Severity		Extent Factor	Weighted Factor	Score
High	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a high-intensity incident.	3	3	9
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Extent/Severity Score = Extent Factor x Weighted Factor***				

Coastal Flooding: The extent and intensity of coastal flooding depend on storm surge height, which accounts for wave height. For areas of San Mateo County affected by coastal flooding, coastal flood-hazard analyses were conducted to estimate base flood elevations (BFEs). Coastal BFEs reflect the increase in water levels during a flood event due to extreme tides and storm surge, as well as overland wave effects.[206]

Extent/Severity		Extent Factor	Weighted Factor	Score
Low	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a low-intensity incident.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Extent/Severity Score = Extent Factor x Weighted Factor***				

Catastrophic Potential

A catastrophic incident can be defined as any natural, human-caused, or technological disaster that results in extraordinary levels of casualties, damage, or disruption, severely affecting the population (including mass evacuations), infrastructure, environment, economy, national morale, or government functions in the area.[207]

Riverine Flooding: The catastrophic potential for riverine flooding is medium in San Mateo County.

Catastrophic Potential		Extent Factor	Weighted Factor	Score
Medium	Medium potential that this hazard could be catastrophic.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Catastrophic Score = Extent Factor x Weighted Factor***				

Urban/Flash Flooding: The catastrophic potential for urban/flash flooding is high in San Mateo County.

Catastrophic Potential		Extent Factor	Weighted Factor	Score
High	High potential that this hazard could be catastrophic.	3	3	9
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Catastrophic Score = Extent Factor x Weighted Factor***				

[206] Federal Emergency Management Agency. (2019). FEMA Flood Insurance Study: San Mateo County, California and Incorporated Areas (Volume 1). Retrieved from https://map1.msc.fema.gov/data/06/S/PDF/06081CV001D.pdf?LOC=11e394c553a8e30e6fb4d190822123cb.
[207] Federal Emergency Management Agency. (2019). National Response Framework (Fourth Edition). Retrieved from https://www.fema.gov/sites/default/files/documents/NRF_FINALApproved_2011028.pdf.

Coastal Flooding: The catastrophic potential for coastal flooding is low in San Mateo County.

Catastrophic Potential		Extent Factor	Weighted Factor	Score
Low	Low potential that this hazard could be catastrophic.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Catastrophic Score = Extent Factor x Weighted Factor***				

4.6.4.3. Warning Time

Flooding can be unexpected and leave a short window for evacuation, if required. However, because of the sequential pattern of weather conditions required to cause serious flooding, a flood event without warning is unlikely.

Riverine Flooding: The NWS San Francisco Bay Area Forecast Office is responsible for issuing flood watches, advisories, and warnings for San Mateo County. **Table 4-69** outlines the flood hazard products related to riverine flooding issued by the NWS as conditions warrant.[208] Typically, the NWS issues flood watches several hours to multiple days in advance of the onset of possible flooding. In situations where a river or stream is expected to be the primary source of flooding, forecast confidence may allow for a Flood Watch to be issued several days in advance.

Table 4-69. NWS Flood Advisories

Type	Description
Flood Watch	Issued to indicate current or developing conditions that are favorable for flooding. The occurrence is neither certain nor imminent. A watch is typically issued several hours to days before the onset of possible flooding. In situations where a river or stream is expected to be the primary source of flooding, forecast confidence may allow a Flood Watch to be issued several days in advance.
Flood Advisory	Issued when a flood event warrants notification but is less urgent than a warning. Advisories are issued for conditions that could cause significant inconvenience and, if caution is not exercised, could lead to situations that may threaten life and/or property.
Flood Warning	Issued to inform the public of flooding that poses a serious threat to life and/or property. A Flood Warning may be issued hours to days in advance of the onset of flooding based on forecast conditions. Floods occurring along a river usually contain river stage (level) forecasts.

Urban/Flash Flooding: The NWS San Francisco Bay Area Forecast Office is responsible for issuing flash flood watches and warnings for San Mateo County. **Table 4-70** outlines the advisories related to urban/flash flooding issued by the NWS as conditions warrant.[209] Flash floods are characterized by their rapid onset and short duration.

[208] National Weather Service. (n.d.). Flood Related Products. Retrieved from https://www.weather.gov/safety/flood-products.
[209] Ibid.

Table 4-70. NWS Flood Advisories

Type	Description
Flood Watch	Issued to indicate current or developing conditions that are favorable for flooding. The occurrence is neither certain nor imminent. A watch is typically issued several hours to days before the onset of possible flooding. In situations where a river or stream is expected to be the primary source of flooding, forecast confidence may allow a Flood Watch to be issued several days in advance.
Flood Advisory	Issued when a flood event warrants notification but is less urgent than a warning. Advisories are issued for conditions that could cause significant inconvenience and, if caution is not exercised, could lead to situations that may threaten life and/or property.
Flash Flood Warning	Issued to inform the public, emergency management, and other cooperating agencies that flash flooding is in progress, imminent, or highly likely. Flash Flood Warnings are urgent messages as dangerous flooding can develop very rapidly, with a serious threat to life and/or property. Flash Flood Warnings are usually issued minutes to hours in advance of the onset of flooding.

NWS issues Flash Flood Impact-Based Warnings for events that occur within approximately six (6) hours of heavy rainfall. The flash flood impact-based warnings fall into the three (3) categories listed in **Table 4-71**.[210]

Table 4-71. NWS Flash Flood Impact-Based Warnings

Type	Description
Base	Used most of the time when flash flood impact is possible.
Considerable	Used rarely, when there are indications that flash flooding capable of unusual severity or impact is imminent or ongoing, and urgent action is needed to protect lives and property. Widespread and significant roadway flooding, as well as possible flooding of structures, is expected. Will trigger the Wireless Emergency Alert system.
Catastrophic	Used exceedingly rarely, when there is an extreme threat to life and property expected or occurring. Flooding is expected to reach levels rarely, if ever, seen. Will trigger the Wireless Emergency Alert system.

Coastal Flooding: The NWS San Francisco Bay Area Forecast Office is responsible for issuing coastal flood watches and warnings for San Mateo County. **Table 4-72** outlines the advisories related to coastal flooding issued by the NWS as conditions warrant.[211] Typically, NWS issues coastal flood watches and warnings several hours to days before the possible onset of coastal flooding.

Table 4-72. NWS Coastal Flood Advisories

Type	Description
Coastal Flood Watch	Issues when coastal flooding with significant impacts is possible.
Coastal Flood Warning	Issued when coastal flooding that will pose a serious threat to life and property is occurring, imminent, or highly likely.

210 National Weather Service. (2019). Impact-Based Flash Flood Warning. Retrieved from https://www.weather.gov/media/wrn/FFW-IBW-factsheet.pdf.
211 National Weather Service. (n.d.). NWS Glossary. Retrieved from https://forecast.weather.gov/glossary.php?.

4.6.4.4. Probability and Frequency

The presence of elements that cause flooding and past major flooding throughout the County suggests that many people and properties are at risk of future flooding. It is estimated that San Mateo County will continue to experience direct and indirect impacts of flooding events each year, which may induce secondary hazards such as infrastructure deterioration or failure, utility failures, power outages, water quality and supply concerns, transportation delays, accidents, and inconveniences. Additionally, isolated, lower-impact events occur with regularity. The number of years between floods of any given severity significantly varies due to a naturally changing climate. Climate change is expected to increase the severity and frequency of heavy rainfall in San Mateo County.

Riverine Flooding: Isolated, low-impact events occur regularly, and the number of years between floods of any given severity varies significantly due to a naturally variable climate. The number of years between floods of any given severity significantly varies due to a naturally changing climate. According to the USGS, the recurrence interval is the probability that the given event will be equaled or exceeded in any given year, based on past occurrences.

The NFIP classifies floods through the use of recurrence intervals and probabilities of occurrence, as outlined in **Table 4-73**. According to the USGS, the recurrence interval is the probability that the given event will be equaled or exceeded in any given year, determined through statistical analysis of past water-level observations or detailed modeling.[212]

Table 4-73. Recurrence Intervals and Probabilities of Occurrences

Flood Recurrence Interval	Annual Exceedance Probability
2 years	50%
5 years	20%
10 years	10%
25 years	4%
50 Years	2%
100 years	1%
200 years	0.5%
500 years	0.2%

The frequency of flooding can be estimated from analyses of past streamflow or stage data. Flood frequency is now typically expressed as an Annual Exceedance Probability (AEP), which represents the estimated chance that a certain river streamflow or stage level will be equaled or exceeded in a given year. Although it is no longer as common, flood frequency is still sometimes expressed as an Average Recurrence Interval (ARI), which represents the average period of time between events of similar magnitude, calculated over a very long period. The ARI value equals 100 divided by AEP. ARI values are often confusing to the general public because people commonly misunderstand that the value predicts the subsequent flood of a specific magnitude. For example, it is possible for two (2) or more floods with

212 United States Geological Survey. (2018). The 100-Year Flood. Retrieved from https://www.usgs.gov/water-science-school/science/100-year-flood.

AEPs of 1% or lower to occur in a short period. The same flood event typically has different AEP/ARI values at different points along a river.

Probability of Occurrence		Probability Factor	Weighted Factor	Score
Medium	A significant hazard event is likely to occur within 25 years.	2	N/A	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology).				

Urban/Flash Flooding: The probability of urban/flash flooding depends on seasonal weather patterns and land conditions. Flash flooding is typically caused by inadequate drainage following heavy rainfall or rapid snowmelt. Urban areas tend to have a higher probability of flash flooding due to high impervious-surface coverage and higher population density, which may be affected by standing or flowing water. Another concern is when rainfall rates exceed the conveyance capacity of built infrastructure, such as municipal sewer systems (i.e., stormwater and/or sanitary sewers). For these reasons, it is more probable that flash flooding will occur within more urbanized areas.

Probability of Occurrence		Probability Factor	Weighted Factor	Score
High	A significant hazard event is likely to occur annually.	3	N/A	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology).				

FEMA NRI Annualized Frequency

The FEMA NRI defines inland flooding as when streams and rivers exceed the capacity of their natural or constructed channels to accommodate water flow, and water overflows the banks, spilling into adjacent low-lying, dry land (fluvial flooding), or when excessive rainfall overwhelms drainage systems, leading to surface water accumulation (pluvial flooding). Inland flooding can occur anywhere it rains, even if there are no nearby bodies of water.

The inland flooding annualized frequency value represents the number of inland flooding occurrences, in event days, per year over the period of record (26 years). A higher annualized frequency value results in higher EAL and Risk Index scores. **Table 4-74** outlines the annualized frequency for inland flooding, based on FEMA NRI data, for San Mateo County.

Table 4-74. Inland Flooding Annualized Frequency *(FEMA National Risk Index)*

Events on Record *(1996 – 2023)*	Annualized Frequency
39	1.39
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.	

Coastal Flooding: The probability of coastal flooding is based on storm surge height, which is the height of water accounting for waves.

Probability of Occurrence		Probability Factor	Weighted Factor	Score
Low	A significant hazard event is likely to occur within 100 years.	1	N/A	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology).				

FEMA NRI Annualized Frequency

The coastal flooding annualized frequency value represents the modeled frequency of a coastal flooding occurrence, in event days, per year. A higher annualized frequency value results in higher EAL and Risk Index scores. **Table 4-75** outlines the annualized frequency for coastal flooding, based on FEMA NRI data, for San Mateo County.

Table 4-75. Coastal Flooding Annualized Frequency *(FEMA National Risk Index)*

Events on Record *(1996 – 2023)*	Annualized Frequency
n/a	0.99
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.	

Repetitive Loss and Severe Repetitive Loss Properties

FEMA defines a Repetitive Loss property as an NFIP-insured property meeting at least one (1) of the following paid loss criteria since 1978, regardless of any changes in ownership:

- Four (4) or more separate claims payments greater than $5,000 each (including building and contents payment).
- Two (2) or more separate flood insurance claims payments (building payments only), where the total of the payments is greater than the property's current value.

Additionally, to receive a designation, at least two (2) of the claim payments must occur within 10 years of one another.[213]

A Severe Repetitive Loss property is defined by FEMA as any NFIP-insured single-family or multi-family residential building meeting at least one (1) of the following paid loss criteria since 1978 or from a building constructed after 1978, regardless of any changes in ownership:

- That has incurred flood-related damage for which four (4) or more separate claims payments have been made, with the amount of each claim (including building and contents payments) exceeding $5,000, and with the cumulative amount of such claims payments exceeding $20,000.
- For which at least two (2) separate claims payments (building payments only) have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the building.

[213] Federal Emergency Management Agency, National Flood Insurance Program. (2023). A Policyholder's Guide to Severe Repetitive Loss. Retrieved from https://agents.floodsmart.gov/sites/default/files/fema_nfip-policyholders-guide-severe-repetitive-loss_brochure_07-2023.pdf.

Additionally, to receive a designation, at least two (2) of the claims must be within 10 years of each other. Claims within 10 days of each other will be counted as one (1) claim.[214]

Table 4-76 summarizes FEMA Repetitive Loss and Severe Repetitive Loss properties in San Mateo County.[215]

Table 4-76. San Mateo County Repetitive Loss and Severe Repetitive Loss Properties

Jurisdiction	Total Repetitive Loss Properties	Total Severe Repetitive Loss Properties	Mitigated Repetitive Loss and Severe Repetitive Loss Properties
Unincorporated San Mateo County	5 *(**3** Single Family; **1** Non-Residential Business; **1** Single Family Residential Building)*	2 *(**1** Single Family Residential Building; **1** Non-Residential Business)*	0
Town of Atherton	0	0	0
City of Belmont	2 *(**1** More Than Four (4) Units Residential Building; **1** Non-Residential Building)*	0	0
City of Brisbane	0	0	0
City of Burlingame	2 *(**1** Non-Residential Building; **1** Residential Condo Association)*	0	0
Town of Colma	0	0	0
City of Daly City	3 *(**3** Two (2)-Four (4) Unit Residential Building)*	1 *(**1** Non-Residential Building)*	0
City of East Palo Alto	0	0	0
City of Foster City	2 *(**2** Single Family)*	0	0
City of Half Moon Bay	0	0	0
Town of Hillsborough	1 *(**1** Single Family Residential Building)*	0	0
City of Menlo Park	1 *(**1** Single Family)*	0	0
City of Millbrae	3 *(**2** Single Family Residential Building; **1** Non-Residential Building)*	1 *(**1** Single Family Residential Building)*	0
City of Pacifica	1 *(**1** Single Family)*	0	0
Town of Portola Valley	1 *(**1** Single Family)*	1 *(**1** Single Family)*	0

[214] Federal Emergency Management Agency, National Flood Insurance Program. (2021). National Flood Insurance Program: Flood Insurance Manual. Retrieved from https://www.fema.gov/sites/default/files/documents/fema_nfip-all-flood-insurance-manual-apr-2021.pdf.
[215] Federal Emergency Management Agency. (2026). OpenFEMA Dataset: NFIP Multiple Loss Properties - v1. Retrieved from https://www.fema.gov/openfema-data-page/nfip-multiple-loss-properties-v1.

Jurisdiction	Total Repetitive Loss Properties	Total Severe Repetitive Loss Properties	Mitigated Repetitive Loss and Severe Repetitive Loss Properties
City of Redwood City	3 *(**1** Single Family; **2** Single Family Residential Building)*	0	0
City of San Bruno	3 *(**1** Single Family; **1** Non-Residential Building; **1** Single Family Residential Building)*	0	0
City of San Carlos	2 *(**1** Single Family; **1** Non-Residential Building)*	0	0
City of San Mateo	2 *(**1** Single Family; **1** Two (2)-Four (4) Unit Residential Building)*	0	0
City of South San Francisco	10 *(**2** Non-Residential Building; **1** Non-Residential Business; **3** Single Family Residential Building; **1** Residential (2, 3, or 4 units) Non-Condo Building; **3** Non-Residential Building)*	1 (**1** Non-Residential Building)	0
Town of Woodside	0	0	0
Occupancy Type: *Single Family = Single family residence • Two (2)-Four (4) Unit Residential Building = Two (2)-four (4) unit residential building • More Than Four (4) Units Residential Building = Residential building with more than four (4) units • Non-Residential Building = Non-residential building • Non-Residential Business = Non-residential business • Single Family Residential Building = Single-family residential building with the exception of a mobile home or a single residential unit within a multi-unit building • Residential (2, 3, or 4 units) Non-Condo Building = Residential non-condo building with two (2), three (3), or four (4) units seeking insurance on all units • Residential (5 or more units) Non-Condo Building = Residential non-condo building with 5 or more units seeking insurance on all units • Residential Mobile/Manufactured Home = Residential mobile/manufactured home • Residential Condo Association = Residential condo association seeking coverage on a building with one (1) or more units • Single Residential Unit = Single residential unit within a multi-unit building • Non-Residential Mobile/manufactured Home = Non-residential mobile/manufactured home • Non-Residential Building = Non-residential building • Non-Residential Unit = Non-residential unit within a multi-unit building*			

Table 4-77 summarizes the NFIP active policies and coverage in force data for San Mateo County and its municipalities.

Table 4-77. San Mateo County NFIP Policies

Jurisdiction	Community ID	NFIP Policies	Insurance in Force	Total Claims Paid	Sum of Claims Paid
Unincorporated San Mateo County	060311	55	$19,784,000.00	26	$1,306,319.94
Town of Atherton	060312	9	$3,150,000.00	1	$0
City of Belmont	065016	15	$7,370,000.00	2	$0
City of Brisbane	060314	3	$1,500,000.00	1	$602.29
City of Burlingame	065019	123	$51,072,000.00	35	$2,105,071.86
Town of Colma	060316	1	$1,000,000.00	0	$0
City of Daly City	060317	2	$700,000.00	6	$44,690.91
City of East Palo Alto	060708	354	$113,925,000.00	7	$170,166.91

Jurisdiction	Community ID	NFIP Policies	Insurance in Force	Total Claims Paid	Sum of Claims Paid
City of Foster City	060318	27	$8,408,000.00	8	$173,223.06
City of Half Moon Bay	060319	32	$11,033,000.00	2	$4,826.64
Town of Hillsborough	060320	15	$4,729,000.00	5	$92,668.28
City of Menlo Park	060321	227	$64,327,000.00	5	$62,703.56
City of Millbrae	065045	77	$26,498,000.00	14	$159,205.04
City of Pacifica	060323	77	$23,162,000.00	16	$242,134.65
Town of Portola Valley	065052	9	$2,971,000.00	3	$32,095.96
City of Redwood City	060325	240	$96,418,000.00	49	$1,961,364.30
City of San Bruno	060326	124	$39,498,000.00	12	$206,360.27
City of San Carlos	060327	67	$31,085,000.00	18	$2,089,112.50
City of San Mateo	060328	146	$53,724,000.00	23	$607,426.02
City of South San Francisco	065062	88	$50,839,000.00	28	$1,130,186.54
Town of Woodside	060330	8	$2,654,000.00	3	$54,431.45
	Total	**1,699**	**$613,847,000.00**	**264**	**$10,442,590.18**

4.6.4.5. Past Events

Table 4-78 lists all flood, flash flood, and coastal flood events included in this analysis that have been recorded in San Mateo County, as reported by NCEI, between 1996 and 2025.

Table 4-78. Flood Past Events (1996 – 2025)

Event Type	Total Events	Total Deaths	Total Injuries	Total Property Damage	Total Crop Damage
Flood	37	0	0	$10.1 Million	$0
Flash Flood	12	1	0	$808,000	$0
Coastal Flood	5	0	0	$5,000	$0
Note: *Events listed in this table are based on impacts to an area (zone) of San Mateo County; as such, impacts to more than one area (zone) will result in multiple entries. When determining probability estimates, efforts were made to distinguish single events from events affecting multiple areas.*					

Table 4-79 summarizes a number of significant flooding events within San Mateo County.

Table 4-79. Significant Past Events (1996 – 2025)

Date	Description
December 31, 2022	An atmospheric river impacted the Bay Area on December 31st, resulting in significant rainfall. Initial forecasts called for the most intense rainband to move progressively southward towards the Central Coast as the day went on. However, the morning of the 31st, a surface low developed west of San Francisco, and the river stalled over the Bay Area. At 5:58 AM, the California Highway Patrol reported flash flooding on US Highway 101 at Oyster Point Road in the City of South San Francisco. By 10:58 AM, the entire roadway had flooded, and the Highway was closed. The flooding caused traffic backups and diversions, with Interstate 280 as the alternate route. The northbound lanes were reopened around 8:00 PM, and the southbound lanes around 9:00 PM. Some locations saw more than four (4) inches of rain in a single day. Heavy rainfall, high tides, inadequate maintenance of drainage infrastructure, and insufficient vegetation management combined to cause flooding in multiple areas, including the Belmont Mobile Home Park. Flooding from these storms displaced nearly 100 people, including many living in mobile homes in unincorporated areas of the County. The storms also toppled trees across San Mateo County and caused several mudslides.
January 16, 2020	A potent cold front swept through the region on January 16th, bringing widespread rain, gusty winds, low elevation snow, and thunderstorms. This system caused flooding on roadways, downed trees, small hail, and snow at elevations as low as 2,400 feet. Numerous flights were delayed or canceled at the San Francisco International Airport.
April 7, 2018	A late-season atmospheric river impacted the area in early April. A very moist air mass made landfall across the North Bay before moving southward across the rest of the Bay Area. The system produced enough rainfall to cause minor/nuisance flooding across much of the region. Numerous flood advisories were issued. Total rainfall amounts of up to seven (7) inches were reported.
March 1, 2018	An upper-level system with a strong cold front moved through the Bay Area. This system brought widespread rainfall, causing localized roadway flooding, strong winds, lightning, and small hail. Gusts in the mountains reached 60 mph, and hail was seen up to a half inch in diameter. The bulk of the precipitation and its subsequent impacts occurred in early March.
December 2015 – January 2016	In January 2016, El Niño brought more rainfall to the Bay Area in just two days than in the previous three (3) Januarys combined. Overall, San Mateo County largely avoided serious damage and flooding from these storms. La Honda recorded the highest rainfall in the County at 1.5 inches. Aside from some debris, power outages, and transportation accidents, no major issues were reported within the County. City response teams actively monitored debris buildup to help prevent potential problems. To reduce flooding impacts, the San Mateo County Department of Public Works and local cities established two (2) dozen sites where residents could collect free sandbags.
February 6, 2015	A strong winter storm impacted California after nearly a month and a half without rainfall and the driest January on record. The storm brought heavy rainfall, gusty winds, and damage to trees and power lines, along with some minor flooding of urban areas. Rainfall was heaviest in the mountains, with amounts between five (5) and inches. Heavy rainfall resulted in flooding of the southbound US Highway 101 off-ramp in the Town of Atherton.

Date	Description
January 20, 2010	A significant storm brought strong winds and heavy rainfall to the San Francisco and Monterey Bay areas. This storm developed over the Pacific Ocean with a strong parent low pressure system based in the Gulf of Alaska. Flooding occurred, mainly affecting vehicles. Heavy rainfall caused Pulgas Creek to overflow its banks, flooding some classrooms at Central Middle School in the City of San Carlos. Also, several streets were blocked off in low-lying areas just west of US Highway 101, including Taylor Avenue in the City of San Carlos and parts of Rolison Road in Redwood City. In the Town of Atherton, officials closed March Road from Middlefield Road to Fair Oaks Avenue because a creek had begun to overflow. Furthermore, heavy rainfall caused Harbor Boulevard under the State Route 82 overpass to flood, submerging a vehicle to the base of its windows. The road was barricaded to stop anyone else from driving into the floodwaters. Belmont Creek flooding forced the evacuation of a car repair business after three (3) inches of water covered the floor.
December 31, 2025	Widespread flooding occurred throughout San Mateo County due to small stream overflows and poor drainage. Most damage occurred in the City of East Palo Alto, the City of San Mateo, Daly City, the Town of Colma, the City of Brisbane, the City of San Bruno, the City of South San Francisco, and the City of Pacifica. Approximately three (3) inches of rainfall were recorded over a 24-hour period. The flooding continued into the first few days of January 2006. Property damage of $5 million was reported.
February 14, 2000	Widespread rainfall with 24-hour accumulations of more than five (5) inches occurred over the area from February 13th to February 14th. Urban and small-stream flooding occurred in most counties in the area, including San Mateo. A number of houses in Daly City had to be evacuated and eventually destroyed due to mudslides caused by consecutive years of above-average rainfall.
February 3, 1997	A levee breached along a dry creek bed, Arroyo Mocha. The breach caused damage to roads and property and resulted in one (1) death. Cascading effects caused flash flooding along San Francisquito Creek and Pescadero Creek.
January 1, 1997	Southwest portions of San Mateo County recorded heavy rainfall of approximately 0.5 inches per hour for several hours. Ground saturation prevented rainfall absorption. Pescadero Creek reached flood stage by late morning. By 10:00 AM, La Honda Road was closed due to ground saturation and a resulting mudslide. Additionally, Butano Creek flooded, closing Pescadero Road.
December 10, 1996	Widespread urban flooding was reported throughout the County, leaving US Highway 101 underwater.

4.6.4.6. Vulnerability

Population Exposed

Riverine Flooding: 14% or less of the population in San Mateo County is exposed to riverine flooding. The population most vulnerable to riverine flooding is those who are within the floodplain. In San Mateo County, populations on the Pacific Coast are particularly vulnerable to flooding, and areas along the Bay may see flooding farther inland, all the way to Bayshore Freeway to the west and Interstate 880 to the east.[216] Additionally, the underserved populations that are uniquely vulnerable to riverine flooding include, but are not limited to, low-income individuals, the elderly, children, and those with access and functional needs.

[216] San Mateo County. (2025). 2023-2031 Housing Element of the General Plan. Retrieved from https://www.smcgov.org/planning/san-mateo-county-housing-element-update.

Population Exposure		Vulnerability Factor	Weighted Factor	Score
Low	14% or less of the population is exposed to the hazard.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population Exposure Score = Extent Factor x Weighted Factor***				

Urban/Flash Flooding: 30% or more of the population in San Mateo County is exposed to urban/flash flooding. The population in densely populated areas is most vulnerable to urban/flash flooding due to the prevalence of impermeable surfaces (e.g., concrete, asphalt), which prevent water from seeping into the ground and exacerbate rainwater runoff. Additionally, older communities developed before modern stormwater regulations were implemented are vulnerable due to inadequate stormwater management capacity. The underserved populations that are uniquely vulnerable to riverine flooding include, but are not limited to, low-income individuals, the elderly, children, and those with access and functional needs. **Table 4-80** summarizes the underserved population in San Mateo County.

Table 4-80. Underserved Population in San Mateo County

Category	Estimate	Percent
Population Below Poverty Level[217]	49,359	6.7%
Income Below $25,000 (Households)[218]	18,773	7.1%
Spanish Spoken at Home[219]	124,233	17.6%
Speak English Less Than "Very well"[220]	120,715	17.1%
Language Other Than English[221]	322,325	45.8%
Foreign Born[222]	265,258	35.7%
Household Without a Vehicle[223]	11,869	3.1%
65 Years and Over[224]	132,242	17.8%
Senior (65 Years and Over) Living Alone[225]	8,355	3.2%

[217] United States Census Bureau. (2024). S1701: Poverty Status in the Past 12 Months (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S1701?g=050XX00US06081.
[218] United States Census Bureau. (2024). S1901: Income in the Past 12 Months (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S1901?g=050XX00US06081.
[219] United States Census Bureau. (2024). S1601: Language Spoken at Home (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S1601?g=050XX00US06081.
[220] Ibid.
[221] Ibid.
[222] United States Census Bureau. (2024). DP02: Selected Social Characteristics in the United States (2024: ACS 5-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP5Y2024.DP02?g=050XX00US06081.
[223] United States Census Bureau. (2024). S0801: Commuting Characteristics by Sex (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S0801?g=050XX00US06081.
[224] United States Census Bureau. (2024). DP05: ACS Demographics and Housing Estimates (2024: ACS 5-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP5Y2024.DP05?g=050XX00US06081.
[225] United States Census Bureau. (2024). DP02: Selected Social Characteristics in the United States (2024: ACS 5-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP5Y2024.DP02?g=050XX00US06081.

Population Exposure		Vulnerability Factor	Weighted Factor	Score
High	30% or more of the population is exposed to the hazard.	3	3	9
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population Exposure Score = Extent Factor x Weighted Factor***				

Coastal Flooding: 14% or less of the population in San Mateo County is exposed to coastal flooding. Coastal flooding exposure is predominantly concentrated along the shoreline, including low-lying coastal areas on both coasts. The low-lying areas along the Bay shoreline are highly urbanized. The underserved populations that are uniquely vulnerable to coastal flooding include, but are not limited to, low-income individuals, the elderly, children, and those with access and functional needs living in coastal areas of the County.

Population Exposure		Vulnerability Factor	Weighted Factor	Score
Low	14% or less of the population is exposed to the hazard.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population Exposure Score = Extent Factor x Weighted Factor***				

Property Exposed

Any property located in areas on the Pacific Coast is particularly vulnerable to flooding, and property along the Bay may experience flooding farther inland, all the way to Bayshore Freeway to the west and Interstate 880 to the east.

Toxic Release Inventory Reporting Facilities: Toxic Release Inventory (TRI) facilities are known to manufacture, process, store, or otherwise use certain chemicals above minimum thresholds. If damaged by a flood, these facilities could release chemicals that cause cancer or other human health effects, significant adverse acute human health effects, or significant adverse environmental effects.[226] During a flood event, containers holding these materials can rupture and leak into the surrounding area, causing disastrous environmental and community impacts. In San Mateo County, one (1) facility within the 100-year floodplain is a TRI reporting facility.

Roads: The following major roads within San Mateo County pass through the 100-year floodplain, making them more vulnerable to flooding. Although these roads are built above flood levels and other structures, such as levees, are in place to reduce flooding, they can still be vulnerable during severe flood events. Such events may render them impassable, blocking access to affected areas.

- State Highway 1
- State Highway 82
- State Highway 84
- State Highway 92
- State Highway 109
- State Highway 114
- US Highway 101
- Intestate 380

[226] United States Environmental Protection Agency. (2025). What is the Toxics Release Inventory? Retrieved from https://www.epa.gov/toxics-release-inventory-tri-program/what-toxics-release-inventory.

Bridges: Flooding events can significantly impact road bridges, which are important because many provide the only ingress and egress to some neighborhoods. In San Mateo County, there are approximately 62 bridges that are within or pass through the 100-year floodplain.

Water and Sewer Infrastructure: Water and sewer systems can be affected by flooding. Floodwater can back up drainage systems, causing localized flooding. Culverts can be blocked by debris from flood events, which can also trigger localized urban flooding. Floodwaters can enter and thus contaminate drinking water supplies. Sewer systems can back up, spilling wastewater into homes, neighborhoods, rivers, and streams.

Levees: Historically, levees have been used to control flooding in portions of San Mateo County. Levees within the County were built for flood protection (in the north and central portions of the County) and for salt evaporation ponds (in the southeast portion of the County). The County does not believe these levees could withstand the intensities of a 1% annual flood event. Additionally, coastal flooding from San Francisco Bay circumvents levees near the Bay, leading to flooding within the residential area next to San Francisquito Creek on the east side of the City. These vulnerability estimates are based on current flood levels and do not account for potential sea level rise, which would exacerbate vulnerability and further reduce the levees' ability to prevent/control flooding. According to the USACE National Levee Database, there are 33 levee systems in San Mateo County, listed in **Table 4-81**.[227]

Levee failures could place large numbers of people and substantial property at risk. Unlike dams, levees do not serve any purpose beyond providing flood protection and (less frequently) recreational space for the community. A levee failure could be devastating, depending on the severity of flooding and the extent of land development. In addition to damaging buildings, infrastructure, trees, and other large objects, levee failure can also lead to significant water-quality and debris-disposal issues. Severe erosion is also a consideration.

Table 4-81. Levee Systems in San Mateo County

Name	System ID	Operation/ Maintenance Organization	Location	Flooding Source	Behind Levee
Marina Lagoon	1905003037	Not Available	City of Foster City	San Francisco Bay	**16,772** Buildings **76,332** People **$18 Billion** Property Value **8.2 acres** of Farmland **0** Endangered Species **30** Critical Structures
San Mateo County Levee 3	1905003042	City of San Mateo	City of San Mateo	San Mateo Creek	**41** Buildings **444** People **$60 Million** Property Value **0 acres** of Farmland **0** Endangered Species **0** Critical Structures

227 United States Army Corps of Engineers. (n.d.). National Levee Database. Retrieved from https://levees.sec.usace.army.mil/.

Name	System ID	Operation/ Maintenance Organization	Location	Flooding Source	Behind Levee
San Mateo County Levee 9	1905003051	Not Available	City of Menlo Park	San Francisco Bay	**0** Buildings **0** People **$0** Property Value **0.7 acres** of Farmland **1** Endangered Species **0** Critical Structures
San Mateo County Levee 15	1905003252	Not Available	City of Menlo Park	Unnamed	**2** Buildings **3,642** People **$570 Million** Property Value **0 acres** of Farmland **0** Endangered Species **0** Critical Structures
San Mateo County Levee 15	1905003171	Not Available	City of Foster City	Belmont Slough	**0** Buildings **0** People **$0** Property Value **0 acres** of Farmland **0** Endangered Species **0** Critical Structures
San Mateo County Levee 25	1905003089	Not Available	Redwood City	Unnamed	**0** Buildings **0** People **$0** Property Value **5.3 acres** of Farmland **0** Endangered Species **0** Critical Structures
San Mateo County Levee 26	1905003260	Not Available	City of Menlo Park	Unnamed	**1** Buildings **1** People **$13 Million** Property Value **2.4 acres** of Farmland **1** Endangered Species **1** Critical Structures
San Mateo County Levee 28	1905003189	Not Available	Redwood City	Unnamed	**19** Buildings **164** People **$99 Million** Property Value **0 acres** of Farmland **0** Endangered Species **30** Critical Structures
San Mateo County Levee 32	1905003070	City of Foster City	Redwood City	Unnamed	**0** Buildings **0** People **$0** Property Value **33.6 acres** of Farmland **0** Endangered Species **0** Critical Structures
San Mateo County Levee 35	1905003111	Not Available	City of Menlo Park	Unnamed	**3** Buildings **6,916** People **$13 Million** Property Value **78.7 acres** of Farmland **0** Endangered Species **1** Critical Structures

Name	System ID	Operation/ Maintenance Organization	Location	Flooding Source	Behind Levee
San Mateo County Levee 36	1905003092	Not Available	Redwood City	Steinberger Slough	**0** Buildings **0** People **$0** Property Value **4.2 acres** of Farmland **0** Endangered Species **0** Critical Structures
San Mateo County Levee 37	1905003257	Not Available	City of Menlo Park	San Francisco Bay	**0** Buildings **0** People **$0** Property Value **4.2 acres** of Farmland **0** Endangered Species **0** Critical Structures
San Mateo County Levee 38	1905003121	Not Available	Redwood City	Corkscrew Slough	**0** Buildings **0** People **$0** Property Value **0.4 acres** of Farmland **0** Endangered Species **0** Critical Structures
San Mateo County Levee 39	1905003122	Not Available	Redwood City	Unnamed	**0** Buildings **0** People **$0** Property Value **2.9 acres** of Farmland **0** Endangered Species **0** Critical Structures
San Mateo County Levee 40	1905003109	Not Available	Redwood City	Redwood Creek	**0** Buildings **0** People **$0** Property Value **0 acres** of Farmland **0** Endangered Species **0** Critical Structures
San Mateo County Levee 42	1905003261	Not Available	City of Menlo Park	Ravenswood Slough	**0** Buildings **0** People **$0** Property Value **2.0 acres** of Farmland **0** Endangered Species **1** Critical Structures
San Mateo County Levee 46	1905003106	Not Available	Redwood City	Unnamed	**8** Buildings **1,020** People **$77 Million** Property Value **0 acres** of Farmland **0** Endangered Species **0** Critical Structures
San Mateo County Levee 50	1905003046	Not Available	Redwood City	San Francisco Bay	**1** Buildings **3** People **$2 Million** Property Value **17.1 acres** of Farmland **0** Endangered Species **0** Critical Structures

Name	System ID	Operation/ Maintenance Organization	Location	Flooding Source	Behind Levee
San Mateo County Levee 52	1905003168	Nikon Ventures Corp.	City of Belmont	Belmont Creek	**14** Buildings **0** People **$140 Million** Property Value **0 acres** of Farmland **0** Endangered Species **1** Critical Structures
San Mateo County Levee 53	1905003034	Not Available	Redwood City	San Francisco Bay	**0** Buildings **0** People **$0** Property Value **6.0 acres** of Farmland **0** Endangered Species **0** Critical Structures
San Mateo County Levee 54	1905003091	Not Available	Redwood City	Unnamed	**0** Buildings **0** People **$0** Property Value **0 acres** of Farmland **0** Endangered Species **0** Critical Structures
San Mateo County Levee 55	1905003120	Not Available	Redwood City	Unnamed	**0** Buildings **0** People **$0** Property Value **1.1 acres** of Farmland **0** Endangered Species **0** Critical Structures
San Mateo County Levee 56	1905003107	Redwood City	Redwood City	Unknown	**3,215** Buildings **24,251** People **$4 Billion** Property Value **8.5 acres** of Farmland **0** Endangered Species **13** Critical Structures
San Mateo County Levee 58	1905003255	Not Available	City of Menlo Park	Unnamed	**0** Buildings **0** People **$0** Property Value **0.7 acres** of Farmland **1** Endangered Species **0** Critical Structures
San Mateo County Levee 61	1905003145	Not Available	City of South San Francisco	San Francisco Bay	**1** Buildings **46** People **$24 Million** Property Value **0 acres** of Farmland **0** Endangered Species **0** Critical Structures
San Mateo County Levee 62	1905012019	Not Available	City of East Palo Alto	San Francisquito Creek	**2,249** Buildings **12,615** People **$1 Billion** Property Value **0 acres** of Farmland **0** Endangered Species **5** Critical Structures

Name	System ID	Operation/ Maintenance Organization	Location	Flooding Source	Behind Levee
San Mateo County Levee 63	1905003247	Not Available	Redwood City	Unnamed	**0** Buildings **0** People **$0** Property Value **13.3 acres** of Farmland **0** Endangered Species **0** Critical Structures
San Mateo County Levee 64	1905003243	Not Available	Redwood City	Unnamed	**1** Buildings **8** People **$3 Million** Property Value **0 acres** of Farmland **0** Endangered Species **0** Critical Structures
San Mateo County Levee 65	1905003206	Not Available	City of San Mateo	San Francisco Bay	**1,288** Buildings **6,086** People **$840 Million** Property Value **3.1 acres** of Farmland **0** Endangered Species **2** Critical Structures
San Mateo County Levee 66	1905003240	Not Available	Redwood City	San Pedro Creek	**0** Buildings **0** People **$0** Property Value **3.1 acres** of Farmland **0** Endangered Species **0** Critical Structures
San Mateo County Levee 68	1905003241	Not Available	Redwood City	Unnamed	**0** Buildings **0** People **$0** Property Value **2.2 acres** of Farmland **0** Endangered Species **0** Critical Structures
San Mateo County Levee 72	1905003148	Not Available	Pescadero	Pescadero Creek	**0** Buildings **0** People **$0** Property Value **3.1 acres** of Farmland **1** Endangered Species **0** Critical Structures
Santa Clara County Levee 3	1905012131	Santa Clara Valley Water District	City of East Palo Alto	Mayfield Slough	**5,417** Buildings **17,094** People **$3 Billion** Property Value **14.5 acres** of Farmland **0** Endangered Species **15** Critical Structures

Further details on each levee within San Mateo County can be found in the USACE's National Levee Database. The Database captures all known levees in the United States and allows users to search for specific levee data. Data available includes the location of levees, maps, a general text description of the levee system (i.e., a summary of why the levee is there, and the benefits it provides), performance and condition, people and assets behind the levee, and the responsible entity, among other information. The Database serves as a national resource to raise awareness and build preparedness for flooding.

Manufactured Homes: The Department of Housing and Urban Development defines manufactured homes as movable dwellings, eight (8) feet or wider and 40 feet or more long, designed to be towed on its own chassis, with transportation gear integral to the unit when it leaves the factory, and without the need for a permanent foundation. Manufactured homes include multi-wide and expandable manufactured homes, but excluding travel trailers, motorhomes, and modular housing. Due to their lightweight and often unanchored design, manufactured housing is extremely vulnerable to flooding and will generally sustain the most damage.

Manufactured homes provide affordable housing for some of the most underserved populations. Compared to other housing types, residents of manufactured homes tend to have a higher rate of poverty, have disabilities or mobility limitations, be seniors or families with young children, and include a higher proportion of immigrants. As a result, this population is highly vulnerable during floods and more likely to experience significant impacts, including displacement, loss of shelter, and limited access to recovery resources.[228] In San Mateo County, approximately 1.2% of the occupied housing units are manufactured homes.[229]

Riverine Flooding: 10% to 24% of the total assessed property, infrastructure, and resources value is exposed to riverine flooding in San Mateo County. Any property and infrastructure (e.g., major roads, transportation systems, utilities) that is located within the floodplain is vulnerable to riverine flooding. Building exposure to a 100-year flood scenario analysis was estimated by Hazus. In addition, annualized losses were calculated. Hazus estimates that there are 203,314 buildings in the region with an aggregate replacement value (excluding contents) of $155.4 billion. **Table 4-82** and **Table 4-83** summarize the relative distribution of the value with respect to the general occupancies by the County (i.e., study region) and scenario, respectively.

Table 4-82. Building Exposure by Occupancy Type for San Mateo County

Occupancy	Exposure	Percent of Total
Residential	$110,367,218,000	71.0%
Commercial	$27,536,437,000	17.7%
Industrial	$9,355,404,000	6.0%
Agricultural	$493,281,000	0.3%
Religion	$1,535,559,000	1.0%
Government	$1,072,841,000	0.7%
Education	$4,997,591,000	3.2%
Total	**$155,358,331,000**	**100%**

228 Headwaters Economics. (2022). Mobile Home Residents Face Higher Flood Risk. Retrieved from https://headwaterseconomics.org/natural-hazards/mobile-home-flood-risk/.
229 United States Census Bureau. (2024). S2504: Physical Housing Characteristics for Occupied Housing Units (2023: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S2504?q=San%20Mateo%20County,%20California&g=050XX00US17031.

Table 4-83. Building Exposure by Occupancy for the Scenario

Occupancy	Exposure	Percent of Total
Residential	$6,983,093,000	48.4%
Commercial	$4,587,168,000	31.8%
Industrial	$2,062,176,000	14.3%
Agricultural	$148,989,000	1.0%
Religion	$165,226,000	1.1%
Government	$142,899,000	1.0%
Education	$325,512,000	2.3%
Total	**$14,415,063,000**	**100%**

Table 4-84 provides a general distribution of building values in San Mateo County.

Table 4-84. San Mateo County Population and Building Value Data

Population	Residential Building Value	Non-Residential Building Value	Total
763,661	$110,367,218,000	$44,991,113,000	$155,358,331,000

Property Exposure		Vulnerability Factor	Weighted Factor	Score
Medium	10% to 24% of the total assessed property value is exposed to a hazard.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property Exposure Score = Extent Factor x Weighted Factor***				

Urban/Flash Flooding: 25% or more of the total assessed property, infrastructure, and resources value is exposed to urban/flash flooding in San Mateo County. In particular, properties and infrastructure in older, densely populated communities developed before modern stormwater regulations were implemented are vulnerable to urban/flash flooding due to inadequate stormwater management capacity.

Property Exposure		Vulnerability Factor	Weighted Factor	Score
High	25% or more of the total assessed property value is exposed to the hazard.	3	1	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property Exposure Score = Extent Factor x Weighted Factor***				

Coastal Flooding: 9% or less of the total assessed property, infrastructure, and resources value is exposed to coastal flooding in San Mateo County. Exposure to coastal flooding for property and infrastructure is predominantly concentrated along the shoreline.

Property Exposure		Vulnerability Factor	Weighted Factor	Score
Low	9% or less of the total assessed property value is exposed to a hazard.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property Exposure Score = Extent Factor x Weighted Factor***				

Changes in Development

Information on changes in development within San Mateo County is provided in **Chapter 3** (Community Profile) of this Assessment.

Riverine Flooding: The changes in development have increased San Mateo County's exposure to riverine flooding by 4% or less. The vulnerability associated with riverine flooding is directly related to development within the riverine floodplain (i.e., SFHA). However, San Mateo County has implemented existing floodplain and construction regulations to help reduce the impacts of flooding. For example, design regulations ensure that streams and other natural drainage systems are not altered in ways that affect their character and thereby cause drainage, erosion, or flooding problems, and that structures are located outside flood zones, drainage channels, and other areas subject to inundation.[230]

Changes in Development		Vulnerability Factor	Weighted Factor	Score
Low	Changes in development have increased the community's exposure to the hazard by 4% or less.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Changes in Development Score = Extent Factor x Weighted Factor***				

Urban/Flash Flooding: The changes in development have increased San Mateo County's exposure to urban/flash flooding between 5% and 9%. San Mateo County and its municipalities actively pursue various strategies to mitigate the impacts of urban/flash flooding, including installing and improving local stormwater drainage systems, implementing low-impact development techniques, requiring stormwater treatment for new development and redevelopment projects, and encouraging nature-based infrastructure.

Changes in Development		Vulnerability Factor	Weighted Factor	Score
Medium	Changes in development have increased the community's exposure to the hazard between 5% and 9%.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Changes in Development Score = Extent Factor x Weighted Factor***				

Coastal Flooding: The changes in development have increased San Mateo County's exposure to coastal flooding by 4% or less. The vulnerability to coastal flooding is directly related to development along the coastline. However, San Mateo County has implemented existing floodplain and construction regulations to help reduce the impacts of coastal flooding.

230 San Mateo County. (2025). 2023-2031 Housing Element of the General Plan. Retrieved from https://www.smcgov.org/planning/san-mateo-county-housing-element-update.

Changes in Development		Vulnerability Factor	Weighted Factor	Score
Low	Changes in development have increased the community's exposure to the hazard by 4% or less.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Changes in Development Score = Extent Factor x Weighted Factor***				

4.6.4.7. Impacts

Population and Life Safety

Most deaths during a flood (i.e., riverine, urban/flash flood, coastal flooding) occur when vehicles are driven into hazardous floodwater. Vehicles trying to drive through flooded areas or standing water can be quickly swept away by 12 to 18 inches of moving water, placing occupants at a high risk of drowning. Additionally, floodwater and standing water have many hazards that can be hidden below the flooded areas; these can include, but are not limited to, downed power lines, hazardous waste, sewage, germs and contaminants, physical objects (e.g., debris, sharp objects), and wild or stray animals (e.g., rodents and snakes). Exposure to these hazards can result in wound infections, skin rashes, gastrointestinal illnesses, and tetanus, among other complications.[231] After flooding events, excess moisture and standing water can contribute to mold growth in buildings. Mold may pose a health risk to building occupants, particularly those with pre-existing compromised immune systems (e.g., infants, children, the elderly, and pregnant women).

Common public health risks associated with flood events also include:

- **Unsafe Food:** Floodwaters carry disease-causing bacteria, dirt, oil, human and animal waste, as well as chemicals from farms and industries. When these waters come into contact with food, including crops in agricultural areas, they can render the food unsafe. Refrigerated and frozen foods are also vulnerable during power outages caused by flooding. Additionally, foods stored in cardboard, plastic bags, jars, bottles, or paper packaging may become contaminated with mold.
- **Contaminated Drinking and Washing Water, and Poor Sanitation:** Flooding contaminates clean water sources with pollutants, which can also saturate the groundwater. Flooded wastewater treatment plants may become overwhelmed, leading to raw sewage backflows. Private wells are at risk of contamination from floodwater, and private sewage disposal systems can overflow, increasing the risk of infection.
- **Mosquitoes and Animals:** Floods provide new breeding grounds for mosquitoes in wet areas and stagnant pools. The public should dispose of dead animals that can carry viruses and diseases only in accordance with guidelines issued by local animal control authorities. Leptospirosis, a bacterial disease predominantly associated with rats, often accompanies floods in developing countries, although the risk is low in industrialized regions unless cuts or wounds come into direct contact with contaminated floodwaters or contaminated animal waste.
- **Mold and Mildew:** Excessive exposure to mold and mildew can cause flood victims, especially those with allergies and asthma, to contract upper respiratory diseases, triggering cold-like symptoms. Mold can grow within 24 to 48 hours in wet, damp areas of buildings and homes that

[231] Centers for Disease Control and Prevention. (2024). Safety Guidelines: Floodwater. Retrieved from https://www.cdc.gov/floods/safety/floodwater-after-a-disaster-or-emergency-safety.html.

have not been properly cleaned after flooding (e.g., water-infiltrated walls, floors, carpets, toilets, and bathrooms). Very small mold spores can be easily inhaled by humans and, in sufficient quantities, can cause allergic reactions, asthma episodes, and other respiratory problems. Infants, children, seniors, and pregnant women are considered most susceptible to mold-induced health problems.

- **Carbon Monoxide Poisoning:** In the event of power outages following floods, some people use alternative fuels (e.g., small gasoline engines, stoves, generators, lanterns, gas ranges, charcoal, wood) for heating or cooking in enclosed or partly enclosed spaces. Built-up carbon monoxide from these sources can poison people and animals.
- **Reentering and Cleaning Flooded Homes and Buildings:** Flooded buildings can pose significant health hazards to people entering them. Electrical power systems can become hazardous, and gas leaks can trigger fire and explosions. Flood debris (e.g., broken bottles, wood, stones, walls) may cause injuries to those cleaning damaged buildings. Additionally, containers of hazardous chemicals may be buried under flood debris. Hazardous dust and mold can circulate through a building and be inhaled by those engaged in cleanup and restoration.
- **Mental Stress and Fatigue:** People who live through a devastating flood can experience long-term psychological impact. The expense and effort required to repair flood-damaged homes impose severe financial and psychological burdens on affected individuals. Post-flood recovery can cause anxiety, anger, depression, lethargy, hyperactivity, and sleeplessness. There is also a long-term concern among the affected that their homes could flood again.

Hazus estimated the number of households expected to be displaced by the flood scenario and the number of displaced people who would require accommodation in temporary public shelters. The model estimates 8,833 households (or 26,498 people) will be displaced due to the flood scenario. Displacement includes households evacuated from within or very near the inundated area. Of these, 1,514 people (out of a total population of 763,661) will seek temporary shelter in public shelters.

Riverine Flooding: A population that is exposed to riverine flooding is likely to experience some adverse impacts (e.g., injuries requiring acute medical care). The total number of injuries and casualties resulting from typical riverine flooding is generally preventable based on advanced weather forecasting, watches, and warnings. Injuries and deaths are typically avoidable when proper warnings and precautions are taken.

Population and Life Safety Impact		Impact Factor	Weighted Factor	Score
Medium	Populations exposed to this hazard are likely to experience some adverse impacts, such as injuries requiring acute medical care.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population and Life Safety Impact Score = Impact Factor x Weighted Factor***				

Urban/Flash Flooding: A population that is exposed to urban/flash flooding is likely to experience some adverse impacts (e.g., injuries requiring acute medical care). Urban/flash flooding presents unique challenges to population and life safety due to the short time between warning and onset, which limits emergency services' time to implement protective actions (e.g., evacuations). This increases the potential impacts from an urban/flash flood event.

Population and Life Safety Impact		Impact Factor	Weighted Factor	Score
Medium	Populations exposed to this hazard are likely to experience some adverse impacts, such as injuries requiring acute medical care.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population and Life Safety Impact Score = Impact Factor x Weighted Factor***				

Coastal Flooding: A population that is exposed to coastal flooding is likely to experience minimal adverse impacts (e.g., ambulatory injuries). The potential for injuries and deaths is typically not anticipated if proper warning and precautions are taken.

Population and Life Safety Impact		Impact Factor	Weighted Factor	Score
Low	Populations exposed to this hazard are likely to experience minimal adverse impacts, such as ambulatory injuries.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population and Life Safety Impact Score = Impact Factor x Weighted Factor***				

Underserved Population

The underserved population faces unique impacts as a result of flooding (i.e., riverine, urban/flash flooding, coastal flooding). These groups include, but are not limited to, the low-income population, population living on single access roads, people with limited English proficiency, individuals without access to lifelines, those with access and functional needs, the elderly, and undocumented individuals. The underserved population is more likely to live in low-lying areas, which are more prone to flooding, and less likely to have flood insurance. Furthermore, this population often has fewer financial resources to prepare for, respond to, and recover from flooding. Flood events can displace residents from their homes, disrupting communities and increasing social and economic hardships. The recovery and rebuilding process may take longer in these areas due to limited resources. The elderly and individuals with access and functional needs are more likely to require medical attention, which may not be readily available due to isolation during a flood, and they may have greater difficulty evacuating.[232] Additionally, individuals without adequate warning of the event (i.e., limited access to modern communications) may be unable to receive watches and warnings promptly, leading to delayed or inadequate action.

Riverine Flooding: The underserved population exposed to riverine flooding in San Mateo County is likely to experience significant adverse/disproportionate impacts (e.g., fatalities and severe injuries).

[232] United States Environmental Protection Agency. (2021). Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts. Retrieved from https://www.epa.gov/cira/social-vulnerability-report.

Underserved Population Impact		Impact Factor	Weighted Factor	Score
High	Underserved populations exposed to the hazard are likely to experience significant adverse/disproportionate impacts, such as fatalities and severe injuries.	3	3	9
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Underserved Population Impact Score = Impact Factor x Weighted Factor***				

Urban/Flash Flooding: The underserved population exposed to urban/flash flooding in San Mateo County is likely to experience significant adverse/disproportionate impacts (e.g., fatalities and severe injuries).

Underserved Population Impact		Impact Factor	Weighted Factor	Score
High	Underserved populations exposed to the hazard are likely to experience significant adverse/disproportionate impacts, such as fatalities and severe injuries.	3	3	9
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Underserved Population Impact Score = Impact Factor x Weighted Factor***				

Coastal Flooding: The underserved population exposed to coastal flooding in San Mateo County is likely to experience some adverse/disproportionate impacts (e.g., injuries requiring acute medical care). Low-income households near the coastline face unique impacts due to limited resources for coastal adaptation measures or relocation.

Underserved Population Impact		Impact Factor	Weighted Factor	Score
Medium	Underserved populations exposed to the hazard are likely to experience some adverse/disproportionate impacts, such as injuries requiring acute medical care.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Underserved Population Impact Score = Impact Factor x Weighted Factor***				

Property, Facilities, and Critical Infrastructure

Flooding (i.e., riverine, urban/flash, and coastal) can affect agricultural, residential, and commercial areas, resulting in structural damage to homes and businesses, damage to electrical systems, destruction of personal belongings, and mold growth. Critical infrastructure designed and built within the 100-year floodplain will also be impacted. Basements (or any part of a structure that is below-grade) are the most vulnerable parts of a structure during a flood event. If the exterior walls of a basement collapse due to external water pressure, the basement will flood immediately. Additionally, any buried infrastructure (e.g., pipelines) can be affected by changes in soil conditions, erosion, and debris. Flooding of major roads and railways can significantly disrupt transportation systems, but the force of floodwater can also cause physical damage to roads and bridges. Water and wastewater treatment plants are often located near water sources and are therefore likely to be affected and temporarily out of operation. Damaged facilities within the 100-year floodplain using hazardous materials may also release toxic chemicals into the community.

Blocked or damaged roads can isolate communities and hinder access within the planning area, affecting emergency services' ability to reach vulnerable populations or carry out necessary repairs. Flood or debris-impacted bridges can also cause isolation. Underground utilities may be damaged, and levees might fail or be overtopped, leading to flooding of protected lands. Floodwater can cause drainage system backups, resulting in localized flooding, while debris-blocked culverts can increase urban flood risk. Additionally, floodwaters may contaminate drinking water supplies, and sewer system backups can cause wastewater spills into homes, neighborhoods, rivers, and streams.

Hazus estimates that about 115 buildings will be at least moderately damaged, which is over 50% of the total number of buildings in the scenario. An estimated 44 buildings will be completely destroyed. **Table 4-85** summarizes the expected damage by general occupancy for the buildings in the County.

Table 4-85. Expected Building Damage by Occupancy

Building Occupancy	1 – 10		11 – 20		21 – 30		31 – 40		41 – 50		>50	
	Count	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*
Agriculture	0	0	6	75	1	13	0	0	0	0	1	13
Commercial	60	38	84	53	12	8	2	1	0	0	0	0
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	36	43	42	50	4	5	2	2	0	0	0	0
Religion	1	25	3	75	0	0	0	0	0	0	0	0
Residential	586	28	901	42	343	16	206	10	62	3	31	1
Total	**683**	**-**	**1,036**	**-**	**360**	**-**	**210**	**-**	**62**	**-**	**32**	**-**

Table 4-86 summarizes the expected damage by general building type.

Table 4-86. Expected Building Damage by Building Type

Building Occupancy	1 – 10		11 – 20		21 – 30		31 – 40		41 – 50		>50	
	Count	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*
Concrete	48	49	46	47	3	3	1	1	0	0	0	0
Manufacturing Housing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	21	48	21	48	2	5	0	0	0	0	0	0
Steel	20	43	26	57	0	0	0	0	0	0	0	0
Wood	585	27	903	42	341	16	207	10	61	3	31	1

For essential facilities, there are 14 hospitals in the County with a total bed capacity of 2,496 beds. There are 261 schools, 60 fire stations, 28 police stations, and eight (8) emergency operation centers. The Hazus model estimates the time to restore critical facilities to fully functional use. Before the flood was analyzed in this scenario, San Mateo County had 2,496 hospital beds available for use. On the day of the scenario flood event, Hazus estimates that 2,436 hospital beds are available in the County. **Table 4-87** summarizes the expected damage to essential facilities in San Mateo County.

Table 4-87. Expected Damage to Essential Facilities

Classification	Total	Number of Facilities		
		At Least Moderate	*At Least Substantial*	*Loss of Use*
Emergency Operations Centers	8	0	0	0
Fire Stations	60	4	0	3
Hospitals	14	1	0	1
Police Stations	28	1	0	0
Schools	261	4	0	4

Riverine Flooding: More than $500,000, but less than $5 million in property damage is expected from a *single major* riverine flood event, or damages are expected to occur to more than 5% but less than 15% of the property value within San Mateo County.

Property, Facilities, and Critical Infrastructure Impact		Impact Factor	Weighted Factor	Score
Medium	More than $500,000 but less than $5 million in property, facilities, and infrastructure damage is expected from a single significant event, or damages are expected to occur to more than 5% but less than 15% of the property value within the jurisdiction.	2	2	4
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property, Facilities, and Critical Infrastructure Impact Score = Impact Factor x Weighted Factor***				

Urban/Flash Flooding: More than $5 million in property damage is expected from a *single major* urban/flash flood event, or damages are expected to occur to 15% or more of the property value within San Mateo County.

Property, Facilities, and Critical Infrastructure Impact		Impact Factor	Weighted Factor	Score
High	More than $5 million in property, facilities, and infrastructure damage is expected from a single significant event, or damages are expected to occur to 15% or more of the property value within the jurisdiction.	3	2	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property, Facilities, and Critical Infrastructure Impact Score = Impact Factor x Weighted Factor***				

Coastal Flooding: Less than $5 million in property damage is expected from a *single major* coastal flooding event, or damages are expected to occur to less than 5% of the property value within San Mateo County.

Property, Facilities, and Critical Infrastructure Impact		Impact Factor	Weighted Factor	Score
Low	Less than $500,000 in property, facilities, and infrastructure damages is expected from a single significant event, or damages are expected to occur to less than 5% of the property value within the jurisdiction.	1	2	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property, Facilities, and Critical Infrastructure Impact Score = Impact Factor x Weighted Factor***				

Economy

Floods (i.e., riverine, urban/flash flooding, and coastal flooding) can significantly affect San Mateo County's economy, causing loss of business operations, damage to inventory (i.e., buildings, transportation, and utility systems), as well as costs for relocation, wage loss, and rental expenses due to repairs and replacements. Businesses may be flooded and unable to reopen until repairs are completed. Studies indicate that 40% of businesses do not reopen after a disaster, another 25% close within one (1) year, and 90% fail within two (2) years of experiencing a disaster.[233]

Locations directly flooded experience the greatest economic impact. In the affected areas, renovations to commercial buildings may be necessary, which could disrupt associated services. Significant damage may occur in agricultural areas, destroying crops and other agricultural products. Finally, flooding can cause extensive damage to public utilities and disrupt service delivery. Power and communication may be lost, and drinking water and wastewater treatment facilities may be temporarily unavailable.

Another economic impact includes local property values and insurance rates. Properties in flood-prone areas may decrease in value, and insurance costs could increase as the flood risk grows. This can make it more difficult for homeowners and businesses to obtain loans and other types of financial aid.

The tourism industry may also be affected by major flood events, as popular vacation areas often overlap with flood hazard zones.

Hazus breaks down building losses into two (2) categories – direct building losses and business interruption losses. Direct building losses refer to the estimated costs of repairing or replacing damage to the building and its contents. Business interruption losses are the losses incurred from the inability to operate a business due to damage sustained during the flood. Business interruption losses also include temporary living expenses for people displaced from their homes by the flood.

The total building-related losses estimated by Hazus were $1.75 billion, of which 41% were related to business interruption in San Mateo County. The residential occupancies made up 36% of the total loss. **Table 4-88** summarizes the losses associated with the building damage.

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[233] Access. (2020). Study: 40% of Businesses Fail to Reopen After a Disaster. Retrieved from https://www.accesscorp.com/press-coverage/study-40-percent-businesses-fail-reopen-disaster/.

Table 4-88. Building-Related Economic Loss Estimates ***(Millions of Dollars)***

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss	Building	499.7	136.7	60.3	23.5	720.2
	Content	297.4	417.5	113.7	89.0	917.6
	Inventory	0.0	83.9	15.4	17.6	116.9
	Subtotal	**797.1**	**638.2**	**189.3**	**130.1**	**1,754.7**
Business Interruption	Income	23.4	283.0	5.2	26.1	337.7
	Relocation	90.0	91.1	6.0	14.7	201.8
	Rental Income	94.5	65.0	1.3	1.3	162.1
	Wage	55.2	309.2	8.6	128.7	501.6
	Subtotal	**263.1**	**748.2**	**21.2**	**170.8**	**1,203.2**
Total		**1,060.2**	**1,386.4**	**210.5**	**300.9**	**2,957.9**

Hazus estimates the amount of debris generated by the flood scenario. Debris estimates were divided into three (3) general categories – finishes (e.g., dry wall, insulation), structural (e.g., wood, brick), and foundations (e.g., concrete slab, concrete block, rebar). The distinction is made because different types of material-handling equipment are required to manage debris.

The analysis estimated that a total of 36,053 tons of debris will be generated. Of the total amount, 77% is comprised of finishes, 13% is structural, and 11% is foundations. If the debris tonnage is converted to an estimated number of truckloads, it will require 1,443 truckloads (25 tons/truck) to remove the debris.

Riverine Flooding: A single *significant* riverine flood event in San Mateo County is likely to result in a total economic impact greater than $100,000 but less than or equal to $10 million.

Economic Impact		Impact Factor	Weighted Factor	Score
Medium	Total economic impact is likely to be greater than $100,000, but less than or equal to $10 million.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Economic Impact Score = Impact Factor x Weighted Factor***				

Urban/Flash Flooding: A single *significant* urban/flash flood event in San Mateo County is likely to result in a total economic impact greater than $100,000 but less than or equal to $10 million.

Economic Impact		Impact Factor	Weighted Factor	Score
Medium	Total economic impact is likely to be greater than $100,000, but less than or equal to $10 million.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Economic Impact Score = Impact Factor x Weighted Factor***				

Coastal Flooding: A single *significant* coastal flood event in San Mateo County is likely to result in a total economic impact greater than $100,000 but less than or equal to $10 million.

Economic Impact		Impact Factor	Weighted Factor	Score
Medium	Total economic impact is likely to be greater than $100,000, but less than or equal to $10 million.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Economic Impact Score = Impact Factor x Weighted Factor***				

FEMA NRI Expected Annual Loss Estimates

An inland flooding NRI EAL score and rating represent a community's relative level of expected building, population, and agriculture loss each year due to inland flooding when compared to the rest of the United States. The EAL score is positively associated with a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-89** outlines the inland flooding EAL for San Mateo County.

Table 4-89. Inland Flooding Expected Annual Loss *(FEMA National Risk Index)*

Population	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Expected Annual Loss Rating
0.04	$569,118	$211.3 Million	$400,71	$212.3 Million	98.95	Relatively High
Population exposure is defined as the estimated number of people determined to be exposed to a hazard according to a hazard type-specific methodology. *Expected annual loss scores are calculated using an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).*						

A coastal flooding NRI EAL score and rating represent a community's relative level of expected building and population loss each year due to coastal flooding when compared to the rest of the United States. The EAL score is positively associated with a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-90** outlines the coastal flooding EAL for San Mateo County.

Table 4-90. Coastal Flooding Expected Annual Loss *(FEMA National Risk Index)*

Population	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Expected Annual Loss Rating
0.0	$15,767	$8.6 Million	n/a	$8.7 Million	94.56	Relatively High
Population exposure is defined as the estimated number of people determined to be exposed to a hazard according to a hazard type-specific methodology. *Expected annual loss scores are calculated using an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).*						

Environment

Flooding (i.e., riverine, urban/flash, and coastal) accelerates soil erosion, degrades water quality, and leads to the loss of important environmental resources, thereby making ecosystems more vulnerable.

Migrating fish can wash into roads or over dikes into flooded fields, with no possibility of escape. Pollution from roads, such as oil and hazardous materials, can wash into rivers and streams. During floods, these can settle onto normally dry soils, rendering them unsuitable for agricultural use. Human development, such as bridge abutments, levees, or logjams from timber harvesting, can increase stream bank erosion, causing rivers and streams to migrate into non-natural courses.

Many species of mammals, birds, reptiles, amphibians, and fish in San Mateo County live in plant communities that depend on streams, wetlands, and floodplains. Wildlife and fish are affected when plant communities are eliminated or fundamentally altered, reducing habitat. Since water supply is a major limiting factor for many animals, riparian communities are of special importance.

Flooding can also lead to secondary hazards and significant environmental impacts. Flood-related damage to water and wastewater treatment infrastructure can lead to sewer backups and the discharge of raw sewage into streams and water systems, posing a threat to ecosystems and public health. Flood events can also impact the quality of drinking water. Additionally, industrial facilities located in flood-prone areas may release hazardous materials, contaminating soil, water, and air. San Mateo County currently has 24 hazardous materials facilities, some of which are located within the 100-year and 500-year floodplains.

Riverine Flooding: Environmental impact from a single *significant* event is likely to be localized, requiring some outside resources and support; and/or repair, cleanup, restoration, or preservation work. Riverine floods evolve more slowly than urban/flash floods; however, their environmental impacts tend to occur over a broader area.

Environment Impact		Impact Factor	Weighted Factor	Score
Medium	Environmental impact from a single significant event is likely to be minimal, requiring little to no outside resources and support; and/or minimal repair, cleanup, restoration, or preservation work.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Environmental Impact Score = Impact Factor x Weighted Factor***				

Urban/Flash Flooding: Environmental impact from a single *significant* event is likely to be localized, requiring some outside resources and support; and/or repair, cleanup, restoration, or preservation work. Urban/flash floods tend to be more localized than riverine flooding, limiting the area of environmental impact. However, there are instances in which an urban/flash flood event evolves into a riverine-flooding event.

Environment Impact		Impact Factor	Weighted Factor	Score
Medium	Environmental impact from a single significant event is likely to be minimal, requiring little to no outside resources and support; and/or minimal repair, cleanup, restoration, or preservation work.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Environmental Impact Score = Impact Factor x Weighted Factor***				

Coastal Flooding: Environmental impact from a single *significant* event is likely to be localized, requiring some outside resources and support; and/or repair, cleanup, restoration, or preservation work. Coastal floods tend to be more localized than riverine and urban/flash flooding, limiting the area of environmental impact.

Environment Impact		Impact Factor	Weighted Factor	Score
Medium	Environmental impact from a single significant event is likely to be minimal, requiring little to no outside resources and support; and/or minimal repair, cleanup, restoration, or preservation work.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Environmental Impact Score = Impact Factor x Weighted Factor***				

Continuity of Operations/Delivery of Services

A flood (i.e., riverine, urban/flash, and coastal) can have widespread, cascading impacts on a community's ability to deliver day-to-day services and maintain continuity of operations. These impacts include damage to first responders' infrastructure (e.g., fire and police stations, emergency operations centers, hospitals), disruptions to utilities (e.g., power, water, communication), and impassable roads and bridges, hindering the delivery of day-to-day services. Floods can damage power plants, substations, and power lines, resulting in power outages that could last several days. Water treatment facilities can also be compromised, potentially contaminating drinking water supplies. Furthermore, if critical infrastructure (e.g., fire and police stations) is within the flooded area, it can significantly impact response and recovery operations. These impacts may warrant requesting external resources to mitigate their impact on the jurisdiction's continuity of operations/delivery of services.

Riverine Flooding: There may be impacts lasting less than 24 hours on San Mateo County's ability to meet the essential day-to-day operational demands and needs of the community in the event of a *single major* riverine flood event.

Continuity of Operations/Delivery of Services Impact		Impact Factor	Weighted Factor	Score
Low	Impact lasting less than 24 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single significant event.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Continuity of Services/Delivery of Services Impact Score = Impact Factor x Weighted Factor***				

Urban/Flash Flooding: There may be impacts lasting between 24 hours and 72 hours on San Mateo County's ability to meet the essential day-to-day operational demands and needs of the community in the event of a *single major* urban/flash flood event.

Continuity of Operations/Delivery of Services Impact		Impact Factor	Weighted Factor	Score
Medium	Impact lasting between 24 and 72 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single significant event.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Continuity of Services/Delivery of Services Impact Score = Impact Factor x Weighted Factor***				

Coastal Flooding: There may be impacts lasting between 24 hours and 72 hours on San Mateo County's ability to meet the essential day-to-day operational demands and needs of the community in the event of a *single major* coastal flood event.

Continuity of Operations/Delivery of Services Impact		Impact Factor	Weighted Factor	Score
Medium	Impact lasting between 24 and 72 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single significant event.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Continuity of Services/Delivery of Services Impact Score = Impact Factor x Weighted Factor***				

Future Development

Information on changes in development within San Mateo County is provided in **Chapter 3** (Community Profile) of this Assessment.

Any areas of future growth and development located within identified hazard areas could be impacted by the flood hazard. Development frequently results in more impervious surfaces (e.g., concrete, asphalt), which in turn lead to increased stormwater runoff volumes. This excess runoff can surpass channel capacity, induce erosion, and escalate the frequency and severity of downstream flooding. This threatens structures, ecosystems, and floodplain functionality. In urban areas, dense development without adequate stormwater infrastructure increases the impacts of urban/flash flooding, particularly during extended, heavy rainfall events. Moreover, flooding can overwhelm drainage and sewer infrastructures, disrupt transportation networks, and compromise structural integrity. Generally, if future development factors (e.g., floodplain management, land use planning) are not properly addressed, they can exacerbate the physical impacts of flooding on a community.

The County intends to discourage development in vulnerable areas and/or encourage higher regulatory standards at the local level. All municipal planning partners have general plans that address frequently flooded areas and have committed to linking them to this LHMP update. This provides an opportunity to make informed land use decisions by considering how future growth could affect flood hazard areas. In addition, partners who are participating in good standing in the NFIP have agreed to regulate new development in the mapped floodplain in accordance with standards that equal or exceed those specified in 44 CFR Section 60.3. This will ensure that any development permitted in the floodplain is constructed to eliminate or significantly reduce flood risk exposure.

Additionally, with 25% of municipalities in the County participating in the CRS program, there is an incentive to adopt consistent, appropriate, and higher regulatory standards in communities with the highest flood risk. All municipal planning partners have committed to maintaining their good standing under the NFIP through initiatives identified in this LHMP.

Riverine Flooding: Future development trends will minimally increase the impacts of riverine flooding in San Mateo County.

Future Development Impact		Impact Factor	Weighted Factor	Score
Low	Future development trends will minimally increase the impacts of this hazard.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Future Development Impact Score = Impact Factor x Weighted Factor***				

Urban/Flash Flooding: Future development trends will increase, but not significantly, the impacts of urban/flash flooding in San Mateo County.

Future Development Impact		Impact Factor	Weighted Factor	Score
Medium	Future development trends will increase the impacts of this hazard, but not significantly.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Future Development Impact Score = Impact Factor x Weighted Factor***				

Coastal Flooding: Future development trends will minimally increase the impacts of coastal flooding in San Mateo County.

Future Development Impact		Impact Factor	Weighted Factor	Score
Low	Future development trends will minimally increase the impacts of this hazard.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Future Development Impact Score = Impact Factor x Weighted Factor***				

Climate Change

As global average temperatures rise, evaporation increases, adding moisture to the atmosphere and, in turn, leading to more precipitation. Globally, heavy precipitation events are expected to increase as much as three (3) times the historical average by the end of the century. Although heavy precipitation does not necessarily lead to flooding, the risk of flooding increases, and in some locations, even moderate rainfall can cause significant damage.[234]

Climate change is expected to make flood events more severe and more frequent due to fewer but more intense precipitation events from atmospheric rivers and extratropical cyclones. For instance, what was historically a 200-year storm (one with a 1 in 200 chance of occurring each year) could, by 2100, increase in frequency to about 40 to 50 years (to a 1 in 150/160 chance each year). This means that the 100-year and 500-year floodplains may expand, and the current floodplains may become 40- to 50-year floodplains. Climate change is also likely to increase the frequency and severity of droughts, causing soil to dry out and harden. When precipitation returns, more water runs off the surface than is absorbed into the ground, which can increase downstream flooding.[235] Furthermore, disaster response and relief costs are anticipated to increase as heavy rainfall events that lead to flooding are expected to become more frequent and severe. Flood insurance and flood prevention activities costs will rise due to the increasing risk of flooding.

Riverine Flooding: Climate change trends will significantly increase the risks and impacts of riverine flooding. Climate change is projected to increase the intensity of heavy rainfall events (e.g., atmospheric rivers), which significantly raises the risk of riverine flooding. These extreme precipitation events can quickly overwhelm creek capacity, causing them to overtop their banks. County agencies are actively managing mitigation actions and initiatives within high risk areas to maintain flow capacity and reduce the impacts of riverine flooding.

Climate Change Impact		Impact Factor	Weighted Factor	Score
High	Climate Change trends will significantly increase the impacts of this hazard.	3	1	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Climate Change Impact Score = Impact Factor x Weighted Factor***				

Urban/Flash Flooding: Climate change trends will significantly increase the risks and impacts of urban/flash flooding. Urban/flash flooding occurs when intense rainfall exceeds the capacity of municipal drainage systems. In San Mateo County, urban areas with high percentages of impervious surfaces are at the greatest risk, as high runoff rates can lead to flash flooding. This risk is further compounded when heavy rainfall occurs simultaneously with high tides (e.g., King Tides), which can block drainage systems and prevent stormwater from reaching the Bay, leading to localized flooding in areas far from the immediate shoreline.

[234] Denchak, M. (2019). Flooding and Climate Change: Everything You Need to Know. Retrieved from https://www.nrdc.org/stories/flooding-and-climate-change-everything-you-need-know.
[235] San Mateo County. (2026). Safety Element (Draft).

Climate Change Impact		Impact Factor	Weighted Factor	Score
High	Climate Change trends will significantly increase the impacts of this hazard.	3	1	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Climate Change Impact Score = Impact Factor x Weighted Factor***				

Coastal Flooding: Climate change trends will significantly increase the risks and impacts of coastal flooding. Coastal flooding in San Mateo County is primarily driven by storm surges and extreme wave action on the shoreline. Climate Change intensifies 1% annual chance storms, pushing water levels higher during storm surges and increasing wave reach. This poses immediate threats to critical assets in low-lying areas (e.g., San Francisco International Airport and major transit corridors), which face periodic inundation during severe coastal storms, even before accounting for long-term sea level rise.[236]

Climate Change Impact		Impact Factor	Weighted Factor	Score
High	Climate Change trends will significantly increase the impacts of this hazard.	3	1	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Climate Change Impact Score = Impact Factor x Weighted Factor***				

Secondary Impacts

The following are cascading or indirect hazards that may follow the primary hazard event. These hazards can occur concurrently with or be triggered by the initial event and may exacerbate its overall impact.

- Bank Erosion
- Coastal Erosion
- Landslides
- Overbank Flooding
- Hazardous Materials Incident
- Transportation Disruptions
- Power Outage
- Changes in Sediment Supply and Movement
- Saltwater Intrusion
- Habitat and Species Loss
- Hazardous Materials Incidents
- Transportation Disruptions
- Power Outage

4.6.4.8. Issues

Flooding (i.e., riverine, urban/flash, coastal) presents a range of challenges that can impact a community's preparedness, response, recovery, and mitigation efforts. While not exhaustive, the

[236] San Mateo County Office of Sustainability. (2018). Sea Level Rise Vulnerability Assessment. Retrieved from https://www.smcsustainability.org/wp-content/uploads/2018-03-12_SLR_VA_Report_2.2018_WEB_FINAL.pdf.

following outlines key flood-related issues the planning team identified that San Mateo County may encounter during such events.

- FEMA's current flood hazard maps may not reliably represent the actual flood risk in the planning area. This is most prevalent in areas protected by levees that are not accredited by the FEMA mapping process.
- Over 60% of the population within the 1% annual chance floodplain has either very high or relatively high social vulnerability.
- The extent of flood protection currently provided by flood control facilities (dams, dikes, and levees) is not known due to a lack of an established national policy on flood protection standards.
- The levee system in the planning area does not consistently provide sufficient protection against a 1% annual chance flood event.
- Risk associated with the flood hazard overlaps risks associated with other hazards such as earthquakes, landslides, and coastal erosion. This provides an opportunity to seek mitigation alternatives with multiple objectives that can reduce risks from multiple hazards.
- Land use practices are not consistent with the scope of regulatory floodplain management within the planning area.
- The impact of climate change on flood conditions in San Mateo County remains uncertain.
- Additional information is required concerning flood risk to facilitate the risk-based analysis of capital projects.
- To determine the cost-effectiveness of future mitigation projects, sustained effort is necessary to gather damage reports and historical damage data, such as high-water marks on structures.
- Ongoing flood hazard mitigation will require funding from multiple sources.
- A coordinated hazard mitigation effort is necessary among jurisdictions within the County affected by flood hazards.
- Floodplain community members must continue to seek and receive information about flood preparedness and resources available during and after floods.
- The concept of residual risk should be considered in the design of future capital flood control projects and should be communicated to community members living in the floodplain.
- Promoting flood insurance as a means of protecting private property owners from the economic impacts of frequent flooding should continue, including those outside the 100 and 500-year floodplains.
- Existing floodplain-compatible uses, such as agricultural and open space, must be maintained. There is constant pressure to convert these uses to more intense uses within the planning area during periods of moderate to high growth.
- The economy affects a jurisdiction’s ability to manage its floodplains. Budget cuts and personnel losses can strain resources needed to support floodplain management.
- Flooding can damage communication systems (e.g., power lines, cell towers), which can leave residents isolated and unable to communicate with first responders.

- Urban/flash flooding can occur with limited warning time, giving residents minimal time to react or evacuate.
- Lack of adequate stormwater management capacity in older communities that were developed before modern stormwater regulations.

4.6.4.9. Risk Profile

FEMA Risk Index Score

The FEMA Inland Flooding (riverine and urban/flash flooding) Risk Index score and rating represent a community's relative risk of inland flooding when compared to the rest of the United States. **Table 4-91** illustrates the Inland Flooding Risk Index rating and score for San Mateo County.

Table 4-91. Inland Flooding Total Risk Score *(FEMA National Risk Index)*

Rating	Score
Relatively High	98.4
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability, and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).	

The FEMA Coastal Flooding Risk Index score and rating represent a community's relative risk of coastal flooding when compared to the rest of the United States. **Table 4-92** illustrates the Coastal Flooding Risk Index rating and score for San Mateo County.

Table 4-92. Coastal Flooding Total Risk Score *(FEMA National Risk Index)*

Rating	Score
Relatively High	91.8
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability, and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).	

Overall Risk Score

Table 4-93 represents the Flood Total Risk Score for San Mateo County, based on the Risk Assessment Methodology, as defined in Section 4.3 of this Plan.

Table 4-93. Flood Total Risk Score

Hazard Event	Probability Factor	Sum of Weighted Extent Factors	Sum of Weighted Vulnerability Factors	Sum of Weighted Impact Factors	Consequence Score	Total Risk Score*
Urban/Flash Flooding	3	18	14	32	64	89
Riverine Flooding	2	12	6	28	46	43
Coastal Flooding	1	9	5	25	39	18

Extent: Sum of the weighted Extent factors.
Vulnerability: Sum of the weighted Vulnerability factors.
Impact: Sum of the weighted Impact factors.

Consequence Score: Extent + Vulnerability + Impact (Sum of all weighted factors).
Total Risk Score = Probability x Consequence
* Normalized to 100

Total Risk Score Legend

Classification	Probability	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 4	0 – 12	0 – 24	0 – 32
Medium (M)	2	7 – 12	5 – 10	13 – 26	25 – 48	33 – 66
High (H)	3	13 – 18	11 – 15	27 – 39	49 – 72	67 – 100

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.5. Landslide

A landslide is a mass of rock, debris, or earth moving down a slope. Furthermore, landslides may be minor or very large and can move at slow to very high speeds. Landslides are a type of "mass wasting", which denotes any downslope movement of soil and rock under the direct influence of gravity.[237] The term "landslide" describes a wide variety of processes that result in the downward and outward movement of slope-forming materials, including rock, soil, artificial fill, or combinations thereof. The materials may move by falling, toppling, sliding, spreading, or flowing. The mode of movement and the kinds of materials involved will differentiate the type of landslide. **Table 4-94** lists and describes the types of landslides.[238]

Table 4-94. Landslide Types

Type	Description
Rotational Landslide	Ground rotates and slides along a curved failure plane.
Transitional Landslide	Ground slides with little rotation along a flat plane parallel surface.
Block Slide	A type of translational landslide made of mostly one (1) block of surface material that moves downslope.
Rockfall	Gravity causes rocks and other materials to move downslope. Rockfalls are common during earthquakes or periods of excessive rainfall.
Topple	Pieces of a cliff or rock face fall forward as large rocks.
Earthflow	Forms on moderate slopes when fine-grained material liquefies and flows outward in an hourglass shape.
Lateral Spread	When surface material extends or spreads on gentle slopes, this type of ground deformation is often associated with earthquake shaking.
Debris Flow	A fast-moving mixture of water, mud, trees, and other materials that flows downvalley and can travel great distances.
Debris Avalanche	An extremely large and fast-moving debris flow.
Creep	Soils and surface materials that slowly move down a slope.

Landslides are an important natural process because they shape the Earth's landscape and contribute to a region's overall environmental quality. However, when landslides affect people, property, or infrastructure, they are considered a natural hazard. Landslides in hillside terrain can pose a serious hazard to downslope property and structures. They can disrupt roadways and other infrastructure lifelines, destroy private property, and cause flooding, bank erosion, and rapid channel migration. A landslide can move rapidly down slopes or through channels and can strike with little or no warning. It can travel miles from its source, growing as it descends, picking up trees, boulders, cars, and anything else in its path. Although slides behave as fluids, they convey many times the hydraulic force of water due to the mass of material they carry.

Mudflows are formally defined as a flowing mass of fine-grained earth materials with high fluidity and water content of up to 60%. While the term mudslide is a popular catch-all phrase often used by the media

[237] United States Geological Survey. (n.d.). What is a Landslide and What Causes One? Retrieved from https://www.usgs.gov/faqs/what-landslide-and-what-causes-one.
[238] United States Geological Survey. (2023). Types of Landslides. Retrieved from https://www.usgs.gov/media/images/types-landslides.

to describe such events, it is technically imprecise, as it encompasses a broader range of debris-laden floods and landslides.[239]

The California Department of Conservation classifies landslides into six (6) categories listed in **Table 4-95**.[240]

Table 4-95. Common Landslide Types

Type	Description
Earth Flow	The majority of the soil materials are fine-grained, cohesive silt and clay, and occur in moderately steep slopes (10% to 30% grade). Earth flows are slow-moving (centimeters or millimeters over days or weeks), often triggered by prolonged rainfall, and sometimes do not occur until well after a rainfall event or the rainy season.
Debris Flow	The majority of the soil is coarse-grained (e.g., fine sand to boulder-size particles) and non-cohesive, and commonly begins as a shallow mass of soil and weathered rock that slides. Debris flows tend to be small to an aerial extent, and their deposits are relatively thin.
Debris Slide	The majority of the soil is coarse-grained, most commonly in unconsolidated sandy or gravelly units, but also in residual soils formed by in-place weathering of relatively hard rock. Debris slides tend to occur on very steep slopes (60% to 70% grade) where the base of the slope is undercut with erosion. These move at rates ranging from meters per day to meters per minute and are often triggered by a single heavy rainfall event or a series of storms that deliver enough rain to trigger a debris slide.
Rockslides	Involves bedrock, in which the rock that moves remains largely intact for at least a portion of the movement. Rockslides occur in a variety of sizes on a variety of gradients (35% to 70% grade) and have a range of triggering mechanisms.
Rock Falls	Occurs when a mass of rock detaches from a steep slope by sliding, spreading, or toppling and descends mainly through the air by falling, bouncing, or rolling. Rock falls can be triggered by heavy rainfall, earthquakes, and freeze-thaw wedging.

Landslides are caused by a combination of geological and climatic conditions, as well as the influence of urbanization. Examples of landslide triggers include shaking from earthquakes, heavy rainfall (especially on fire-burned slopes and vegetation-stripped areas, which can cause large amounts of rapid runoff), wildfires, volcanic activity (often accompanied by earthquakes and laden with ash and debris), and human modification of the land. Additionally, earthquake shaking can trigger underwater landslides (i.e., submarine landslides), which can generate tsunamis and damage coastal areas. Vulnerable natural conditions are affected by human development and the infrastructure that supports it. In some cases, irrigation increases the potential for landslides. Other factors that can contribute to a landslide formation include:

- Change in slope of the terrain
- Increased load on the land
- Shocks and vibrations

[239] United States Geological Survey. (n.d.). Landslides Glossary (Mudflow and Mudslide). Retrieved from https://www.usgs.gov/glossary/landslides-glossary.
[240] California Department of Conservation. (n.d.). Landslides. Retrieved from https://www.conservation.ca.gov/cgs/landslides/types.

- Change in water content
- Groundwater movement
- Frost action
- Weathering of rocks
- Removing or changing the type of vegetation covering slopes

While small landslides are frequently the result of human activity, the largest landslides are often natural phenomena with little or no human contribution. The sites of large landslides are typically areas of previous landslide movement that are periodically reactivated by significant precipitation or seismic events.

4.6.5.1. Location

The best available predictor of where landslides and earth flows might move is the location of past movements. Past landslides can be recognized by their distinctive topographic shapes, which can persist for thousands of years. Most landslides recognizable in this fashion range from a few acres to several square miles, and many show no evidence of recent movement and are not currently active. A small proportion of them may become active in any given year, with movements concentrated within all or part of the landslide masses or around their edges. The recognition of ancient dormant mass-movement sites is important for identifying areas susceptible to flows and slides, as these sites can be reactivated by earthquakes or exceptionally wet weather. Also, because they consist of broken materials and frequently disrupt groundwater flow, these dormant sites are vulnerable to construction-triggered sliding.

Although landslides are primarily associated with mountainous regions, they can also occur in generally lowland areas. In lowland areas, landslides occur due to roadway and building development, river bluff failures, collapse of mine waste piles, and a wide variety of slope failures associated with quarries and open-pit mines. Because the factors affecting landslides can be geophysical or human-caused, landslides can occur in developed or undeveloped areas, or anywhere where the terrain has been altered for roads, houses, utilities, buildings, or even lawns in the backyard.

Landslides are typically a function of soil type and slope steepness. Soil type is a key indicator for landslide potential and is used by geologists and geotechnical engineers to determine soil stability for construction standards. In general, landslide hazard areas are characterized by land features that increase the risk of downslope movement of material.

- A slope greater than 33%.
- A history of landslide activity or movement during the last 10,000 years.
- Stream or wave activity, which has caused erosion, undercuts a bank or cuts into a bank to cause the surrounding land to be unstable.
- The presence or potential for snow avalanches.
- The presence of an alluvial fan indicates vulnerability to the flow of debris or sediments.
- The presence of impermeable soils (e.g., silt or clay) mixed with granular soils (e.g., sand or gravel).

Landslide susceptibility maps describe the relative likelihood of future landsliding based solely on the intrinsic properties of a location or site. There are three (3) site factors that most determine susceptibility – prior failure, rock or soil strength, and slope steepness.[241] In 2011, CGS used a combination of regional rock-strength and slope data to create statewide susceptibility classes for deep-seated landslides. The analysis assumed that susceptibility to deep-seated landslides is low on very low slopes in all rock materials and increases with slope and in weak rocks. The analysis also factored in locations of past landslides. **Figure 4-14** illustrates the landslide susceptibility in San Mateo County.

Figure 4-14. Deep-Seated Landslide Susceptibility

[Map under development…]

The USGS Landslide Inventory and Susceptibility map shows landslide susceptibility, with colors ranging from yellow (lower) to red (higher), while areas without color have negligible risk. **Note:** The model does not explicitly account for long-runout and omits a handful of landslides (less than 1%), so some caution should be exercised in areas downslope of highly susceptible terrain.

Post-Wildfire Debris Flow

Areas with recent wildfire burn scars are also at higher risk for debris flows. Wildfires can significantly alter a watershed's hydrologic response to the point that even modest rainstorms can produce dangerous flash floods and debris flows. California's first major rainfall event of the winter, after the historic 2020 wildfire season, prompted evacuation orders and flood watches and warnings for several recent burn areas in the State. The biggest debris flow impacts were in Monterey County and included major damage along the Big Sur Coast, closing California Highway 1 indefinitely, and damage to numerous homes, causing at least one (1) injury (River Fire). Minor home damage occurred in the Bond Fire in Orange County, and small non-destructive debris flows were observed in the CZU Lightning Complex burn area in Santa Cruz and San Mateo Counties.[242]

4.6.5.2. Extent/Severity

In the United States, slope failures cause billions of dollars in damage and kill between 25 and 50 people, primarily through rockfalls, rockslides, and debris flows. Worldwide, landslides cause thousands of deaths and billions in economic losses.[243] Beyond direct structural damage, landslides pose a serious hazard by blocking road access, isolating communities and delaying emergency services, and damaging utility infrastructure (e.g., power and communication lines). Landslides can also degrade water quality and harm aquatic habitats by introducing sediment into rivers and streams.

While there is no universally accepted scale for landslide intensity, potential severity can be estimated by analyzing regional risk strength and slope steepness (i.e., landslide susceptibility). These factors help assess the likely extent and intensity of deep-seated landsliding.

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241 California Department of Conservation. (n.d.). Landslides. Retrieved from https://www.conservation.ca.gov/cgs/landslides.
242 United States Geological Survey. (2021). Evaluation of Debris Flow Activity in Recent California Burn Areas Following Atmospheric River Event. Retrieved from https://www.usgs.gov/tools/central-california-coast-debris-flows-january-2021.
243 American Geosciences Institute. (n.d.). Landslides. Retrieved from https://profession.americangeosciences.org/society/intersections/landslides/.

Extent/Severity		Extent Factor	Weighted Factor	Score
Medium	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a medium-intensity incident.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Extent/Severity Score = Extent Factor x Weighted Factor***				

Catastrophic Potential

A catastrophic incident can be defined as any natural, human-caused, or technological disaster that results in extraordinary levels of casualties, damage, or disruption, severely affecting the population (including mass evacuations), infrastructure, environment, economy, national morale, or government functions in the area.[244] The catastrophic potential for a landslide event is low in San Mateo County.

Catastrophic Potential		Extent Factor	Weighted Factor	Score
Low	Low potential that this hazard could be catastrophic.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Catastrophic Score = Extent Factor x Weighted Factor***				

4.6.5.3. Warning Time

These events can occur slowly (inches per year) or suddenly (many feet per second), with the velocity of movement depending on slope angle, material, and water content. While monitoring methods can provide insight into the type of movement and the potential time of failure, there is currently no practical warning system for individual landslides. Assessing geology, vegetation, and predicted precipitation can help identify high-risk areas during specific time periods. Generally accepted warning signs for landslide activity include:[245]

- Springs, seeps, or saturated ground in areas that have not typically been wet before.
- New cracks or unusual bulges in the ground, street pavements, or sidewalks.
- Soil moving away from foundations.
- Ancillary structures (e.g., decks, patios) tilting or moving relative to the main house.
- Tilting or cracking of concrete floors and foundations.
- Broken water lines and other underground utilities.
- Leaning telephone poles, trees, retaining walls, or fences.
- Offset fence lines.
- Sunken or down-dropped roadbeds.
- Rapid increase in creek water levels, possibly accompanied by increased turbidity (soil content).

[244] Federal Emergency Management Agency. (2019). National Response Framework (Fourth Edition). Retrieved from https://www.fema.gov/sites/default/files/documents/NRF_FINALApproved_2011028.pdf.
[245]

- Sudden decrease in creek water levels, though rainfall is ongoing or has recently stopped.
- Sticking doors and windows, and visible open spaces indicating frames out of plumb.
- A faint rumbling sound that increases in volume as the landslide nears.
- Unusual sounds (e.g., trees cracking, boulders knocking together).

USGS provides a notification system for potential landslides, listed in **Table 4-96**. Watches and warnings may be issued for discrete areas and may include advice to contact the area's local emergency management. Additionally, rainfall-induced debris flow watches and warnings are weather-dependent and will closely track NWS flash flood advisories.[246]

Table 4-96. USGS Landslide Advisories

Type	Description
Landslide Advisory	A general statement about the potential of landslide activity in a given region relative to developing rainfall predictions. An advisory may include general statements about rainfall conditions that can lead to debris flow activity and list precautions to take in the event of heavy rainfall.
Landslide Watch	Issued when landslide activity is possible but not imminent. People in or planning to travel through a watch area should be prepared for landslides and stay informed about developing weather patterns.
Landslide Warning	Issued to indicate that landslide activity is presently occurring, and extreme caution should be taken.

4.6.5.4. Probability and Frequency

The probability of occurrence for a landslide in San Mateo County is medium because a *significant* event is likely to occur within 25 years. In San Mateo County, landslides are typically triggered by severe weather (e.g., heavy rainfall), so the potential for landslides largely coincides with the potential for sequential severe weather, which results in saturated, steep, vulnerable soils. Most weather-induced landslides in the County occur during the winter months after the water table has risen. Landslides that result from earthquakes can occur at any time.

Probability of Occurrence		Probability Factor	Weighted Factor	Score
Medium	A significant hazard event is likely to occur within 25 years.	2	N/A	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology).				

FEMA NRI Annualized Frequency

The landslide annualized frequency value represents the estimated number of recorded landslide occurrences, in events, each year over the period of record (11.8 years). **Table 4-97** outlines the annualized frequency for landslides, based on FEMA NRI data, for San Mateo County.

[246] United States Geological Survey. (n.d.). What is the Difference Between a Landslide Advisory, a Landslide Watch, and a Landslide Warning? Retrieved from https://www.usgs.gov/faqs/what-difference-between-landslide-advisory-landslide-watch-and-landslide-warning.

Table 4-97. Landslide Annualized Frequency *(FEMA National Risk Index)*

Events on Record *(Annualized Probability)*	Annualized Frequency
n/a	3.9
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.	

4.6.5.5. Past Events

In San Mateo County, significant landslides have occurred in conjunction with heavy rainfall events. **Table 4-98** lists notable landslide events that affected San Mateo County between 1980 and 2025.[247]

Table 4-98. Significant Landslide Events

Date	Event Type	Location	Description
March 9, 2023 – July 10, 2023	Severe Winter Storms, Flooding, Landslides, and Mudslides	San Mateo County *(Various Municipalities)*	The County experienced an unprecedented amount of rainfall through the end of 2022 and into 2023, which resulted in several roadway failures, slip-outs, and flooding. Over 15 different locations required repair projects. *(EM-3592)*
February 21, 2023 – July 10, 2023	Severe Winter Storms, Straight-line Winds, Flooding, Landslides, and Mudslides	San Mateo County *(Various Municipalities)*	The County experienced an unprecedented amount of rainfall through the end of 2022 and into 2023, which resulted in several roadway failures, slip-outs, and flooding. Over 15 different locations required repair projects. *(DR-4699)*
December 27, 2022 – January 31, 2023	Severe Winter Storms, Flooding, Landslides, and Mudslides	San Mateo County *(Various Municipalities)*	The County experienced an unprecedented amount of rain through the end of 2022 and into 2023, which resulted in several roadway failures, slip-outs, and flooding. Over 15 different locations required repair projects. *(DR-4683)*
February 13, 2019 – February 14, 2019	Severe Winter Storms, Flooding, and Mudslides	Portola Valley, La Honda	Part of La Honda Road near Skyline Boulevard washed away. There was a mudslide covering the eastbound lane of State Route 84 at State Route 35, and another blocking three-fourths of the westbound lane at State Route 84 and Hildebrand Road.
December 6, 2014	Landslide	Between Old La Honda Road and State Highway 35 at Skyline Boulevard	A landslide led to a traffic alert on State Road 84 East, where only one (1) lane was open for traffic.

[247] The information for this table was sourced from multiple references.

Date	Event Type	Location	Description
April 22, 2006	Landslide	Half Moon Bay	A landslide downed fiber-optic phone lines, leading to service outages in several San Mateo County coastal cities.
April 1, 2006 – April 4, 2006	Debris Flow	San Francisco Peninsula Coast	Heavy, persistent rainfall in the Santa Cruz Mountains during the first half of April triggered numerous landslides. The areas hardest hit were saturated hillsides in Brisbane, Broadmoor, and El Granada. In total, 83 damage sites were documented throughout San Mateo County. A landslide caused State Highway 1 at Devil's Slide to be closed for several months. Damage was estimated at nearly $13 million, with at least $6 million charged to county road damage.
December 17, 2005 – January 12, 2006	Winter Storms (Severe Storms, Flood, Mudslides, Landslides)	San Mateo County	Damage estimates for the region exceeded $100 million. Three (3) homes were nearly destroyed by mudslides.
February 2, 1998	El Niño (Flood and Landslides)	San Mateo County *(Various Municipalities)*	San Mateo County recorded $55 million in damage to public and private properties. La Honda, Moss Beach, Pacifica, Daly City, and Portola Valley listed $38 million in damage. Hundreds of hillsides failed, the pre-existing Polhemus landslide (earth slump) reactivated, and shoreline retreat occurred in Daly City, Pacifica, Tunitas Creek, and Moss Beach. *(DR-1203)*
February 1998	Landslides	San Mateo County	The main slide in La Honda continued to move steadily, accelerating after rainfall on February 11th. Three (3) houses at the landslide's head, along with five (5) others nearby, were red-tagged. San Mateo County drilled three (3) wells across the landslide and started pumping, while also digging plastic-lined trenches to improve drainage. Additionally, seven (7) homes on Esplanade Drive in Pacifica were evacuated after a 30-foot cliff retreated 10 feet closer to the houses.

Date	Event Type	Location	Description
January 4, 1982	Landslide, Severe Storm	San Mateo County *(City of Pacifica and Others)*	After an intense storm, many small to major landslides occurred in steep sections of the western and northern portions of the County, mostly in sparsely populated areas. Three (3) children died after a strip of hillside slid hundreds of feet and destroyed two (2) homes in the City of Pacifica. The County reported millions of dollars in property damage from the event.

Sites of Repetitive Landslides

In addition to the one-time events listed in **Table 4-98**, the following ongoing problem areas have been reported:

- The southwestern portion of the County has experienced repeated damage from debris flows, including the Tunitas Creek, San Gregorio, and Pescadero watersheds. Debris flows are widespread on the natural slopes west of Skyline Ridge. They have been observed in Alpine Road, Crystal Springs, San Bruno Mountain, and Point San Pedro, as well as the County's coastal sea cliffs.
- State Highway 1 has been closed due to landslides multiple times at Devil's Slide. In 1995 and 2006, landslides led to extended closures. The new Tom Lantos Tunnel, opened in March 2013, allows the Highway to bypass Devil's Slide, reducing vulnerability.
- The Coastside of the County is the most susceptible to landslide hazards, especially Sky Londa, La Honda, and Loma Mar. These areas have a history of landslides, making them susceptible to future sliding during heavy rainfall or seismic activity.

4.6.5.6. Vulnerability

Population Exposed

15% to 29% of the population in San Mateo County is exposed to landslides. In general, the entire population in landslide-susceptible areas is considered vulnerable, especially those in high- or very high-susceptibility areas. The growing population in mountainous regions, and the fact that many homes are built on property atop or below bluffs and on steep slopes prone to mass movement, increase the number of lives at risk from this hazard. All people exposed to landslide hazards are potentially vulnerable to its impacts. Populations with access and functional needs, as well as the elderly and children, are more vulnerable to landslide hazards because they may not be able to evacuate quickly enough to avoid the impacts.

Population Exposure		Vulnerability Factor	Weighted Factor	Score
Medium	15% to 29% of the population is exposed to the hazard.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population Exposure Score = Extent Factor x Weighted Factor***				

Property Exposed

10% to 24% of the total assessed property, infrastructure, and resources value is exposed to landslides in San Mateo County. In general, any property located within landslide susceptibility areas is considered vulnerable, especially those in high or very high landslide susceptibility areas. A significant number of roads, bridges, and utilities in San Mateo County may be exposed to landslides. There are seven (7) major roads that intersect the mapped areas with a high or very high susceptibility to landslides.

- Interstate 280
- Interstate 380
- State Highway 1
- State Highway 82
- State Highway 84
- State Highway 92
- US Highway 101

Additionally, 26 bridges in San Mateo County are exposed to landslides. Bridges in areas of high landslide risk often provide the only ingress and egress to large areas.

Electric infrastructure is highly susceptible to landslides, which can cause minor damage or complete destruction of power lines. Several lines serve to distribute electricity both within and outside San Mateo County. Disruption of multiple lines could lead to a major power outage extending beyond the county. Additionally, there are several industrial structures located in landslide-prone areas in the County. In the event of a landslide impacting these structures, holding tanks can be disturbed, resulting in chemical release and contamination of surrounding areas.

Property Exposure		Vulnerability Factor	Weighted Factor	Score
Medium	10% to 24% of the total assessed property value is exposed to a hazard.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property Exposure Score = Extent Factor x Weighted Factor***				

Changes in Development

Information on changes in development within San Mateo County is provided in **Chapter 3** (Community Profile) of this Assessment.

The changes in development have increased San Mateo County's exposure to landslides by less than 4%.

Changes in Development		Vulnerability Factor	Weighted Factor	Score
Low	Changes in development have increased the community's exposure to the hazard by 4% or less.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Changes in Development Score = Extent Factor x Weighted Factor***				

4.6.5.7. Impacts

Population and Life Safety

A population that is exposed to landslides is likely to experience significant adverse impacts (e.g., fatalities and severe injuries). Landslides can cause injuries and fatalities to anyone who gets trapped in a vehicle or structure during a landslide, either in transit or if they happen to be standing in the area when the landslide occurs. Buildings, roads, and other structures built on slopes prone to landslides can collapse, trapping people and causing injury or death. Additionally, landslides can block roads and pathways, impacting access to emergency services and potentially hindering evacuation and response efforts.[248] Landslides can also inflict damage on homes, infrastructure, and transportation systems, resulting in both physical harm and substantial economic losses for individuals and communities. Furthermore, landslides can disrupt or contaminate water sources, posing health risks associated with contaminated drinking water.

Population and Life Safety Impact		Impact Factor	Weighted Factor	Score
High	Populations exposed to this hazard are likely to experience significant adverse impacts, such as fatalities and severe injuries.	3	3	9
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population and Life Safety Impact Score = Impact Factor x Weighted Factor***				

Underserved Population

The underserved population exposed to landslides in San Mateo County is likely to experience significant adverse/disproportionate impacts (e.g., fatalities and severe injuries). The underserved population faces unique impacts from these events. These groups include, but are not limited to, low-income households, individuals aged 65 and older, children, individuals with access and functional needs, and populations living on single access roads. Lower-income populations may live in homes that are less structurally sound. In the event of a landslide, the foundation of these homes can be damaged or completely destroyed, resulting in financial strain for these households. The elderly population (i.e., 65 years old and older), especially those with access and functional needs, may have physical limitations that make evacuation more difficult in an emergency. Furthermore, the elderly population may lack access to social connections and community support that can assist with preparing for and responding to emergencies, evacuating, improving home resilience, managing medical needs, and locating support services. Individuals living in isolated areas with limited access (e.g., one (1) road in and one (1) road out) are uniquely vulnerable to landslides because these communities may be cut off from community lifelines if a landslide were to block access for an extended period.

[248] Centers for Disease Control and Prevention. (2024). Landslides and Mudslides and Your Safety. Retrieved from https://www.cdc.gov/landslides-and-mudslides/about/index.html.

Underserved Population Impact		Impact Factor	Weighted Factor	Score
High	Underserved populations exposed to the hazard are likely to experience significant adverse/disproportionate impacts, such as fatalities and severe injuries.	3	3	9
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Underserved Population Impact Score = Impact Factor x Weighted Factor***				

Property, Facilities, and Critical Infrastructure

More than $500,000 but less than $5 million in property damage is expected from a *single major* landslide event, or damages are expected to occur to more than 5% but less than 15% of the property value within San Mateo County. Landslides pose a direct threat to the physical integrity of the County's built environment, particularly when property, facilities, and critical infrastructure are located in mountainous or coastal terrain. Rapidly moving landslides can cause the total structural failure of buildings, bridges, and overpasses. Conversely, slow-moving, deep-seated landslides can cause foundational damage to infrastructure and property, requiring costly repairs.

Beyond direct structural damage, ground movement often compromises essential utility networks. The displacement of soil can sever underground gas and water mains or damage electrical and communication conduits, triggering secondary hazards (e.g., localized fires and hazardous material releases).

The transportation network is especially vulnerable, as landslides frequently obstruct primary arterial roads, primary corridors, and transit rails. Such blockages can physically isolate entire communities, severing access routes required for emergency response vehicles and recovery operations. Maintaining the structural stability of these transit segments is essential to ensuring the County's operational continuity during and after a landslide. Although the placement of roads in valleys or along the sides of slopes, and the roads themselves, can destabilize slopes over the long term.

Property, Facilities, and Critical Infrastructure Impact		Impact Factor	Weighted Factor	Score
Medium	More than $500,000 but less than $5 million in property, facilities, and infrastructure damage is expected from a single significant event, or damages are expected to occur to more than 5% but less than 15% of the property value within the jurisdiction.	2	2	4
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property, Facilities, and Critical Infrastructure Impact Score = Impact Factor x Weighted Factor***				

Economy

A single *significant* landslide event in San Mateo County is likely to result in a total economic impact greater than $100,000 but less than or equal to $10 million. Landslide events can have profound and multifaceted economic impacts, affecting communities, businesses, and all levels of government. Initially, landslides cause direct damage to infrastructure (e.g., buildings, roads, bridges), resulting in costs for repair, reconstruction, and debris removal. These costs not only strain public budgets but also divert resources from other vital community needs. Furthermore, businesses experience significant disruptions, with some forced to temporarily or permanently cease operations, resulting in lost income, revenue, employment, and productivity. The ripple effects extend to the broader economy, as supply chains are disrupted, and consumer spending patterns shift in the aftermath of the disaster. Efforts to rebuild and recover from a landslide often require substantial investment, which can stimulate economic activity in construction and related sectors but also highlight the need for improved resilience and preparedness strategies.

Specific industries that may be more impacted in San Mateo County include those that rely on agricultural and timber, cultural resources, or scenic areas. Agricultural resources include rangelands, timberlands, cultivated farmlands, and dairy lands. Landslides can have major consequences for these resources, particularly timberland, given the large share of this land in remote, steep-slope locations. Roads accessing timberlands are often susceptible to landslides and frequently contribute to these events. Landslide activity on these roads can disrupt production.

Landslides can destroy cultural resources, such as artifacts and structures, or scenic resources, potentially impacting the tourism industry. San Mateo County features a broad range of scenic resources, including the coastline and Pacific Ocean, mountains, hills, ridgelines, inland water features, forests, agricultural features, and distinctive rural communities. Many of these resources, or the access routes to them, are vulnerable to landslides.

Economic Impact		Impact Factor	Weighted Factor	Score
Medium	Total economic impact is likely to be greater than $100,000, but less than or equal to $10 million.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Economic Impact Score = Impact Factor x Weighted Factor***				

FEMA NRI Expected Annual Loss Estimates

A landslide NRI EAL score and rating represent a community's relative level of expected building and population loss each year due to landslides when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-99** outlines the landslide EAL for San Mateo County.

Table 4-99. Landslide Expected Annual Loss *(FEMA National Risk Index)*

Population	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Expected Annual Loss Rating
0.01	$102,750	$4.3 Million	n/a	$4.3 Million	99.1	Relatively High
Population exposure is defined as the estimated number of people determined to be exposed to a hazard according to a hazard type-specific methodology. *Expected Annual Loss scores are calculated using an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).*						

Environment

Environmental impact from a single *significant* landslide event is likely to be localized, requiring some outside resources and support; and/or repair, cleanup, restoration, or preservation work. Landslides can damage natural assets important to the community.

- When landslides enter streams, they can severely affect fish and wildlife habitats and water quality.
- Hillsides that serve as wildlife habitats may be eroded or lost due to landslides.
- Landslide hazard areas often contain critical habitats for endangered species.

Landslides can have major consequences to agricultural resources (i.e., rangelands, timberlands, cultivated farmlands, and dairy lands), primarily timberland, due to the large percentage of such land in remote locations on steep slopes. Roads accessing timberlands are often susceptible to landslides and frequently contribute to these hazards. Also, mass movement activity on these roads can disrupt production.

San Mateo County features a broad range of scenic resources, including the coastline and Pacific Ocean, mountains, hills, ridgelines, inland water features, forests, agricultural features, and distinctive rural communities. Many of these resources, or the access routes to them, are vulnerable to landslides.

Environment Impact		Impact Factor	Weighted Factor	Score
Medium	Environmental impact from a single significant event is likely to be localized, requiring some outside resources and support; and/or repair, cleanup, restoration, or preservation work.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Environmental Impact Score = Impact Factor x Weighted Factor***				

Continuity of Operations/Delivery of Services

There may be impacts lasting less than 24 hours on San Mateo County's ability to meet the essential day-to-day operational demands and needs of the community in the event of a *single major* landslide.

High-risk areas in the County include mountain and coastal roads, as well as transportation infrastructure. Access to main roads is vital for life safety following a disaster and supports resilience during response and recovery efforts. Landslides can obstruct roads, potentially isolating entire communities or parts of them. Such blockages can cause traffic disruptions, delaying emergency response and both public and private transportation.

Continuity of Operations/Delivery of Services Impact		Impact Factor	Weighted Factor	Score
Low	Impact lasting less than 24 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single significant event.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Continuity of Services/Delivery of Services Impact Score = Impact Factor x Weighted Factor***				

Future Development

Information on changes in development within San Mateo County is provided in **Chapter 3** (Community Profile) of this Assessment.

Future development trends will minimally increase the impacts of landslides in San Mateo County. Land use controls (e.g., prohibiting development on unstable soils or steep slopes) are the most cost-effective way to prevent loss of life and property. The County and its planning partners are equipped to handle future growth within landslide hazard areas. San Mateo County and each municipality have adopted their own general plans. Each general plan's safety element establishes standards for protecting the community from landslides. Development in San Mateo County will be regulated through building standards and performance measures to reduce the risk of landslides.

The California Building Standards Code has adopted the International Building Code (IBC) by reference. The IBC includes provisions for geotechnical analyses in steep slope areas with soil types considered susceptible to landslides. These provisions ensure that new construction is built to standards that reduce vulnerability to landslides. Building construction and grading activities are subject to the County Code, which requires a geotechnical report or a slope stability analysis under specific slope conditions. Additionally, the County requires a site evaluation prior to building plan check. Geologic maps are reviewed during the site evaluation, and where building or grading is proposed in areas mapped with landslides, expansive soils, liquefaction potential, or fault rupture hazards, a geotechnical report is required, and design mitigations are identified.

Future Development Impact		Impact Factor	Weighted Factor	Score
Low	Future development trends will minimally increase the impacts of this hazard.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Future Development Impact Score = Impact Factor x Weighted Factor***				

Climate Change

Climate change trends will increase, but not significantly, the risks and impacts of landslides. While climate change does not directly cause landslides, it intensifies the environmental conditions that trigger them. Rising global temperatures increase evaporation and atmospheric moisture, leading to a projected rise in the frequency and severity of heavy precipitation. These intense heavy precipitation events, such as the atmospheric rivers experienced during the 2022 and 2023 winter storms, rapidly saturate soil and destabilize slopes, causing sudden landslides and debris flow that can sever critical transit arteries like State Route 92.

Wildfires are also a contributing factor in the increased frequency and severity of landslides. When wildfires reduce the vegetation that stabilizes the soil, slopes become highly susceptible to landslides during subsequent rainfall. Post-fire hazards (e.g., debris flows) can occur with little warning in the years following a fire due to root decay and lost soil strength.[249] As seen after the 2021 CZU Lightning Complex fire, residents in the South Coast and southern San Mateo County learned that the areas with wildfire burn scars were more vulnerable to landslides during heavy rainfall. Ultimately, as most heavy rainfall and wildfires become more frequent and severe, the likelihood of sudden, high-damage landslides in the County is expected to increase.

Climate Change Impact		Impact Factor	Weighted Factor	Score
Medium	Climate Change trends will increase the impacts of this hazard, but not significantly.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Climate Change Impact Score = Impact Factor x Weighted Factor***				

Secondary Impacts

While many hazards may trigger a landslide, a landslide is unlikely to trigger other hazards, except for erosion and power outages.

4.6.5.8. Issues

Landslides present a range of challenges that can impact a community's preparedness, response, recovery, and mitigation efforts. While not exhaustive, the following outlines key issues that the planning team identified that San Mateo County may encounter during such events.

- The data and science regarding mapping and assessing landslide hazards are constantly evolving. As new data and science become available, assessments of landslide risk should be reevaluated.
- Over 50% of the population exposed to the combination of very high and high landslide susceptibility have either "very high" or "relatively high" social vulnerability.
- The impact of climate change on landslides is uncertain. If climate change affects atmospheric conditions, the vulnerability and impacts of landslides in San Mateo County could increase.
- There are existing homes in landslide risk areas throughout the County. The degree of vulnerability of these structures depends on the codes and standards applied during construction.
- Future development could lead to more homes in landslide risk areas.
- Landslides may cause negative environmental consequences (e.g., water quality degradation).
- The risk associated with the landslide hazard overlaps the risk associated with other hazards, including earthquakes, flooding, and wildfire. The County has an opportunity to pursue mitigation alternatives with multiple objectives to reduce risk from multiple hazards.

[249] United States Geological Survey. (2025). What Should I Know About Wildfires and Debris Flows? Retrieved from https://www.usgs.gov/faqs/what-should-i-know-about-wildfires-and-debris-flows.

- As the frequency and severity of wildfires increase in the State of California, the probability of post-fire debris flows will increase within San Mateo County.
- California's Disclosures in Real Property Transactions law requires disclosure if a property is in a landslide hazard area. Such disclosure is dependent upon knowledge by the seller or the seller's real estate agent, or the posting of a landslide hazard map at the offices of the County recorder, County assessor, and County planning agency, and a notice identifying the location of the map and any changes to it.
- Coastal bluff erosion is particularly susceptible to ocean wave height and the direction of wave approach. El Niño conditions often result in substantial increases in the rate of coastal bluff retreat. Roads and residential developments are most at risk from these hazards.

4.6.5.9. Risk Profile

FEMA Risk Index Score

The FEMA Landslide Risk Index score and rating represent a community's relative risk for landslides when compared to the rest of the United States. **Table 4-100** illustrates the Landslide Risk Index rating and score for San Mateo County.

Table 4-100. Landslide Total Risk Score *(FEMA National Risk Index)*

Rating	Score
Relatively High	99.7
Risk Index Values are calculated by combining the Social Vulnerability and Community Resilience components into a single Community Risk Factor, which is then multiplied by the Expected Annual Loss component (Expected Annual Loss x (Social Vulnerability / Community Resilience) = Risk Index).	

Overall Risk Score

Table 4-101 represents the Landslide Total Risk Score for San Mateo County, based on the Risk Assessment Methodology, as defined in Section 4.3 of this Plan.

Table 4-101. Landslide Total Risk Score

Hazard Event	Probability Factor	Sum of Weighted Extent Factors	Sum of Weighted Vulnerability Factors	Sum of Weighted Impact Factors	Consequence Score	Total Risk Score*
Landslide	2	9	9	30	48	44

Extent: Sum of the weighted Extent factors.
Vulnerability: Sum of the weighted Vulnerability factors.
Impact: Sum of the weighted Impact factors.

Consequence Score: Extent + Vulnerability + Impact (Sum of all weighted factors).
Total Risk Score = Probability x Consequence
* Normalized to 100

Total Risk Score Legend

Classification	Probability	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 4	0 – 12	0 – 24	0 – 32
Medium (M)	2	7 – 12	5 – 10	13 – 26	25 – 48	33 – 66
High (H)	3	13 – 18	11 – 15	27 – 39	49 – 72	67 – 100

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.6. Sea Level Rise

Sea level rise is the increase in the global mean sea level primarily driven by climate change, a trend that is expected to continue.[250] Sea level has a significant role in flooding, coastal erosion, and storm hazards (e.g., coastal flooding).

The two (2) main causes of global sea level rise are thermal expansion caused by warming of the ocean (water expands as it warms) and increased melting of land-based ice (e.g., glaciers and ice sheets). The ocean is absorbing more than 90% of the increased global surface temperatures. As ocean and atmospheric warming continue, sea levels will continue to rise at higher rates than in the current century.[251] Regardless of the cause of sea level rise, a higher average sea level means that hazards such as coastal flooding, flooding, and coastal erosion will have more severe impacts on the population, property, and infrastructure.[252]

Sea level rise varies regionally along the United States coasts due to variations in land and ocean heights. In the next three (3) decades, sea level rise is anticipated to be, on average, four (4) to eight (8) inches in the western United States.[253] However, based on current greenhouse gas emissions and rising global temperatures, a certain amount of sea level rise is guaranteed, with projections for California south of Cape Mendocino of 26 to 36 inches.[254]

As one of the primary and most devastating impacts of climate change, sea level rise is of critical importance to San Mateo County because it is bounded by the Pacific Ocean to the west and the San Francisco Bay to the east.[255] Sea level rise is expected to cause a profound shift in coastal flooding over the next 30 years, as tide and storm surge heights increase and move further inland. By 2050, damaging flooding is expected to occur, on average, 10 times more often than it does currently, and it can be intensified by other local factors.[256] Currently, the rate of sea level rise in the San Francisco Bay area roughly matches the global average and is expected to exceed it under half of NOAA's sea level rise scenarios.[257]

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250 National Geographic. (n.d.). Sea Level Rise. Retrieved from https://education.nationalgeographic.org/resource/sea-level-rise/.
251 National Oceanic and Atmospheric Administration, National Ocean Service. (2024). Is Sea Level Rising? Retrieved from https://oceanservice.noaa.gov/facts/sealevel.html.
252 National Oceanic and Atmospheric Administration, Climate.gov. (2022). Climate Change: Global Sea Level. Retrieved from https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level.
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254 San Mateo County Office of Sustainability. (2018). Sea Level Rise Vulnerability Assessment. Retrieved from https://www.smcsustainability.org/wp-content/uploads/2018-03-12_SLR_VA_Report_2.2018_WEB_FINAL.pdf.
255 Ibid.
256 National Oceanic and Atmospheric Administration, National Ocean Service. (2022). Global and Regional Sea Level Rise Scenarios for the United States. Retrieved from https://earth.gov/sealevel/us/internal_resources/756/noaa-nos-techrpt01-global-regional-SLR-scenarios-US.pdf.
257 San Francisco Baykeeper. (n.d.). Sea Level Rise Long California: Questions and Answers. Retrieved from https://baykeeper.org/shoreview/california-slr.html.

4.6.6.1. Location

All coastal communities in the County are vulnerable to sea level rise. The County's coastline is roughly 60 miles long, with elevations ranging from sea level at Montara, Pacifica, and Half Moon Bay State Beaches, to 100-foot bluffs at Mori Point in the City of Pacifica.[258]

- The eastern side of the County (Bayshore) is exposed to the San Francisco Bay, which is more of a closed system. Communities include Redwood City, Foster City, the City of East Palo Alto, the City of San Mateo, the City of Burlingame, and the City of South San Francisco. The Bayshore is low-lying, and its densely developed lands are already subject to interior flooding caused by heavy rainfall events and high tides that back up Bay water through outfalls into storm drains, then onto streets and other areas.
- The western side of the County (Coastside or coastline) is exposed to the Pacific Ocean, which pertains to the more dynamic sea level rise conditions associated with wave action. Communities include the City of Half Moon Bay, City of Pacifica, Pescadero, and Martin's Beach. The Coastside, which has both cliffs and beaches, is more sparsely populated and is exposed to coastal surge and erosion.

The San Mateo County Sea Level Rise Hazard Map Viewer illustrates various types of information.[259]

- The 3.3 feet and 6.6 feet sea level rise scenarios from the Coastal Storm Modeling System by USGS in 2019. These scenarios include sea level rise hazards, such as permanent and temporary inundation, storm surge, cliff retreat, shoreline change, and groundwater rise. (Our Coast, Our Future)
- The 3 feet, 5.5 feet, and 6.4 feet sea level rise scenarios from the Adapting to Rising Tides, which was released in 2017. These scenarios include sea level rise hazards, such as permanent and temporary inundation and storm surge.
- The groundwater with a 5.5 feet sea level rise scenario is from a joint dataset, produced by Pathways Climate Institute and the San Francisco Estuary Institute in 2022. It uses the 66-inch sea level rise scenario from the set of Adapting to Rising Tides scenarios. (Shallow Groundwater)
- The water elevation points are from various datasets. The Pacific Coast Water Elevations are made up of Mean Higher High Water (MHHW) elevations, Dynamic Water Level (DWL) with a 100-year storm, and the Total Water Level (TWL) with a 100-year storm. The MHHW and DWL data are taken from the CoSMos water elevation rasters. The TWL difference values are taken from modeled extreme total water levels. The Bayside Tidal Elevations layer contains MHHW and 100-year Extreme Tide level data from the San Francisco Tidal Datums and Extreme Tides Study. The Bayside Total Water Levels layer contains data from FEMA's San Mateo Coastal Analysis Reports. The analysis of total water levels was conducted in areas where wave hazards are a risk, so some points may not have a TWL value.
- FEMA SFHAs and BFEs are provided for these zones and represent the elevation of surface water resulting from a 1% annual chance flood.

[258] San Mateo County Office of Sustainability. (2018). Sea Level Rise Vulnerability Assessment. Retrieved from https://www.smcsustainability.org/wp-content/uploads/2018-03-12_SLR_VA_Report_2.2018_WEB_FINAL.pdf.
[259] San Mateo County Office of Sustainability. (n.d.). San Mateo County Sea Level Rise Hazard Map Viewer. Retrieved from https://experience.arcgis.com/experience/1946d443e24b490a8f2ac9d785534f3d/page/Page?org=smcmaps&views=View.

4.6.6.2. Extent/Severity

There are no intensity scales for measuring sea level rise. In 2022, the State of California updated sea level rise scenarios based on the sets of probabilistic projections developed in the Intergovernmental Panel on Climate Change Sixth Assessment Report (IPCC AR6) and reflect the most up-to-date scientific understanding of the physical drivers of sea level rise. Information about the likelihood of meeting or exceeding a specific scenario is embedded in the scenarios themselves (e.g., the High Scenario is less likely than the Intermediate Scenario). **Table 4-102** illustrates the median values of Sea Level Scenarios for each decade from 2020 to 2150, with a baseline of 2000. All median scenario values incorporate the local estimate of vertical land motion.[260]

Table 4-102. Table Sea Level Rise Scenarios for San Francisco

Year	Low *(feet)*	Intermediate-Low *(feet)*	Intermediate *(feet)*	Intermediate-High *(feet)*	High *(feet)*
2020	0.2	0.2	0.2	0.3	0.3
2030	0.3	0.4	0.4	0.4	0.4
2040	0.4	0.5	0.6	0.7	0.8
2050	0.5	0.6	0.8	1	1.3
2060	0.6	0.8	1.1	1.5	2
2070	0.7	1	1.4	2.2	2.9
2080	0.8	1.2	1.8	3	4.1
2090	0.9	1.4	2.4	3.8	5.3
2100	1.1	1.6	3.1	4.8	6.5
2110	1.8	1.8	3.8	5.6	7.8
2120	1.1	2	4.4	6.4	9
2130	1.2	2.2	4.9	7	9.9
2140	1.3	2.4	5.4	7.6	10.8
2150	1.3	2.6	6	8.1	11.7

San Mateo County has been identified as the most vulnerable county to sea level rise in the State of California.[261] The potential for new or prolonged flooding as sea levels rise will not be confined to the shoreline. Sea level rise will increase the likelihood of major flood events because higher water levels in tidal creeks and flood control channels will reduce their capacity to discharge rainfall runoff. While some coastal infrastructure already floods when heavy rainfall events coincide with high tides, rising sea levels will increasingly cause flooding during smaller, more frequent rainfall events.

The extent of sea level rise in the County will continue to increase over the next 30 to 80 years. Sea level rise projections for 2100 in the Our Coast, Our Future (OCOF) and the Adapting to Rising Tides (ART) program scenarios used for this assessment correlate to 0.98 to 1.35 inches per year over the next 80

[260] California Ocean Protection Council. (2024). State of California Sea Level Rise Guidance (2024 Science and Policy Update). Retrieved from https://opc.ca.gov/wp-content/uploads/2024/05/California-Sea-Level-Rise-Guidance-2024-508.pdf.
[261] San Mateo County Civil Grand Jury. (2021). San Mateo County: California's Ground Zero for Sea Level Rise. Retrieved from https://sanmateo.courts.ca.gov/system/files/sea-level-rise.pdf.

years. Sea level rise projections are periodically revised as climate models are improved and new data and observations are incorporated. The intensity of these flooding impacts can be exacerbated by various conditions.

- **Daily Tidal Inundation:** As sea level rises, the amount of land and infrastructure subjected to daily inundation by high tides, also known as increases in mean higher high water, will increase. This would result in increased permanent future inundation of low-lying areas.
- **Annual High Tide Inundation (King Tides):** King Tides are abnormally high, predictable astronomical tides that occur about twice per year. They are the highest tides that occur each year during the winter and summer when the Earth, moon, and sun are aligned. Winter King Tides may be amplified by severe weather, making these events more intense. King Tides result in temporary inundation, including nuisance flooding of low-lying roads, boardwalks, and waterfront promenades.
- **Extreme High Tide Inundation (Storm Surge):** When Pacific Ocean storms coincide with high tides, storm surge can elevate Pacific Ocean and San Francisco Bay water levels and produce extreme high tides. Extreme high tides can cause severe inundation of low-lying roads, boardwalks, and promenades. They can exacerbate coastal and riverine flooding, cause upstream flooding, and interfere with stormwater outfalls.
- **El Niño Winter Storms:** During El Niño winters, atmospheric and oceanographic conditions in the Pacific Ocean produce severe winter storms that bring severe rainfall and storm conditions to the Bay Area. Tides are often elevated 0.5 to 1.0 feet above normal along the coast, and wind setup can further elevate water levels. Typical impacts include inundation of low-lying roads, boardwalks, and waterfront promenades; storm drain backups; wave damage to coastal structures; and erosion of natural shorelines.
- **Ocean Swell and Wind-Wave Events (Storm Waves):** Pacific Ocean storms and strong thermal gradients can produce strong winds that move across the ocean and the Bay. When the wind blows over long stretches of open water, it can generate large waves that impact the shoreline and cause damage. Typical impacts include wave damage along the shoreline, particularly to coastal structures (e.g., levees, docks, piers, wharves, and revetments); backshore inundation due to wave overtopping of structures; and erosion of natural shorelines.

Extent/Severity		Extent Factor	Weighted Factor	Score
Low	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a low-intensity incident.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Extent/Severity Score = Extent Factor x Weighted Factor***				

Catastrophic Potential

A catastrophic incident can be defined as any natural, human-caused, or technological disaster that results in extraordinary levels of casualties, damage, or disruption, severely affecting the population (including mass evacuations), infrastructure, environment, economy, national morale, or government functions in the area.[262] The catastrophic potential of sea level rise is low in San Mateo County.

[262] Federal Emergency Management Agency. (2019). National Response Framework (Fourth Edition). Retrieved from https://www.fema.gov/sites/default/files/documents/NRF_FINALApproved_2011028.pdf.

Catastrophic Potential		Extent Factor	Weighted Factor	Score
Low	Low potential that this hazard could be catastrophic.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Catastrophic Score = Extent Factor x Weighted Factor***				

4.6.6.3. Warning Time

There is no warning time mechanism for sea level rise. However, probabilistic projections for sea level rise over various timescales have been developed. These projections are intended to help decision-makers better understand future sea level rise and when a particular level is expected to occur.

Sea level rise is not a hazard that requires near-term advance warnings to support response and recovery operations. However, several state, county, and federal programs conduct active surveillance of sea level rise in San Mateo County, helping communities prepare for and mitigate the long-term impacts.

4.6.6.4. Probability and Frequency

The probability of occurrence for sea level rise in San Mateo County is high because a *significant* sea level rise event is likely to occur annually. Research projects an increase in sea level rise between 1.4 and 5.5 feet by 2100 along the San Mateo County coast. The rates of sea level rise in the planning area are likely to increase in this century compared to the last, and are expected to increase up to one (1) foot by 2030, two (2) feet by 2050, and 5.5 feet by 2100.[263]

Scenario Exceedance Probabilities: Given that sea level rise depends critically on whether and how quickly global emissions are reduced and on how warming trends are mitigated, no probabilities can be assigned directly to each sea level rise scenario. *Refer to the Extent/Intensity section of this profile*. Instead, each scenario integrates information on a potential future pathway for warming levels and emissions. By extension, assumptions about future warming levels can be translated into the probability of exceeding a particular scenario in that assumed future.[264]

- **Low Scenario:** The probability of exceeding this scenario is greater than 90% at all warming levels.
- **Intermediate-Low Scenario:** This scenario is consistent with the median projected sea level rise in a 2°C world, which means there is a 50% probability of exceeding this scenario with 2°C of additional warming by 2100.
- **Intermediate Scenario:** At a warming level of 3°C in 2100, the probability of exceeding this scenario is 5%. In a very high emissions future with low confidence processes, there is about a 50% chance of exceeding this scenario by 2100.
- **Intermediate-High Scenario:** At a warming level of 3°C in 2100, the probability of exceeding this scenario is 0.1% when not considering the low confidence processes, emphasizing the degree to which these processes are needed to get to this scenario. With the low confidence processes, the probability of exceeding this scenario is approximately 20% for very high warming levels.

[263] California Ocean Protection Council. (2024). State of California Sea Level Rise Guidance (2024 Science and Policy Update). Retrieved from https://opc.ca.gov/wp-content/uploads/2024/05/California-Sea-Level-Rise-Guidance-2024-508.pdf.
[264] Ibid.

- **High Scenario:** The probability of exceeding this Scenario in 2100 is less than 0.1% for all warming levels without considering low confidence processes. However, with very high emissions and warming, and with contributions from the low confidence processes, this probability increases to 8%.

Probability of Occurrence		Probability Factor	Weighted Factor	Score
High	A significant hazard event is likely to occur annually.	3	N/A	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology).				

FEMA NRI Annualized Frequency

The FEMA NRI does not assess sea level rise.

4.6.6.5. Past Events

Sea level rise is a dynamic phenomenon that is constantly evolving, and its impacts are not associated with or reported as singular events. It is already affecting San Mateo County communities. In the last century, San Francisco Bay water levels have risen approximately eight (8) inches.

4.6.6.6. Vulnerability

Population Exposed

14% or less of the population in San Mateo County is exposed to sea level rise. The population in areas with low-lying shorelines is particularly vulnerable. This consists of the population within the coastal communities along the San Francisco Bay, including Redwood City, Foster City, the City of East Palo Alto, the City of San Mateo, the City of Burlingame, and the City of South San Francisco; and along the Pacific Ocean, including the City of Half Moon Bay, the City of Pacifica, Pescadero, and Martin's Beach. Furthermore, sea level rise will result in distinctive exposure for underserved populations, including, but not limited to, children, the elderly, individuals with limited English proficiency, limited education, low/limited income, poor and/or unstable housing conditions, and limited access to vehicles. Areas with increased community vulnerability to sea level rise are concentrated in the County's northern and coastal regions, as well as along the US Highway 101 corridor (i.e., East Palo Alto and Redwood City).[265]

- There are several areas where high concentrations of young children could be exposed to sea level rise, including parts of the City of East Palo Alto, the City of Menlo Park, Redwood City, the City of San Carlos, the City of Belmont, Redwood Shores, Foster City, the City of San Mateo, the City of Burlingame, the City of Brisbane, and El Granada. Many of these areas include the Bay shoreline and also the US Highway 101 corridor.
- Communities of color are most concentrated in the northern and southern parts of the County, including Daly City, Town of Colma, City of South San Francisco, City of San Bruno, City of Millbrae, Redwood City, and the City of East Palo Alto.

[265] San Mateo County Office of Sustainability. (2018). Sea Level Rise Vulnerability Assessment. Retrieved from https://www.smcsustainability.org/wp-content/uploads/2018-03-12_SLR_VA_Report_2.2018_WEB_FINAL.pdf.

- The communities with the highest concentration of limited English proficiency residents are located in the northern and southern areas of the County. These include Daly City, the Town of Colma, South San Francisco, Redwood City, and East Palo Alto.
- The highest concentrations of lower educational attainment (adults with a high school degree or less) are in the City of East Palo Alto, the City of Half Moon Bay, the Town of Colma, Redwood City, and the City of San Mateo.
- A high concentrations of low-income households are scattered throughout the County, but the largest percentage is located in the City of East Palo Alto and the North Fair Oaks area. Many other low-income residents could also be exposed to sea level rise in the City of Menlo Park, Redwood City, the City of San Carlos, the City of San Mateo, the City of Burlingame, and some sections of the City of Millbrae, the City of San Bruno, and the City of Brisbane. Along the coast, the City of Pacifica, El Granada, and the South Coast area have the largest low-income areas exposed to flooding or erosion (impacts from sea level rise). Daly City has a small section of low-income households on the coast.

Population Exposure		Vulnerability Factor	Weighted Factor	Score
Low	14% or less of the population is exposed to the hazard.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population Exposure Score = Extent Factor x Weighted Factor***				

Property Exposed

25% or more of the total assessed property, infrastructure, and resources value is exposed to sea level rise in San Mateo County. Much of the Bayshore is protected by 11 miles of levees and floodwalls (mostly in Redwood City, Foster City, and the City of San Mateo), and the remainder of the shoreline is characterized by 41 miles of non-engineered berms, embankments, and other shoreline features, with an additional 200 miles of inner shoreline features. This critical network currently plays a key role in reducing the frequency and exposure of flooding, enabling economic and community development in low-lying coastal cities such as Foster City, the City of San Mateo, the City of East Palo Alto, and portions of the City of Pacifica. Other facilities and critical infrastructure exposed to sea level rise include:[266]

- **Airport:** San Francisco International Airport and San Carlos Airport
- **Hazardous Materials Sites:** 140 hazardous materials sites, which include four (4) Superfund sites and one (1) closed landfill
- **Energy Infrastructure and Pipelines:** Two (2) power plants, 73 miles of transmission lines, and 12 electric substations
- **Ground Transportation:** 292 miles of local roads, 71 miles of highways (US Highway 101, State Routes 1, 84, 92, and 114), Millbrae Intermodal Station, Caltrain Stations (South San Francisco, San Bruno, and Millbrae)
- **Community and Commercial Land Use, Services, Facilities, and Commercial:** 23 healthcare facilities (including one (1) hospital with an emergency room), three (3) police stations, eight (8) fire stations, 34 schools, 36,604 residential parcels, and 2,235 commercial parcels

[266] Ibid.

- **Wastewater Systems:** Five (5) wastewater treatment plants
- **Stormwater Systems and Interior Drainage:** All tide gates, 51 stormwater pump stations, and 112 miles of storm drains
- **Seaports:** Port of Redwood City
- **Homeless Shelters:** At least two (2) homeless shelters (LifeMoves Maple Street Shelter and Samaritan House in South San Francisco)
- **Park and Recreation Areas:** 79 parks, and portions of the San Francisco Bay Trail and the California Coastal Trail

Property Exposure		Vulnerability Factor	Weighted Factor	Score
High	25% or more of the total assessed property value is exposed to the hazard.	3	1	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property Exposure Score = Extent Factor x Weighted Factor***				

Changes in Development

Information on changes in development within San Mateo County is provided in **Chapter 3** (Community Profile) of this Assessment.

The changes in development have increased San Mateo County's exposure to sea level rise between 5% and 9%. Any development along the coast increases the County's exposure to sea level rise. Land use on the Bayside is mostly commercial and residential, while the Coastside is dominated by agriculture, vacant land, and vegetation.[267]

Changes in Development		Vulnerability Factor	Weighted Factor	Score
Medium	Changes in development have increased the community's exposure to the hazard between 5% and 9%.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Changes in Development Score = Extent Factor x Weighted Factor***				

4.6.6.7. Impacts

Population and Life Safety

A population that is exposed to sea level rise is likely to experience some adverse impacts (e.g., injuries requiring acute medical care). Sea level rise and flooding increase the risk of injury, disease, mental stress, and displacement, as well as disruptions to medical services and infrastructure. Impacts of sea level rise inundation to population and life safety in San Mateo County can include the following:[268]

- **Disruption of Medical Services and Health-Supporting Infrastructure:** The County is home to dozens of public health facilities, which provide emergency and nonemergency health care to both inpatients and outpatients. These facilities include critical facilities such as police and fire

[267] Ibid.
[268] Ibid.

stations, hospitals, hospices, clinics, recreation centers, emergency and homeless shelters, and doctors' offices. Many of these facilities, mostly police and fire stations, are located within the boundaries of the high-end sea level rise flood inundation scenario, meaning they will be affected by long-term flooding. Generally, health-related infrastructure can be damaged during inundation and requires replacement or repair. Additionally, the transportation network connecting people to public health facilities may be damaged or disrupted during floods, impairing their ability to seek medical attention.

- **Physical Injury or Death:** Flooding and inundation can result in physical injury or death due to trauma or drowning. Physical injuries resulting from flood inundation typically occur during or immediately after the event, often due to wet, slippery, flooded roads. Common injuries include sprains, blunt trauma, animal bites, and nonfatal electrocution. Furthermore, during inundation events, strong winds could damage power lines, and intense precipitation could cause streets to flood and stormwater and wastewater systems to overflow, increasing the risk of common injuries.
- **Infectious Disease:** Sea level rise influences the spread of infectious diseases through food, water, and air, resulting in vector-borne, respiratory, contamination, waterborne, and food-borne diseases. In addition to the direct health hazards associated with flooding and storm surges, other indirect health hazards arise after the flooding event.
- **Mental Health, Displacement, and Income Loss:** Flooding can lead to mental health issues (e.g., PTSD, anxiety, depression) and other chronic health problems. Those with pre-existing mental health conditions may require more assistance following flooding. Flooding or sea level rise can cause both temporary and permanent loss of homes and jobs, especially when workplaces are impacted. Since income and stable housing are vital to health, losing these due to economic disruptions can make it harder to afford essentials like food and medical care, increasing stress and depression, and worsening overall health. Displacement from home disrupts social networks and employment, heightening risks of PTSD, depression, suicide, and a rise in chronic illnesses and mental health issues.
- **Existing Health Conditions:** Individuals with existing health conditions are most susceptible to the impacts of sea level rise and flooding. As a risk factor for the impacts of sea level rise, health conditions can exacerbate the negative effects of climate change. Existing health conditions can present additional challenges for individuals in preparing for, responding to, and recovering from the impacts of flooding and sea level rise. Health conditions can include chronic diseases (e.g., asthma, diabetes, heart disease, obesity, cancer), a disability (e.g., impairments of vision, movement, thinking, communicating, hearing, and mental health), and mental illness (e.g., depression, PTSD).

Population and Life Safety Impact		Impact Factor	Weighted Factor	Score
Medium	Populations exposed to this hazard are likely to experience some adverse impacts, such as injuries requiring acute medical care.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population and Life Safety Impact Score = Impact Factor x Weighted Factor***				

Underserved Population

The underserved population exposed to sea level rise in San Mateo County is likely to experience some adverse/disproportionate impacts (e.g., injuries requiring acute medical care). This population may include, but is not limited to, the elderly, children, racial and ethnic minorities, individuals with limited English proficiency, educational barriers, low-income, housing vulnerability, and limited access to vehicles. Some populations have heightened vulnerability to sea level rise impacts due to specific sensitivities, greater exposure, or lower adaptive capacity. Demographic and social characteristics may affect an individual's or household's ability to prepare for, respond to, and recover from sea level rise, contributing to their overall vulnerability.[269]

- Individuals under 18 years old or over 65 years old (especially very young or very elderly) are more susceptible to the impacts of sea level rise when compared to other populations because these groups are more likely to experience difficulties during an inundation event, as well as preparing and responding.
- Racial and ethnic minorities often face a higher rate of chronic health issues such as cardiovascular disease, kidney problems, asthma, and chronic obstructive pulmonary disease. They are more likely to have pre-existing health conditions, live in substandard housing in high-hazard areas, and lack the political and economic resources needed to prepare for and recover from sea level flooding. Additionally, these communities tend to experience higher poverty rates, lower educational achievement, overcrowded households, limited healthcare awareness, and reduced access to transportation.
- Individuals with limited English proficiency are less likely to have access to resources that can help address sea level rise and are more likely to suffer from health and social vulnerabilities that may exacerbate their impacts.
- Limited education could hinder an individual’s ability to understand preparedness information and access recovery resources, and those without a high school diploma are less likely to be aware of how to access government services. Educational advancement is strongly linked to individual and community health, wealth, and resilience. Overall, communities with high concentrations of individuals without high school diplomas are more vulnerable to the effects of sea level rise.
- Low-income individuals may have limited resources to prepare for sea level rise inundation and cope during and after flooding. They have fewer financial resources to address sea level rise needs amid other needs (e.g., housing, healthy food, health, transportation). Low-income populations face a higher risk of exposure to sea level rise because they are more likely to live in vulnerable areas (e.g., rural, coastal, flood-prone areas), neighborhoods with older, poorly maintained infrastructure, and areas with higher air pollution. Low-income individuals are more likely to have higher rates of heart disease, diabetes, and stroke.
- Individuals with poor housing conditions are at higher risk for vulnerability to sea level rise inundation. Housing vulnerability can be affected by unstable housing conditions and tenure, as well as poor quality housing infrastructure.
- Households that are dependent on public transportation, whether due to financial resources or a desire to live a more active life or reduce GHG emissions, are more vulnerable to the impacts of sea level rise inundation than households that own vehicles. This vulnerability not only affects their ability to travel safely during or after an incident, but may also compromise evacuation

[269] Ibid.

(including picking up family members) if they rely heavily on public transportation infrastructure damaged by the hazard.

The County's geographic location (San Francisco Bay to the east and the Pacific Ocean to the west) exposes many underserved communities to the impacts of sea level rise. Additionally, many populations in the County exhibit at least one (1) or more health, demographic, and/or social vulnerability to sea level rise, including age, race, income, housing vulnerability, and pre-existing health conditions. The combined impact of these vulnerabilities places some individuals and communities at an increased risk.

Underserved Population Impact		Impact Factor	Weighted Factor	Score
Medium	Underserved populations exposed to the hazard are likely to experience some adverse/disproportionate impacts, such as injuries requiring acute medical care.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Underserved Population Impact Score = Impact Factor x Weighted Factor***				

Property, Facilities, and Critical Infrastructure

More than $5 million in property damage is expected from a *single major* sea level rise event, or damages are expected to occur to 15% or more of the property value within San Mateo County. The assessed value of parcels within sea level rise inundation areas in San Mateo County exposed to near-term (present-day) flooding exceeds $1 billion, and the assessed value of parcels exposed to erosion and flooding in the long term (between 50 and 100 years) totals approximately $39.1 billion. More than 30,000 residential parcels and 3,000 commercial parcels may also be vulnerable in the long term. Many of the County's facilities and critical infrastructure are concentrated near the Bay, but these structures will not necessarily be equally affected over time. Proximity to the water also does not correlate with vulnerability, as structures and systems located uphill from the Bay will be affected by cross-cutting and cascading impacts of sea level rise.[270]

- **Flood Protection Infrastructure:** Rising sea levels, coupled with severe weather, have significantly increased the risk of catastrophic flooding should levees, floodwalls, or non-engineered structures fail. If a levee or seawall were damaged by high water or erosion, it could be expensive to repair, and it would no longer provide the same level of protection for property and people.
- **Airports:** Overtopping of shoreline levees would lead to temporary or permanent inundation of airport runways and facilities. Impaired facilities would include runways, terminals, parking structures, roads, and railways. Flooded pump stations or backed-up storm drains on runways or in parking garages could trigger more widespread impairment of upstream stormwater systems, further exacerbating flooding elsewhere. Loss of airport-wide operations and disruption to the regional transportation system. Costly damage to airplanes from exposure to saltwater.
- **Hazardous Materials:** Release of hazardous contaminants from flooding, saltwater intrusion, or erosion. Potentially significant impacts on public health and environmental quality.
- **Energy Infrastructure and Pipelines:** Corrosion of pipelines resulting from saltwater intrusion and erosion. Flooding affecting pipelines and substations may lead to temporary or permanent power

[270] Ibid.

outages. There are safety risks for the public from contact with exposed power lines or other health concerns related to power outages.

- **Ground Transportation:** Erosion of roadways causes significant and costly damage, and pick-up/drop-off stations may become inundated. Roadways and railways can face permanent or temporary flooding, leading to the loss of public transportation services. This results in disruption of local and regional travel and commutes. Navigating flooded roads poses threats to public safety and life.
- **Community and Commercial Land Use, Services, Facilities, and Commercial:** Inundation of commercial and residential buildings, damage or loss of emergency care facilities, flooding at medical facilities, homes, schools, and businesses, along with the loss of police and fire services, leading to major disruptions in economic activity.
- **Wastewater Systems:** Inundation of low-lying external power feeds would cause a wastewater treatment plant to cease functioning, and inundation of pump stations may cause significant flooding in water treatment plants. Saltwater intrusion into the wastewater treatment process would disrupt biological treatment and could significantly impede or completely shut it down. Flooding, or secondary impacts of flooding, could cause overflow of untreated waste at the wastewater treatment plant and offsite. This overflow would have significant impacts on environmental and public health.
- **Stormwater Systems and Interior Damage:** Rainstorms and high tides might occur simultaneously, blocking creeks and channels from discharging into San Francisco Bay or the Pacific Ocean. This could lead to overflow in creeks and channels, causing substantial local flooding. Inundation of pump stations could impair local flood mitigation capacity and lead to more severe flooding in adjoining properties and neighborhoods. Overflow from insufficiently sized interior drainage infrastructure can inundate nearby areas. Flood conditions can damage culverts, pump stations, canals, and other stormwater infrastructure, leading to expensive repairs.
- **Seaports:** Inundation of the Port of Redwood City access roads and railways would make it impossible for trucks and trains to access the Port, leading to a loss of operations. Closure of the Port, which would disrupt the delivery of goods and services, could have broader regional economic impacts. Without using the Port for shipping goods, local roads and interstate systems could see increased traffic. Hazardous contaminants present at the Port could be released into the Bay, harming the health and safety of plants, animals, and residents in the area.
- **Homeless Shelters:** Inundation of the LifeMoves Maple Street Shelter would incur significant costs to repair or replace the facility. Replacement of the shelter could cost over $5 million. Disruption of homeless shelter services could negatively affect shelter residents, who are already a vulnerable population.
- **Parks and Recreation Areas:** Erosion-related trail loss could decrease recreational opportunities for lower-income residents, limit tourism, and cause overcrowding in parks unaffected by sea level rise. Both temporary and permanent flooding of trails and park areas might occur due to shoreline levee overflows, creek flooding, or drainage system backups.

Property, Facilities, and Critical Infrastructure Impact		Impact Factor	Weighted Factor	Score
High	More than $5 million in property, facilities, and infrastructure damage is expected from a single significant event, or damages are expected to occur to 15% or more of the property value within the jurisdiction.	3	2	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property, Facilities, and Critical Infrastructure Impact Score = Impact Factor x Weighted Factor***				

Economy

A single *significant* sea level rise event in San Mateo County is likely to result in a total economic impact greater than $100,000 but less than or equal to $10 million. If left unaddressed, sea level rise could have significant impacts on the County's economy, particularly in the long term. The County has some of the wealthiest zip codes in the United States, as well as some very poor areas. Furthermore, six (6) Fortune 500 companies are in the heart of Silicon Valley - Oracle, Visa, Facebook, Gilead Sciences, Franklin Resources, and Core-Mark.[271]

The most severe economic impacts of sea level rise occur where flooding and erosion intersect with high population density and critical infrastructure. In these high-hazard areas, businesses may face long-term closures for repairs or be forced to relocate, leading to significant service disruptions. Beyond physical damage to inventory and utility systems, these disruptions result in revenue and wage losses, as well as increased operational costs for temporary rentals or relocation.

Furthermore, the County faces substantial pressure to repair or adapt vulnerable public assets. Sea level rise directly threatens the continuity of essential services, including drinking water, wastewater treatment, and power and communication networks. Regional transit arteries (e.g., Bay Area Rapid Transit, Caltrain, US Highway 101) and the San Francisco International Airport (the seventh busiest airport in the country, with over 50 million passengers annually) are at risk of frequent inundation, which could stifle regional commerce and tourism. These risks extend to the private sector via the real estate market as sea level rise impacts intensify; property values decline, insurance premiums increase, and ultimately, access to loans and capital for homeowners and local businesses is restricted.

Economic Impact		Impact Factor	Weighted Factor	Score
Medium	Total economic impact is likely to be greater than $100,000, but less than or equal to $10 million.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Economic Impact Score = Impact Factor x Weighted Factor***				

FEMA NRI Expected Annual Loss Estimates

The FEMA NRI does not assess sea level rise.

[271] Ibid.

Environment

Environmental impacts from a *single major* sea level rise event are likely to be minimal, requiring little to no outside resources and support; and/or repair, cleanup, restoration, or preservation work. Many of the County's natural assets, including habitats, ecosystem services, and species, are already (or will be) exposed to sea level rise because they are aquatic systems or located adjacent to water (e.g., tidal marshes, sandy beaches). Sea level rise impacts on natural assets include the loss of habitat for endangered plants and species, biodiversity, natural flood protection, and natural recreational areas. Even a small increase in sea levels can have devastating effects on coastal habitats. It can cause destructive erosion, wetland flooding, salt contamination of aquifers and agricultural soils, and the loss of habitat for fish, birds, and plants.[272]

- **Beaches:** Approximately 13 miles of beaches in the County are exposed to sea level rise hazards. Some parts of the County's coastline are eroding faster than others. For example, Surfer's Beach has lost around 140 feet of beach since 1964. In addition to providing essential habitat for local fauna, beaches are an important recreational asset for all County residents and provide tourism-related economic benefits.
- **Faunal Species:** The County's natural environment hosts a diverse array of shorebirds, waterfowl, and various terrestrial and aquatic species, including some that are threatened or endangered. The threatened western snowy plover, which nests on the ground, is especially vulnerable because its habitat is sensitive to both temporary and permanent flooding. As sea levels rise, dry ground is expected to diminish, potentially further restricting habitat for the Western Snowy Plover.
- **Groundwater:** Sea level rise is anticipated to increase the groundwater table and could pose several potential vulnerabilities and impacts to groundwater resources in the County, particularly in areas where municipal water supplies depend on groundwater. Most of the County's population receives potable water from the State Water Project, meaning groundwater is not a primary source for the potable water supply.
- **Kelp:** There are 11 acres of kelp forests in the County, which are impacted by sea level rise through decreased light availability and forced shoreward migration. Sea level rise may also alter the shape of the coastline and the composition of the substrate (e.g., rocky versus sandy shores), thereby affecting the availability and habitat conditions of macroalgae and their associated species.
- **Rocky Intertidal Habitat Rocky:** Intertidal habitat is moderately sensitive to sea level rise. The Habitat is also affected by hard armoring of the coastline and roads that prevent the inland migration of beaches. These sensitivities are compounded by other natural and human-related factors (e.g., temperature, invasive species, pH, pollution).
- **Wetlands:** Wetlands are a vital natural resource in San Mateo County, safeguarding the shoreline from flooding and erosion caused by severe weather. They also serve as important recreational and educational resources for the community. Additionally, wetlands function as natural barriers that help prevent flooding, control erosion, maintain water quality, and support habitats for fish and wildlife. They provide crucial flood protection, but rising sea levels could diminish these benefits by transforming wetlands into mudflats as water levels increase.

[272] Ibid.

Wetlands are relatively resilient to short-term flooding but are more vulnerable to permanent sea level rise, which could turn them into tidal mudflats. They might counteract such changes by accumulating sediment or rising at a pace equal to the rate of sea level rise, reflecting their adaptive capacity. This process relies on sufficient sediment supply, the extent of shoreline development, and the rate of water-level rise. Yet sea level rise is projected to outpace marsh-level rise, and development near wetlands is likely to block marsh migration. Without significant intervention, most tidal marshes are expected to shift to other habitats (i.e., downshifting), bringing new plant and animal species. Overall, over 7,000 acres of wetlands (approximately 80% of those in the County) could be lost due to flooding or erosion.

Environment Impact		Impact Factor	Weighted Factor	Score
Low	Environmental impact from a single significant event is likely to be minimal, requiring little to no outside resources and support; and/or minimal repair, cleanup, restoration, or preservation work.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Environmental Impact Score = Impact Factor x Weighted Factor***				

Continuity of Operations/Delivery of Services

No impacts are expected on San Mateo County's ability to meet the essential day-to-day operational demands and needs of the community in the event of a *single major* sea level rise event. This is because sea level rise is a gradual, ongoing phenomenon rather than a sudden-onset hazard (e.g., flooding from an atmospheric river); a single event is not expected to compromise the County's immediate operational capability. Daily essential services in San Mateo County remain resilient amid current conditions as local and state stakeholders continue implementing long-term adaptation strategies.

Continuity of Operations/Delivery of Services Impact		Impact Factor	Weighted Factor	Score
No Impact	No impact on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single significant event.	0	1	0
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Continuity of Services/Delivery of Services Impact Score = Impact Factor x Weighted Factor***				

Future Development

Information on changes in development within San Mateo County is provided in **Chapter 3** (Community Profile) of this Assessment.

Future development trends will minimally increase the impact of sea level rise in San Mateo County. The overall land area of San Mateo County will decrease as sea level rise permanently inundates the County's lowest areas. This will affect land use and planning in coastal communities. Local general plans, as well as climate action/adaptation plans in San Mateo County and its jurisdictions, will guide future development. State mandates have sought to strengthen land use applications in areas affected by sea level rise. Furthermore, California legislation (e.g., AB 32, AB 2800, SB 97, SB 379) equips local governments with planning tools to address the impacts of sea level rise as future development pressures intersect with sea level rise hazard areas.

Also, population growth in sea level inundation areas and coastal communities will increase vulnerability and the impacts of sea level rise. Growth over the past decade has considerably increased. The ABAG forecasts a steady rise in the number of households through 2050, estimating a 37% increase by that year.[273] As sea level continues to rise, floodplain boundaries may extend further inland, exposing areas that are not currently vulnerable to sea level rise.

Future Development Impact		Impact Factor	Weighted Factor	Score
Low	Future development trends will minimally increase the impacts of this hazard.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Future Development Impact Score = Impact Factor x Weighted Factor***				

Climate Change

Climate change trends will significantly increase the risks and impacts of sea level rise. The primary reasons for sea level rise are the added water from ice sheets and glaciers and the ocean water's thermal expansion, both of which are a result of increasing global average temperatures.[274] Since 1880, the global average sea level has risen between eight (8) and nine (9) inches, and in 2022, the average sea level was four (4) inches above 1993 levels, a record high. Due to land processes (e.g., erosion, oil and groundwater extraction, subsidence), the rate of local sea level rise along the United States coastline exceeds the global average. Furthermore, nuisance flooding is occurring 300% to 900% more frequently than it did 50 years ago.[275]

Sea level rise is already happening. California has experienced around seven (7) inches of sea level rise from 1905 to 2005, and the rate of increase is projected to grow through the rest of this century. Sea level rise is also projected to increase coastal storm surge heights, while an increase in the number and intensity of extreme storms will lead to more frequent and severe flooding events over the next century. Coastal erosion, temporary flooding, and permanent inundation will increase the risk to coastal communities, infrastructure, and wetlands. The National Research Council (NRC) projects that areas south of Cape Mendocino in California, including San Mateo County, will experience a sea level rise of 17 to 66 inches by 2100. The NRC report indicates that sea level rise rates are likely to increase in this century compared to the last, and that California could experience up to one (1) foot of sea level rise by 2030, two (2) feet by 2050, and 5.5 feet by 2100. According to measurements taken at the San Francisco tide station at the Golden Gate, sea level has risen by eight (8) inches in the San Francisco Bay Area since 1897. Studies show that the Bay Area is particularly vulnerable to sea level rise and changes in salinity, temperature, and runoff, creating a convergence of impacts that will affect Coastside and Bayside communities alike.[276]

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[273] Association of Bay Area Governments. (2023). Plan Bay Area 2050 : San Mateo County Factsheet. Retrieved from https://planbayarea.org/sites/default/files/documents/PBA2050PlusSanMateoCountyFactSheet.pdf?cb=85bf8b37.

[274] National Aeronautics and Space Administration. (n.d.). Understanding Sea Level: Vital Signs. Retrieved from https://sealevel.nasa.gov/understanding-sea-level/key-indicators/global-mean-sea-level/.

[275] Lindsey, R. (2023). Climate Change: Global Sea Level. Retrieved from https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level.

[276] San Mateo County Office of Sustainability. (2018). Sea Level Rise Vulnerability Assessment. Retrieved from https://www.smcsustainability.org/wp-content/uploads/2018-03-12_SLR_VA_Report_2.2018_WEB_FINAL.pdf.

Climate Change Impact		Impact Factor	Weighted Factor	Score
High	Climate Change trends will significantly increase the impacts of this hazard.	3	1	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Climate Change Impact Score = Impact Factor x Weighted Factor***				

Secondary Impacts

The following are cascading or indirect hazards that may follow the primary hazard event. These hazards can occur concurrently with or be triggered by the initial event and may exacerbate its overall impact.

- Flooding and Inundation
- Wave Impacts
- Erosion
- Changes in Sediment Supply and Movement
- Saltwater Intrusion
- Habitat and Species Loss
- Hazardous Materials Incidents
- Transportation Disruptions
- Power Outage

4.6.6.8. Issues

Sea level rise presents a range of challenges that can impact a community's preparedness, response, recovery, and mitigation efforts. While not exhaustive, the following outlines key issues that San Mateo County may encounter during such events.

- The County should consider the adoption of higher regulatory standards to mitigate the impacts of sea level rise on redevelopment.
- Advances in data and science drive quick progress in measuring sea level rise impacts. The County should remain committed to aligning with the most current data and scientific understanding as it develops.
- The costs to reduce impacts from sea level rise will be high and may exceed the County's resources.
- Effective risk communication will be essential for successfully mitigating sea level rise.
- Potential environmental losses include biodiversity and habitat for endangered plant and animal species.
- Potential social losses include natural flood protection and natural recreation areas.
- Future permanent inundation of currently dry areas could disrupt local and regional commutes and travel.
- Saltwater intrusion of wastewater treatment plants could disrupt the biological treatment process and significantly impede or shut down the treatment process.

4.6.6.9. Risk Profile

FEMA Risk Index Score

The FEMA NRI does not assess sea level rise.

Overall Risk Score

Table 4-103 represents the Sea Level Rise Total Risk Score for San Mateo County, based on the Risk Assessment Methodology, as defined in Section 4.3 of this Plan.

Table 4-103. Sea Level Rise Total Risk Score

Hazard Event	Probability Factor	Sum of Weighted Extent Factors	Sum of Weighted Vulnerability Factors	Sum of Weighted Impact Factors	Consequence Score	Total Risk Score*
Sea Level Rise	3	6	8	25	39	54

Extent: Sum of the weighted Extent factors.
Vulnerability: Sum of the weighted Vulnerability factors.
Impact: Sum of the weighted Impact factors.

Consequence Score: Extent + Vulnerability + Impact (Sum of all weighted factors).
Total Risk Score = Probability x Consequence
* Normalized to 100

Total Risk Score Legend

Classification	Probability	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 4	0 – 12	0 – 24	0 – 32
Medium (M)	2	7 – 12	5 – 10	13 – 26	25 – 48	33 – 66
High (H)	3	13 – 18	11 – 15	27 – 39	49 – 72	67 – 100

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.7. Severe Weather

For the purposes of this LHMP, severe weather includes heavy rainfall, severe thunderstorms, strong winds, tornadoes, heat waves/extreme heat, and fog.

Heavy Rainfall

There is no single definition for heavy (or extreme) rainfall. However, meteorologists consider instances in which precipitation (rain or snow) at a location substantially exceeds normal amounts. The amount of precipitation needed to qualify as heavy rain varies with location and season. Rainfall events share characteristics such as high moisture and an atmospheric disturbance (e.g., an atmospheric river), and when these conditions persist over an area, that area will receive more rainfall.[277] Heavy rainfall is most frequently measured by tracking event frequency, analyzing the mean return period, and measuring precipitation over a given period (typically inches of rain within a 24-hour period).[278]

A relatively common weather pattern that brings heavy rainfall and mountain snow to California is often referred to as an **atmospheric river**. About 30% to 50% of the annual precipitation in the West Coast states occurs during a few atmospheric river events, and approximately 80% of the levee breaches in California's Central Valley are associated with atmospheric rivers.[279] Atmospheric rivers are long, concentrated regions in the atmosphere that transport moist air from the tropics to higher latitudes. The combination of moist air and high wind speeds produces heavy precipitation upon landfall, especially over mountainous terrain. As atmospheric rivers move over land, conditions can be similar to a tropical cyclone, leading to flash flooding, mudslides, cyclone-force winds, increased wave heights, and catastrophic damage to life and property.[280]

Severe Thunderstorms

A thunderstorm is a rain shower with thunder and lightning. However, a thunderstorm is classified as severe when it contains one (1) or more of the following – hail of one (1) inch or greater, winds gusting in excess of 58 mph, and/or a tornado.[281]

For a thunderstorm to form, it needs three (3) basic ingredients – moisture, unstable rising air, and a lifting mechanism (e.g., cold fronts, mountainous terrain).[282] Thunderstorms form in three (3) stages –

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[277] National Oceanic and Atmospheric Administration. (2018). Ask the Scientist: Extreme Rainfall, Why it Happens and How We Predict It. Retrieved from https://www.noaa.gov/stories/ask-scientist-extreme-rainfall-why-it-happens-and-how-we-predict-it.
[278] United States Environmental Protection Agency. (2023). Climate Change Indicators: Heavy Precipitation. Retrieved from https://19january2021snapshot.epa.gov/climate-indicators/climate-change-indicators-heavy-precipitation_.html.
[279] Monroe, R. (2019). New Scale To Characterize Strength And Impacts Of Atmospheric River Storms. Retrieved from https://scripps.ucsd.edu/news/new-scale-characterize-strength-and-impacts-atmospheric-river-storms.
[280] National Oceanic and Atmospheric Administration. (2025). Atmospheric Rivers: What are They and How Does NOAA Study Them? Retrieved from https://research.noaa.gov/2023/01/11/atmospheric-rivers-what-are-they-and-how-does-noaa-study-them/.
[281] National Oceanic and Atmospheric Administration, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Thunderstorm Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/thunderstorms/.
[282] Ibid.

the developing stage, the mature stage, and the dissipating stage. The life cycle of a thunderstorm is outlined in **Table 4-104**.[283]

Table 4-104. Stages of a Thunderstorm

Stage		Description
1	Developing	Cumulus clouds form when warm, moist air rises into cold air, and as it rises, the moisture in the air condenses into water droplets. As long as warm air from below continues to rise, the clouds will continue to grow. An updraft of warm, moist air can form when air is forced up the side of a mountain or when air is forced upward at weather fronts, where warm and cool air masses collide. However, updrafts often form simply because warm air rises, without a mountain or front to guide them. Air near the ground heats up during the day as energy from the Sun heats the ground, which subsequently heats the air. The warm air rises higher in the atmosphere because warm air has less mass than cool air.
2	Mature	As the cumulus cloud continues to grow, the tiny water droplets within the cloud grow larger as more water from the rising air is added to them. The cloud starts to appear dark and gray as more water is added, and the growing droplets that make up the cloud become heavier. Once the rising air can no longer hold the raindrops, they begin to fall through the clouds. Meanwhile, cool dry air flows downward in the cloud (i.e., downdraft), resulting in rain. With an updraft, downdraft, and rain, the cloud is now called a cumulonimbus cloud, and the cycling of air up and down is called a thunderstorm cell. The moving air within the cloud builds up electric charges as it slides past other air, allowing lightning to form, and as a result, thunder when lightning strikes. Thunder often happens after you see the bolt of lightning because sound travels slower than light.
3	Dissipating	Once the downdrafts in the cloud become stronger than the updrafts, the storm begins to weaken. Since warm, moist air can no longer rise, cloud droplets can no longer form. The storm dissipates with light rain as the cloud disappears from the bottom to the top. For an ordinary storm, the whole process takes about one (1) hour. However, severe thunderstorms, which are much larger (e.g., supercells and squall lines) and powerful, tend to last several hours.

Thunderstorms can consist of one (1) or multiple convective cells, or one (1) extremely large and powerful convective cell. There are three (3) types of thunderstorms, which are described in **Table 4-105**.[284]

Table 4-105. Thunderstorm Types

Type	Description
Single-Cell Thunderstorms	Thunderstorms are created by just one (1) convection cell in the atmosphere. Most of these are small, lasting only about an hour, and are also called ordinary thunderstorms. These storms often form during the summer and feature towering cumulonimbus clouds that can reach up to 7.5 miles high. Rain and lightning are common. Sometimes hail falls.

[283] University Corporation for Atmospheric Research. (n.d.). How Thunderstorms Form. Retrieved from https://scied.ucar.edu/learning-zone/storms/how-thunderstorms-form.
[284] University Corporation for Atmospheric Research. (n.d.). Thunderstorms. Retrieved from https://scied.ucar.edu/learning-zone/storms/thunderstorms.

Type	Description
Multi-Cell Thunderstorms	Thunderstorms are made up of many convective cells that move as a single unit. Often, the convection cells are arranged as a cluster, with each cell at a different stage of the thunderstorm cycle. Multi-cell storms along a cold or warm front, where warm air is pushed high into the atmosphere above cold air, often form a line known as a squall line. The squall line can be up to 600 miles long. Strong wind gusts can often be found just ahead of the storm.
Supercell Thunderstorms	Thunderstorms with deep, rotating updraft winds (i.e., supercells) are very large and last for hours, releasing significant amounts of rain and sometimes even baseball-sized hail. These include fast-moving convection – air zooming upward at speeds of up to 175 mph. Rotation in supercells sometimes forms violent tornadoes, the largest and most damaging type, because the storms are so long-lived. Several tornadoes can be produced from one (1) supercell thunderstorm. Supercell clouds grow up to 11 miles high in the atmosphere. Although the least common type of thunderstorm, supercell thunderstorms are the most destructive.

Hail is a form of precipitation that consists of solid ice that forms inside thunderstorm updrafts. During a thunderstorm, hail forms when raindrops are carried upward by the thunderstorm's updrafts into extremely cold air and freeze. As the hailstones continue to rise, they collide with liquid water droplets that freeze onto their surfaces. Once the thunderstorm's updraft can no longer hold the weight of the hailstone, which occurs when the updraft weakens, or the hailstone is too heavy, then the hail falls. When a hailstone encounters different liquid water content conditions and temperatures within the thunderstorms, it causes the hailstone to have layers of clear and cloudy ice. The speed at which hail falls primarily depends on four (4) characteristics – hail size, friction between the hailstone and surrounding air, local wind conditions (horizontal and vertical), and the degree of melting of the hailstone.[285]

Strong Winds

Strong winds are classified as those exceeding 58 mph and are often called "straight-line" winds to differentiate the damage they cause from tornado damage. Damage from strong winds accounts for half of all severe weather reports in the lower 48 states and is more common than damage from a tornado. These types of winds can reach up to 100 mph and produce a damage path extending hundreds of miles.[286] **Table 4-106** outlines the different types of strong winds.[287]

Table 4-106. Strong Wind Types

Type	Description
Straight-line Winds	The term describes any thunderstorm wind not associated with rotation and is mainly used to distinguish it from tornadic winds.
Downdraft	A small-scale column of air that rapidly winds towards the ground.

[285] National Oceanic and Atmospheric Administration, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Hail Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/hail/.
[286] National Oceanic and Atmospheric Administration, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Damaging Winds Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/wind/.
[287] National Oceanic and Atmospheric Administration, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Types of Damaging Winds. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/wind/types/.

Type	Description
Macroburst	An outward burst of strong winds at or near the surface with horizontal dimensions larger than 2.5 miles occurs when a strong downdraft reaches the surface. Macroburst winds may begin over a smaller area and then spread to a broader area, sometimes producing damage similar to that of a tornado. Although usually associated with thunderstorms, macrobursts can also occur with showers that are too weak to produce thunder.
Microburst	A small, concentrated downburst that produces an outward burst of strong winds at or near the surface. Microbursts are small (less than 2.5 miles across) and short-lived (five (5) to 10 minutes) with maximum wind speeds sometimes exceeding 100 mph. There are two (2) types of microbursts: wet and dry. A wet microburst is accompanied by heavy precipitation at the surface. Dry microbursts, common in places like the high plains and the intermountain west, occur with little or no precipitation reaching the ground.
Gust Front	The leading edge of rain-cooled air that clashes with warmer thunderstorm inflow. Gust fronts are characterized by a wind shift, temperature drop, and gusty winds out ahead of a thunderstorm. Sometimes the wind pushes air aloft, forming a shelf cloud or a detached roll cloud.
Derecho	A widespread, long-lived windstorm that is associated with a band of rapidly moving showers or thunderstorms. A typical derecho consists of numerous downbursts and downburst clusters. By definition, if the wind damage swath extends more than 240 miles and includes wind gusts of at least 58 mph along most of its length, then the event may be classified as a derecho.
Haboob	A wall of dust that is pushed out along the ground from a thunderstorm downdraft at high speeds.
*A **downburst** is a general term used to describe both macrobursts and microbursts.*	

Strong winds not associated with thunderstorms are often referred to as gradient winds and typically result from tight pressure gradients between strong areas of low pressure and high pressure. These damaging winds can be just as strong as thunderstorm wind gusts, but cover a much larger area, and can result in widespread damage.[288] In coastal regions, a strong wind is called a gale. Gale winds are sustained surface winds between 34 and 47 knots (39 to 54 mph).

Tornado

A tornado is a narrow, violently rotating column of air that extends from a thunderstorm to the ground. A tornado is hard to see unless it forms a condensation funnel made up of water droplets, dust, and debris. Furthermore, tornadoes are among the most violent phenomena in the atmosphere, and atmospheric scientists continue to study them to better understand how they form.[289] Most tornadoes have wind speeds between 65 mph and 110 mph, are approximately 250 feet across, and travel less than a mile before dissipating. Some attain wind speeds of more than 300 mph, stretch more than a mile across, and stay on the ground for dozens of miles.[290] They usually last only a few minutes, although some have

[288] National Weather Service. (n.d.). Non Thunderstorm Wind Hazards. Retrieved from https://www.weather.gov/mhx/NonThunderstormWindHazards.
[289] National Oceanic and Atmospheric Administration, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Tornado Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/tornadoes/.
[290] National Geographic Society. (2024). Wind. Retrieved from https://education.nationalgeographic.org/resource/wind/.

lasted more than an hour and traveled dozens of miles. Tornadoes form mainly from two (2) types of thunderstorms – supercell and non-supercell.[291] **Table 4-107** outlines the types of tornadoes.[292]

Table 4-107. Tornado Types

Type	Description
Supercell	The most common and destructive tornadoes occur from supercells. A supercell is a rotating thunderstorm with a well-defined radar circulation called a mesocyclone. *Supercells can also produce damaging hail, severe non-tornadic winds, frequent lightning, and flash floods.* The rotating updraft from a supercell is the key development for a tornado. One way a column of air can begin to rotate is due to wind shear, when winds at two (2) different levels above the ground blow at different speeds or in different directions. Once the updraft is rotating and fed with warm, moist air flowing at the ground level, a tornado can form.
Non-Supercell	Nearly 20% of all tornadoes are associated with lines of strong thunderstorms called quasi-linear convective systems (QLCS). QLCS tornadoes frequently occur during the late night and early morning hours. These tornadoes, however, tend to be weaker and shorter-lived on average than those associated with supercell thunderstorms. NOAA's National Severe Storms Laboratory (NSSL) researchers are looking for ways to detect QLCS tornadoes more effectively.
Landspout	A type of non-supercell with a narrow, rope-like condensation funnel that forms while the thunderstorm cloud is still growing and there is no rotating updraft – the spinning motion originates near the ground.
Waterspout	Similar to landspouts, except they occur over water. Damage from these types of tornadoes tends to be EF2 or less.

Heat Wave/Extreme Heat

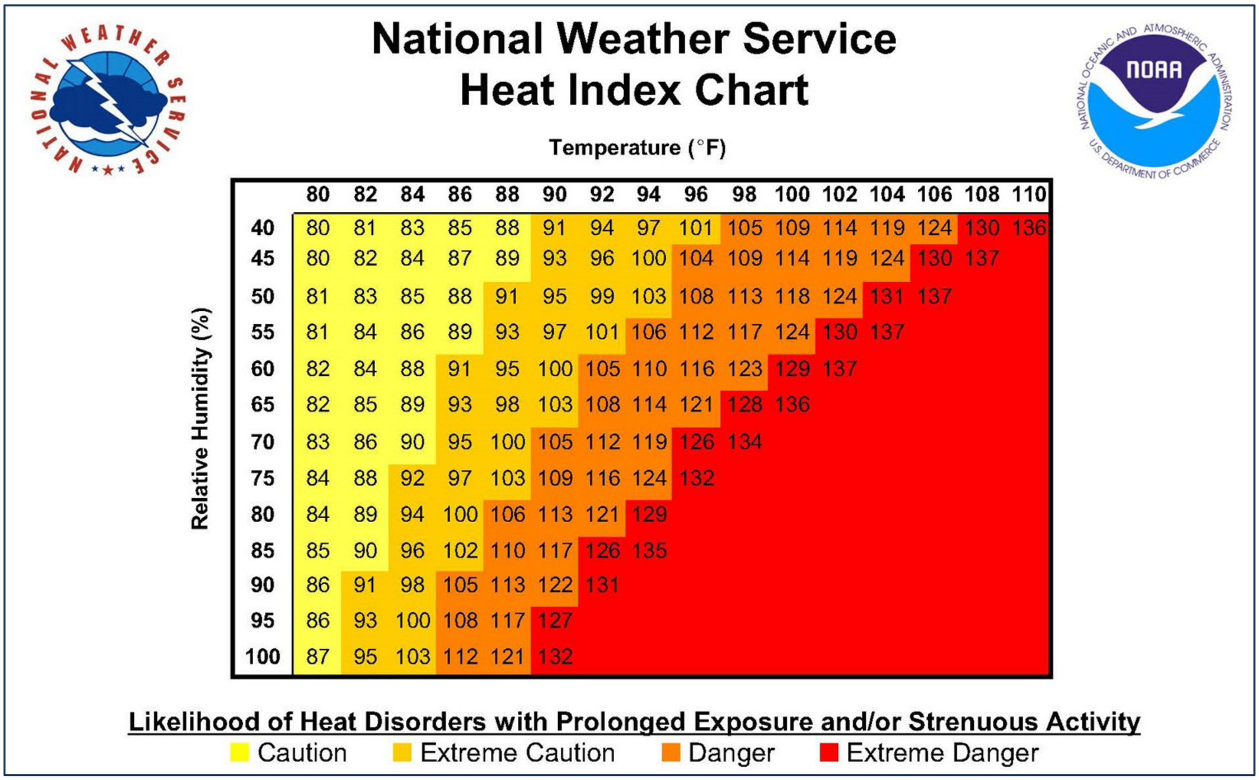
The definition of extreme/excessive heat varies based on factors such as location, weather conditions (e.g., temperature, humidity, cloud cover), and the time of year.[293] Furthermore, the thresholds identified by the NWS Local Forecast Office account for the local climate and expected temperature ranges for a given region. Extreme/excessive heat events are typically characterized by several consecutive days of high daytime and nighttime temperatures, which can pose significant health and safety risks. Elevated nighttime temperatures contribute to extreme/excessive heat events, as individuals and infrastructure lack the opportunity to cool down overnight. NWS uses specific temperature thresholds to define extreme/excessive heat events. During such events, there is an increased likelihood of heat-related illnesses (e.g., heat cramps, heat exhaustion, heat stroke) and potential stress on critical infrastructure, power grids, and water resources.

Heat alone does not make high temperatures a threat; it is the combination of heat and humidity that makes them dangerous.[294] The Heat Index is a measure of how hot the human body perceives the air to be when relative humidity is factored into the actual air temperature (i.e., ambient temperature). **Figure**

[291] National Oceanic and Atmospheric Administration, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Tornado Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/tornadoes/.
[292] National Oceanic and Atmospheric Administration, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Types of Tornadoes. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/tornadoes/types/.
[293] U.S. Environmental Protection Agency and the Centers for Disease Control and Prevention. (2016). Climate Change and Extreme Heat: What You Can Do to Prepared. Retrieved from https://www.epa.gov/sites/default/files/2016-10/documents/extreme-heat-guidebook.pdf.
[294] National Oceanic and Atmospheric Administration. (2022). Heat Index. Retrieve from https://www.noaa.gov/jetstream/global/heat-index#.

4-15 illustrates the NWS Heat Index Chart. The NWS primarily uses Heat Index values to determine excessive heat events and issue the appropriate advisories.[295]

Figure 4-15. NWS Heat Index Chart



National Weather Service
Heat Index Chart

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure and/or Strenuous Activity
Caution   Extreme Caution   Danger   Extreme Danger

Fog

Fog is a cloud near the ground that forms when air near the ground can no longer hold all the moisture it contains. This occurs either when air is cooled to its dew point or when the air's moisture content increases. NWS considers fog particularly hazardous when fog reduces visibility to 0.25 mile or less over a widespread area. These types of incidents can close roads, result in vehicle accidents and airport delays, and impair the effectiveness of emergency response.

Fog in the Bay Area has different origins depending on the time of year. In the summer, the area is characterized by cool marine air and persistent coastal stratus and fog. In winter, ground fog forms in the moist regions of the Sacramento River Delta and arrives in the region via Suisun, San Pablo, and San Francisco bays on cool easterly drainage winds. While this type of fog is less frequent than summer fog, it is typically denser and more likely to cause significantly reduced visibility.

4.6.7.1. Location

Severe weather can occur anywhere in the San Mateo County region and affect the entire planning area.

Low-lying communities near streams or lakes are more prone to flooding when water levels rise during heavy rainfall. Other areas not close to bodies of water can also flood during heavy rainfall events due to

[295] National Weather Service. (n.d.). Heat Forecast Tools. Retrieved from https://www.weather.gov/safety/heat-index.

inadequate stormwater systems. *Refer to Section 4.5.4 (Flood) of this Plan for more information on flooding.* Although heat waves/extreme heat can occur throughout San Mateo County, the hottest temperatures tend to be in the urban lowlands along the Bay and the area southeast of the coastline between Pescadero and San Gregorio. Meanwhile, the cooler temperatures are found along the mountain ridge running northwest to southeast through the center of the County. San Mateo County's unique terrain, combined with the California climate and proximity to the San Francisco Bay to the east and the Pacific Ocean to the west, creates an ideal environment for fog. Fog is more prevalent on the Coastside.

4.6.7.2. Extent/Severity

Severe weather can be life-threatening and can cause substantial damage to infrastructure and property. The extent of damage caused by severe weather depends on the type of severe weather, its strength, and location.

Heavy Rainfall: The Atmospheric River Scale was developed in collaboration with the Center for Western Water and Weather Extremes at Scripps Institution of Oceanography at the University of California, San Diego, and NWS. The scale uses the amount of water vapor in the atmospheric river as its basis and a 24- to 48-hour period as its standard measurement of duration. For example, if an atmospheric river remains over an area for more than 48 hours, the category is increased by one (1), and if it is less than 24 hours, it is decreased by one (1) category. The Atmospheric River Scale has five (5) categories outlined in **Table 4-108**.[296]

Table 4-108. Atmospheric River Scale

Category		Description
1	Weak	Primarily beneficial.
2	Moderate	Mostly beneficial, but also hazardous.
3	Strong	Balance of beneficial and hazardous.
4	Extreme	Mostly hazardous, but also beneficial.
5	Exceptional	Primarily hazardous.

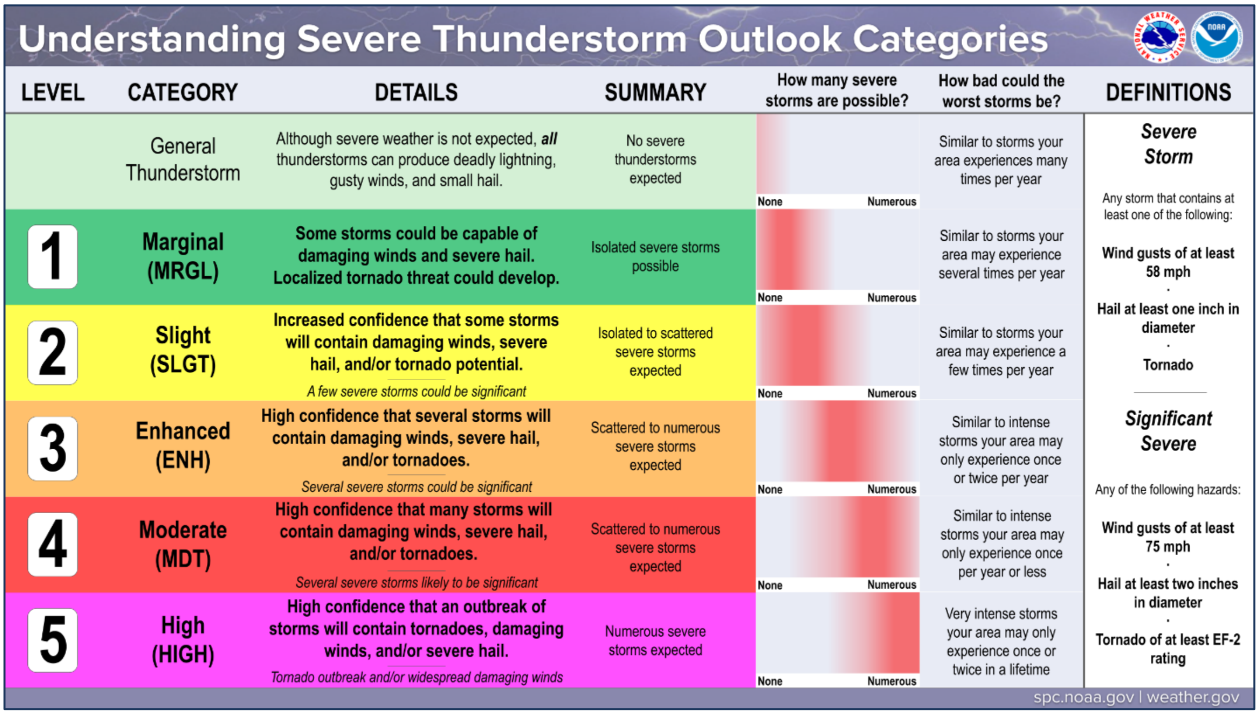
Extent/Severity		Extent Factor	Weighted Factor	Score
Medium	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a medium-intensity incident.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Extent/Severity Score = Extent Factor x Weighted Factor***				

Severe Thunderstorms: The NWS Storm Prediction Center (SPC) uses five (5) categories to describe the risk of severe thunderstorms when issuing Severe Thunderstorm Outlooks. The categorical forecast specifies the severe thunderstorm threat using numbers, descriptive labels, and colors. All thunderstorm

[296] Monroe, R. (2019). New Scale To Characterize Strength And Impacts Of Atmospheric River Storms. Retrieved from https://scripps.ucsd.edu/news/new-scale-characterize-strength-and-impacts-atmospheric-river-storms.

categories imply the potential for lightning and flooding. **Figure 4-16** illustrates NWS SPC severe thunderstorm categories.[297]

Figure 4-16. SPC Severe Thunderstorms Outlook Categories



Hail can vary in shape and size, and only the very large hailstones pose a serious risk to life safety. NWS reports hail size by comparing hailstones to traditional objects and using size-conversion tables to assess and translate severe hail reports. **Table 4-109** lists the traditional conversation of hail size descriptions.[298]

Table 4-109. Converting Traditional Hail Size Description

Hail *(inches)*	Object Analog Reported
0.25	Pea
0.50	Mothball
0.75	Penny
0.88	Nickel
1.00	Quarter
1.50	Walnut, Ping Pong
1.75	Golf Ball

[297] National Weather Services, Storm Prediction Center. (n.d.). Storm Prediction Center Severe Risk Categories. Retrieved from https://www.weather.gov/media/ewx/iwt/SPC_WPC_Differences.pdf.
[298] National Oceanic and Atmospheric Administration, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Hail Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/hail/.

Hail *(inches)*	Object Analog Reported
2.50	Tennis Ball
2.75	Baseball
3.00	Teacup
4.00	Softball
4.50	Grapefruit

Extent/Severity		Extent Factor	Weighted Factor	Score
Medium	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a medium-intensity incident.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Extent/Severity Score = Extent Factor x Weighted Factor***				

Strong Winds: The severity of wind can be measured using the Beaufort Wind Scale, which was developed to estimate and report wind speeds when a measuring instrument is unavailable (e.g., at sea). It was invented in 1805 by Sir Francis Beaufort, a British Navy officer, as a method for interpreting sea conditions. Since then, the scale has been modified to include the effects on land. **Table 4-110** outlines the 13 force classifications that comprise the Beaufort Wind Scale.[299]

Table 4-110. Beaufort Wind Scale

Force	Wind *(knots)*	Classification	Appearance of Wind Effects	
			On the Water	***On Land***
0	< 1	Calm	Sea surface is smooth and mirror-like.	Calm, smoke rises vertically.
1	1 – 3	Light Air	Scaly ripples and no foam crests.	Smoke drift indicates wind direction, and still wind vanes.
2	4 – 6	Light Breeze	Small wavelets, crests are glassy, and no breaking.	Wind felt on the face, leaves rustle, and vanes begin to move.
3	7 – 10	Gentle Breeze	Large wavelets, crests begin to break, and scattered whitecaps.	Leaves and small twigs are constantly moving, and light flags are extended.
4	11 – 16	Moderate Breeze	Small waves of one (1) to four (4) feet are becoming longer with numerous whitecaps.	Dust, leaves, and loose paper were lifted, and small tree branches were moved.
5	17 – 21	Fresh Breeze	Moderate waves of four (4) to eight (8) feet taking a longer form, many whitecaps, and some spray.	Small trees and leaves begin to sway.

[299] National Weather Service. (n.d.). Beaufort Wind Scale. Retrieved from https://www.spc.noaa.gov/faq/tornado/beaufort.html.

Force	Wind *(knots)*	Classification	Appearance of Wind Effects	
			On the Water	***On Land***
6	22 – 27	Strong Breeze	Larger waves of eight (8) to 13 feet, whitecaps are common, and more spray.	Larger tree branches are moving and whistling in the wires.
7	28 – 33	Near Gale	Sea heaps up, waves are 13 to 19 feet, and white foam streaks off breakers.	Whole trees are moving, and resistance is felt when walking against the wind.
8	34 – 40	Gale	Moderately high waves (18 to 25 feet) of greater length, edges of crests begin to break into spindrift, and foam is blown in streaks.	Twigs breaking off trees generally impede progress.
9	41 – 47	Strong Gale	High waves (23 to 32 feet), the sea begins to roll, dense streaks of foam, and spray may reduce visibility.	Slight structural damage occurs, and slate blows off roofs.
10	48 – 55	Storm	Very high waves (29 to 41 feet) with overhanging crests, sea white with densely blown foam, heavy rolling, and lowered visibility.	Seldom experienced on land, trees broken or uprooted, and considerable structural damage.
11	56 – 63	Violent Storm	Exceptionally high waves (37 to 52 feet), foam patches cover the sea, and visibility is reduced.	--
12	> 63	Hurricane	Air filled with foam, waves over 45 feet, sea completely white with driving spray, and visibility greatly reduced.	See Saffir-Simpson Hurricane Wind Scale.

Extent/Severity		Extent Factor	Weighted Factor	Score
Medium	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a medium-intensity incident.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Extent/Severity Score = Extent Factor x Weighted Factor***				

Tornado: Tornadoes can be life-threatening and cause substantial damage to infrastructure and property. The extent/severity of a tornado is measured using the Enhanced Fujita Scale (EF Scale), which is assigned based on an assessment of tornado-related damage after the event has occurred. The EF Scale is based on the estimated wind speeds and related damage. When tornado damage is surveyed, it is compared to a list of Damage Indicators and Degrees of Damage, which helps to better estimate the range of wind speeds the tornado likely produced. The EF Scale was revised from the original Fujita Scale and became operational in February 2007.[300] **Table 4-111** outlines the seven (7) intensities of the EF Scale and associated damage.[301]

Table 4-111. Enhanced Fujita Scale

EF Rating	3 Second Gust *(mph)*	Possible Damage
EFU	Unknown	Tornadoes that are known to occur but do not cause damage or have no damage indicators (e.g., those that remain in open fields).
EF0	65 – 85	Peels the surface off some roofs and causes some damage to gutters or siding.
EF1	86 – 110	Roofs severely stripped, mobile homes overturned or badly damaged, loss of exterior doors, windows, and other broken glass.
EF2	111 – 135	Roofs torn off well-constructed homes, foundations of frame homes shifted, mobile homes completely destroyed.
EF3	136 – 165	Entire stories of well-constructed homes were destroyed, and severe damage was inflicted on large buildings (e.g., shopping malls).
EF4	166 – 200	Well-constructed houses and whole-frame homes are completely leveled.
EF5	Over 200	Strong, frame houses leveled off their foundations and swept away; high-rise buildings have significant structural deformation.

Extent/Severity		Extent Factor	Weighted Factor	Score
Low	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a low-intensity incident.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Extent/Severity Score = Extent Factor x Weighted Factor***				

Heat Wave/Extreme Heat: The NWS HeatRisk Tool is a color-coded, numeric index that provides a forecast of the potential level of risk for heat-related impacts over a 24-hour period. This serves as a supplementary tool for official NWS heat products (i.e., watches, warnings, and advisories) and is meant to provide risk guidance for decision-makers and those who are sensitive to heat (i.e., access and functional needs population, the elderly, children) who require specific actions at levels that may be below the NWS heat product thresholds.

This Tool takes into consideration the following – how unusual the heat is for the time of the year, the duration of the heat (daytime and nighttime temperatures), and if those temperatures pose an elevated risk of heat-related impacts based on data from the CDC. **Table 4-112** outlines the NWS HeatRisk categories and risk of heat-related impacts.[302]

[300] National Weather Service. (n.d.). The Enhanced Fujita Scale (EF Scale). Retrieved from https://www.weather.gov/oun/efscale.
[301] International Code Council. (2020). How Damage Determines a Tornado's Rating: From Fujita to Enhanced Fujita. Retrieved from https://www.iccsafe.org/building-safety-journal/bsj-dives/how-damage-determines-a-tornados-rating-from-fujita-to-enhanced-fujita/.
[302] National Weather Service. (2024). NWS HeatRisk. Retrieved from https://www.wpc.ncep.noaa.gov/heatrisk/.

Table 4-112. NWS HeatRisk Categories

Category		Risk of Heat-Related Impacts
0	Green	Little to no risk from expected heat.
1	Yellow	**Minor:** This level of heat primarily affects individuals who are extremely sensitive to heat, especially when outdoors without effective cooling and/or adequate hydration.
2	Orange	**Moderate:** This level of heat affects most individuals sensitive to heat, especially those without effective cooling and/or adequate hydration. Impacts are possible on some health systems and on heat-sensitive industries.
3	Red	**Major:** This level of heat affects anyone without effective cooling and/or adequate hydration. Impacts are likely in some health systems, heat-sensitive industries, and infrastructure.
4	Magenta	**Extreme:** This level of rare and/or prolonged extreme heat, with little to no overnight relief, affects anyone without effective cooling and/or adequate hydration. Impacts are likely in most health systems, heat-sensitive industries, and infrastructure.

Extent/Severity		Extent Factor	Weighted Factor	Score
Medium	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a medium-intensity incident.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Extent/Severity Score = Extent Factor x Weighted Factor***				

Fog: The extent of dense fog is generally measured by visibility. NWS defines dense fog as conditions where visibility is reduced to 1/4 mile (0.4 kilometers) or less. Also, NWS uses spatial extent, persistence, location, and time of year to assess fog severity. The intensity of fog is typically assessed by visibility measurements, with lower visibility indicating denser fog. Dense fog can significantly impact transportation and public safety by reducing sight distances and increasing the risk of accidents.

Extent/Severity		Extent Factor	Weighted Factor	Score
Low	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a low-intensity incident.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Extent/Severity Score = Extent Factor x Weighted Factor***				

Catastrophic Potential

A catastrophic incident can be defined as any natural, human-caused, or technological disaster that results in extraordinary levels of casualties, damage, or disruption, severely affecting the population (including mass evacuations), infrastructure, environment, economy, national morale, or government functions in the area.[303]

Heavy Rainfall: The catastrophic potential for heavy rainfall is medium in San Mateo County.

[303] Federal Emergency Management Agency. (2019). National Response Framework (Fourth Edition). Retrieved from https://www.fema.gov/sites/default/files/documents/NRF_FINALApproved_2011028.pdf.

Catastrophic Potential		Extent Factor	Weighted Factor	Score
Medium	Medium potential that this hazard could be catastrophic.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Catastrophic Score = Extent Factor x Weighted Factor***				

Severe Thunderstorms: The catastrophic potential for severe thunderstorms is medium in San Mateo County.

Catastrophic Potential		Extent Factor	Weighted Factor	Score
Medium	Medium potential that this hazard could be catastrophic.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Catastrophic Score = Extent Factor x Weighted Factor***				

Strong Winds: The catastrophic potential for strong winds is low in San Mateo County.

Catastrophic Potential		Extent Factor	Weighted Factor	Score
Low	Low potential that this hazard could be catastrophic.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Catastrophic Score = Extent Factor x Weighted Factor***				

Tornado: The catastrophic potential for tornadoes is low in San Mateo County.

Catastrophic Potential		Extent Factor	Weighted Factor	Score
Low	Low potential that this hazard could be catastrophic.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Catastrophic Score = Extent Factor x Weighted Factor***				

Heat Wave/Extreme Heat: The catastrophic potential for heat waves/extreme heat is low in San Mateo County.

Catastrophic Potential		Extent Factor	Weighted Factor	Score
Low	Low potential that this hazard could be catastrophic.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Catastrophic Score = Extent Factor x Weighted Factor***				

Fog: The catastrophic potential for fog is low in San Mateo County.

Catastrophic Potential		Extent Factor	Weighted Factor	Score
Low	Low potential that this hazard could be catastrophic.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Catastrophic Score = Extent Factor x Weighted Factor***				

4.6.7.3. Warning Time

Heavy Rainfall: Heavy rainfall can lead to flooding, which can be unexpected and leave a narrow window for evacuation if needed. The NWS San Francisco Bay Area Forecast Office is responsible for issuing flood advisories and Flash Flood Warnings Impact-Based Warnings for events that occur within approximately six (6) hours of heavy rainfall in San Mateo County. *Refer to Section 4.5.4 (Flood) of this Plan for more information on the warning time during a heavy rainfall event.*

Severe Thunderstorm: The SPC is responsible for issuing severe thunderstorm watches when conditions warrant. While the NWS San Francisco Bay Area Forecast Office is responsible for issuing severe thunderstorm warnings. **Table 4-113** outlines the severe thunderstorm advisories.[304]

Table 4-113. NWS Severe Thunderstorm Advisories

Type	Description
Severe Thunderstorm Watch	Issued by the SPC when atmospheric conditions are favorable for the development of severe thunderstorms, producing at least one (1) inch diameter hail and/or 58 mph or greater wind speeds. The size of the watch can vary depending on the weather situation. Severe thunderstorm watches are usually issued for a duration of four (4) to eight (8) hours. They are typically issued well in advance of the actual occurrence of severe weather. Prior to issuing a Severe Thunderstorm Watch, SPC will usually contact the local NWS Forecast Office to discuss the current weather situation. Afterwards, SPC will issue a preliminary Severe Thunderstorm Watch, and the local NWS Forecast Office will adjust the watch (adding or eliminating counties) and issue it to the public via a Watch Redefining Statement. During the watch, the local Forecast Office will keep the public updated on events within the watch area and notify them when the watch expires or is canceled.
Severe Thunderstorm Warning	Issued by the local NWS Forecast Office when a severe thunderstorm or a line of severe thunderstorms capable of producing hail greater than one (1) inch in diameter and/or 58 mph or greater wind speeds. Severe thunderstorm warnings are usually issued for a duration of one (1) hour. They can be issued without a Severe Thunderstorm Watch already in effect. Severe thunderstorms can produce tornadoes with little or no advance warning. Severe Thunderstorm Warnings will include the storm's location, the towns affected, and the primary threat. If the severe thunderstorm affects nearshore or coastal waters, it will be issued as the combined product (Severe Thunderstorm Warning and Special Marine Warning). If the severe thunderstorm is also causing heavy rainfall, this warning may also be combined with a Flash Flood Warning. *Refer to Section 4.5.4 (Flood) of this Plan for more information on the warning time during a heavy rainfall event.*

[304] National Weather Service. (n.d.). National Weather Service Glossary. Retrieved from https://forecast.weather.gov/glossary.php.

Strong Winds: When a strong wind event is forecast, the NWS San Francisco Bay Area Forecast Office issues wind-related advisories, watches, and warnings. However, strong winds often accompany severe thunderstorms; therefore, severe thunderstorm watches and warnings typically include the potential for winds greater than 58 mph. **Table 4-114** outlines the wind-related advisories.[305,306]

Table 4-114. NWS Strong Wind Advisories

Type	Description
Wind Advisory	Sustained winds of 30 to 39 mph or stronger are expected to last for at least one (1) hour.
High Wind Watch	Issued when a high wind event is possible, but its occurrence, location, and/or timing remain uncertain.
High Wind Warning	Issued when sustained, strong winds with even stronger gusts are expected or occurring. Generally, for sustained wind speeds of 40 mph or greater lasting for one (1) hour or longer, or winds of 58 mph or greater for any duration.
Gale Watch	Issued for locations along the water when one (1) or both of the following conditions are possible to begin within 36 hours and are not directly associated with a tropical cyclone – sustained winds of 34 to 47 knots (39 to 55 mph) or frequent gusts (duration of two (2) or more hours) between 34 knots and 47 knots.
Gale Warning	Issued for locations along the water when one (1) or both of the following conditions are expected to begin within 36 hours and are not directly associated with a tropical cyclone – sustained winds of 34 to 47 knots (39 to 55 mph) or frequent gusts (duration of two (2) or more hours) between 34 knots and 47 knots.

Tornado: The average lead time (i.e., warning time/speed of onset) for a tornado warning is less than 15 minutes.[307,308] The SPC issues daily forecasts (i.e., convective outlooks) for organized severe thunderstorms over the United States based on current weather observations and forecast models. Furthermore, areas at higher risk of tornadoes are closely monitored. If conditions are favorable for tornado development, SPC issues tornado watches that typically last four (4) to six (6) hours. This way, the general public, local NWS forecast offices, emergency managers, and storm spotters are alerted to the possibility of tornadoes. Once a tornado has been sighted or indicated by weather radar, the NWS San Francisco Bay Area Forecast Office issues tornado warnings.[309] This means that a tornado warning is not issued until a storm has a radar-indicated rotation or a tornado is confirmed, resulting in extremely short lead times. **Table 4-115** outlines the tornado advisories.[310]

[305] Ibid.
[306] National Weather Service. (n.d.). Wind Warnings, Watches, and Advisories. Retrieved from https://www.weather.gov/safety/wind-ww.
[307] National Oceanic and Atmospheric Administration. (2011). Tornadoes 101. Retrieved from https://www.noaa.gov/stories/tornadoes-101.
[308] Erdman, J. (2021). How Accurate Are Tornado Warnings? Here's What the Last Five Years of Data Says. Retrieved from https://weather.com/storms/tornado/news/2021-04-05-tornado-warning-nws-accuracy.
[309] National Oceanic and Atmospheric Administration, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Tornado Forecasting. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/tornadoes/forecasting/.
[310] National Weather Service. (n.d.). National Weather Service Glossary. Retrieved from https://forecast.weather.gov/glossary.php.

Table 4-115. NWS Tornado Advisories

Type	Description
Tornado Watch	Issued by the NWS SPC when atmospheric conditions are favorable for the development of severe thunderstorms, potentially capable of producing tornadoes. The size of the watch can vary depending on the weather situation. Tornado watches are usually issued for a duration of four (4) to eight (8) hours. They are typically issued well in advance of the actual occurrence of tornadoes. Prior to issuing a Tornado Watch, SPC will usually contact the local NWS Forecast Office to discuss the current weather situation. Afterward, SPC will issue a preliminary Tornado Watch, and the local NWS Forecast Office will adjust the watch (adding or eliminating counties) and issue it to the public via a Watch Redefining Statement. During the watch, the local Forecast Office will keep the public updated on events within the watch area and notify them when the watch expires or is canceled.
Tornado Warning	Issued by the local NWS Forecast Office when a severe thunderstorm has radar indications of intense low-level rotation in the presence of atmospheric conditions conducive to tornado development, and/or is producing a tornado based on reports. They can be issued even if a Tornado Watch is not already in effect. Tornado Warnings will include the tornado's location and the areas in its path. If the tornado will affect the nearshore or coastal waters, it will be issued as the combined product (Tornado Warning and Special Marine Warning). If the thunderstorm causing the tornado is also producing heavy rainfall, this warning may be combined with a Flash Flood Warning. Refer to the Flood section of this Plan for more information on the warning time during a heavy rainfall event.

Heat Wave/Extreme Heat: During an extreme/excessive heat event, the NWS San Francisco Bay Area Forecast Office issues excessive heat advisories, watches, and warnings. NWS local offices collaborate with local agencies (e.g., emergency managers, public health professionals) to determine when to issue an advisory for the local area by establishing heat index thresholds for each advisory. **Table 4-116** outlines the NWS heat-related advisories for San Mateo County.[311]

Table 4-116. NWS Extreme Heat Advisories

Type	Description
Excessive Heat Outlook	Issued when the potential exists for an excessive heat event in the next three (3) to seven (7) days. An Outlook provides information to those who need considerable lead time to prepare for the event.
Heat Advisory	Issued within 12 hours of the onset of extremely dangerous heat conditions. Generally, an advisory is issued when the heat index values are expected to reach 100°F or higher for at least two (2) days, and nighttime air temperatures will not reach below 75°F.
Excessive Heat Watch	Issued when conditions are favorable for an excessive heat event in the next 24 to 72 hours. Generally, a watch is issued when the risk of a heat wave has increased, but its occurrence and timing are still uncertain.
Excessive Heat Warning	Issued within 12 hours of the onset of extremely dangerous heat conditions. Generally, a warning is issued when the heat index is expected to reach 105°F or higher for at least two (2) days, and nighttime air temperatures are not expected to reach below 75°F.

[311] Ibid.

Fog: When fog is forecast to reduce visibility by 0.25 mile or less, the NWS San Francisco Bay Area Forecast Office issues a dense fog advisory. **Table 4-117** outlines the fog-related advisories.[312]

Table 4-117. NWS Fog Advisories

Type	Description
Dense Fog Advisory	Issued when widespread visibility of 0.25 mile or less is expected.

4.6.7.4. Probability and Frequency

The probability of severe weather in San Mateo County depends on the type of severe weather.

Heavy Rainfall: The probability of occurrence for heavy rainfall events in San Mateo County is high because a *significant* event is likely to occur annually. The probability of heavy rainfall in San Mateo County is primarily driven by seasonal Pacific storm tracks and the region's complex coastal topography. Approximately 75% of San Mateo County's annual precipitation occurs between November and March, with 50% occurring between December and February. As average winter temperatures have increased, so has the frequency of heavy rainfall events (e.g., severe atmospheric rivers).[313]

Probability of Occurrence		Probability Factor	Weighted Factor	Score
High	A significant hazard event is likely to occur annually.	3	N/A	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology).				

FEMA NRI Annualized Frequency

The FEMA NRI does not assess heavy rainfall.

Severe Thunderstorms: The probability of occurrence for severe thunderstorm events in San Mateo County is medium because a *significant* event is likely to occur within 25 years. The probability of severe thunderstorms in San Mateo County is driven by rare atmospheric instability and seasonal frontal systems. While thunderstorms are relatively infrequent along the coast, they are most likely to occur during the winter and early spring. Typically, severe thunderstorms are caused by intense cold fronts from the Pacific Ocean.

Probability of Occurrence		Probability Factor	Weighted Factor	Score
Medium	A significant hazard event is likely to occur within 25 years.	2	N/A	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology).				

FEMA NRI Annualized Frequency

The FEMA NRI does not assess severe thunderstorms.

312 Ibid.
313

Strong Winds: The probability of occurrence for strong wind events in San Mateo County is high because a *significant* event is likely to occur annually. Due to its coastal topography, San Mateo County tends to experience moderate afternoon winds. However, in winter, particularly during atmospheric river events, strong winds tend to impact the County multiple times annually.

Probability of Occurrence		Probability Factor	Weighted Factor	Score
High	A significant hazard event is likely to occur annually.	3	N/A	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology).				

FEMA NRI Annualized Frequency

The strong wind annualized frequency value represents the average number of recorded strong wind hazard occurrences, in event days, per year over the period of record (36 years). **Table 4-118** outlines the annualized frequency for strong wind, based on FEMA NRI data, for San Mateo County.

Table 4-118. Strong Winds Annualized Frequency *(FEMA National Risk Index)*

Events on Record *(1986 – 2023)*	Annualized Frequency
1	0.03
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.	

Tornado: The probability of occurrence for tornado events in San Mateo County is low because a *significant* event is likely to occur within 100 years. Historically, tornadoes in San Mateo County are infrequent, and when they do occur, they tend to be weak.

Probability of Occurrence		Probability Factor	Weighted Factor	Score
Low	A significant hazard event is likely to occur within 100 years.	1	N/A	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology).				

FEMA NRI Annualized Frequency

The tornado annualized frequency value represents the average number of recorded tornado hazard occurrences, in event days, per year over the period of record (36 years). **Table 4-119** outlines the annualized frequency for tornadoes, based on FEMA NRI data, for San Mateo County.

Table 4-119. Tornado Annualized Frequency *(FEMA National Risk Index)*

Events on Record *(1986 – 2023)*	Annualized Frequency
3	0.05
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.	

Heat Wave/Extreme Heat: The probability of occurrence for heat wave/extreme heat events in San Mateo County is high because a *significant* event is likely to occur annually. In San Mateo County, extreme heat is an emerging hazard of concern because the region is not well accustomed to high temperatures, leaving both infrastructure and the public more vulnerable. These events are also increasing in both frequency and severity.

Probability of Occurrence		Probability Factor	Weighted Factor	Score
High	A significant hazard event is likely to occur annually.	3	N/A	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology).				

FEMA NRI Annualized Frequency

The FEMA NRI analyzes extreme heat data as a heat wave – a period of abnormally and uncomfortably hot and unusually humid weather, typically lasting two (2) or more days, with temperatures outside the historical averages for a given area. The heat wave annualized frequency value represents the average number of heat wave hazard occurrences per year, in event days, over the period of record (18 years). **Table 4-120** outlines the annualized frequency for heat waves, based on FEMA NRI data, for San Mateo County.

Table 4-120. Heat Wave Annualized Frequency *(FEMA National Risk Index)*

Events on Record *(2005 – 2024)*	Annualized Frequency
38	4.5
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.	

Fog: The probability of occurrence for fog events in San Mateo County is low because a *significant* event is likely to occur within 100 years. Research indicates that fog in the Bay Area has declined by approximately 33% since the mid-20th century due to climate change.[314]

Probability of Occurrence		Probability Factor	Weighted Factor	Score
Low	A significant hazard event is likely to occur within 100 years.	1	N/A	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology).				

FEMA NRI Annualized Frequency

The FEMA NRI does not assess fog.

4.6.7.5. Past Events

Table 4-121 lists all heavy rainfall, strong wind (58 mph or greater), tornado, excessive heat, and fog events included in this analysis that have been recorded in San Mateo County, as reported by NCEI, between 1996 and 2025.[315]

[314] Bardeen, S. (2024). The Future of Fog. Retrieved from https://www.ppic.org/blog/the-future-of-fog/.
[315] National Centers for Environmental Information. (2025). Storm Events Database. Retrieved from https://www.ncdc.noaa.gov/stormevents/.

Table 4-121. Severe Weather Past Events (1996 – 2025)

Event Type	Total Events	Total Deaths	Total Injuries	Total Property Damage	Total Crop Damage
Heavy Rainfall	20	1	20	$2.2 Million	$10.3 Million
Strong Winds *(Events with winds 58 mph or greater. Reported under High Wind by NCEI)*	56	1	1	$3.6 Million	$0
Tornado	2	0	0	$800,000	$0
Heat Wave/Extreme Heat *(Reported under Excessive Heat by NCEI)*	4	3	0	$0	$0
Fog *(Reported under Dense Fog by NCEI)*	9	0	0	$25,000	$0
Note: *Events listed in this table are based on impacts to an area (zone) of San Mateo County; as such, impacts to more than one area (zone) will result in multiple entries. When determining probability estimates, efforts were made to distinguish single events from events affecting multiple areas.*					

4.6.7.6. Vulnerability

Population Exposed

While the entire population of San Mateo County is exposed to severe weather, certain demographic groups have unique vulnerabilities to these events. This includes underserved populations such as low-income individuals, the elderly, children, people with access and functional needs, and those with limited English proficiency. Additionally, individuals lacking permanent shelter, outdoor workers (e.g., construction, utility, and agricultural workers), and those in substandard housing or mobile homes face heightened risks due to limited structural protection or direct exposure to the elements. **Table 4-122** summarizes the underserved population in San Mateo County.

Table 4-122. Underserved Population in San Mateo County

Category	Estimate	Percent
Population Below Poverty Level[316]	49,359	6.7%
Income Below $25,000 (Households)[317]	18,773	7.1%
Spanish Spoken at Home[318]	124,233	17.6%
Speak English Less Than "Very well"[319]	120,715	17.1%
Language Other Than English[320]	322,325	45.8%

[316] United States Census Bureau. (2024). S1701: Poverty Status in the Past 12 Months (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S1701?g=050XX00US06081.
[317] United States Census Bureau. (2024). S1901: Income in the Past 12 Months (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S1901?g=050XX00US06081.
[318] United States Census Bureau. (2024). S1601: Language Spoken at Home (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S1601?g=050XX00US06081.
[319] Ibid.
[320] Ibid.

Category	Estimate	Percent
Foreign Born[321]	265,258	35.7%
Household Without a Vehicle[322]	11,869	3.1%
65 Years and Over[323]	132,242	17.8%
Senior (65 Years and Over) Living Alone[324]	8,355	3.2%

Heavy Rainfall: 30% or more of the population in San Mateo County is exposed to heavy rainfall. The population most vulnerable to heavy rainfall is those living in flood-prone areas, particularly in floodplains, where the risk increases when rivers or creeks overflow. Densely populated areas are also highly vulnerable to urban/flash flooding due to the prevalence of impermeable surfaces (e.g., concrete, asphalt), which prevent water from seeping into the ground and exacerbate rainwater runoff. Additionally, older communities developed before modern stormwater regulations were implemented are vulnerable due to inadequate stormwater management capacity. Populations on the Pacific Coast and along the Bay, extending inland to the Bayshore Freeway and Interstate 880, have an increased vulnerability.[325] Vulnerability is further increased for individuals residing in areas isolated from major roads.

Population Exposure		Vulnerability Factor	Weighted Factor	Score
High	30% or more of the population is exposed to the hazard.	3	3	9
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population Exposure Score = Extent Factor x Weighted Factor***				

Severe Thunderstorms: 30% or more of the population in San Mateo County is exposed to severe thunderstorms. Although the entire population is vulnerable to severe thunderstorms, the most vulnerable include those in substandard housing or mobile homes that lack structural reinforcement to withstand winds of 58 mph or greater, tornadoes, or large hail. Individuals involved in outdoor recreational activities (e.g., boating, playing sports, hiking) are also at increased risk due to sudden exposure to these elements.

Population Exposure		Vulnerability Factor	Weighted Factor	Score
High	30% or more of the population is exposed to the hazard.	3	3	9
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population Exposure Score = Extent Factor x Weighted Factor***				

321 United States Census Bureau. (2024). DP02: Selected Social Characteristics in the United States (2024: ACS 5-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP5Y2024.DP02?g=050XX00US06081.
322 United States Census Bureau. (2024). S0801: Commuting Characteristics by Sex (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S0801?g=050XX00US06081.
323 United States Census Bureau. (2024). DP05: ACS Demographics and Housing Estimates (2024: ACS 5-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP5Y2024.DP05?g=050XX00US06081.
324 United States Census Bureau. (2024). DP02: Selected Social Characteristics in the United States (2024: ACS 5-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP5Y2024.DP02?g=050XX00US06081.
325 San Mateo County. (2025). 2023-2031 Housing Element of the General Plan. Retrieved from https://www.smcgov.org/planning/san-mateo-county-housing-element-update.

Strong Winds: 30% or more of the population in San Mateo County is exposed to strong winds. Although the entire population in San Mateo County is vulnerable to strong winds, the most vulnerable are those who live in substandard housing or mobile homes, as these structures often lack the reinforcement to withstand winds of 58 mph or greater.

Population Exposure		Vulnerability Factor	Weighted Factor	Score
High	30% or more of the population is exposed to the hazard.	3	3	9
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population Exposure Score = Extent Factor x Weighted Factor***				

Tornado: 30% or more of the population in San Mateo County is exposed to tornadoes. Although the entire population in San Mateo County is vulnerable to tornadoes, the most vulnerable are those in structures that lack reinforcement to withstand tornadic forces. Additionally, any individuals outdoors without immediate access to shelter are highly vulnerable during these rare events.

Population Exposure		Vulnerability Factor	Weighted Factor	Score
High	30% or more of the population is exposed to the hazard.	3	3	9
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population Exposure Score = Extent Factor x Weighted Factor***				

Heat Wave/Extreme Heat: 30% or more of the population in San Mateo County is exposed to heat waves/extreme heat. Certain communities are more vulnerable during heat waves/extreme heat events due to higher rates of pre-existing health conditions, reliance on public transportation, or living in urban areas with limited vegetation, which increases susceptibility to heat stress. Individuals with pre-existing medical conditions are uniquely at risk of heat-related illnesses during these events. San Mateo County has one of the lowest percentages of homes with air conditioning units in California.[326]

Population Exposure		Vulnerability Factor	Weighted Factor	Score
High	30% or more of the population is exposed to the hazard.	3	3	9
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population Exposure Score = Extent Factor x Weighted Factor***				

Fog: 30% or more of the population in San Mateo County is exposed to fog. The primary concern with dense fog is significantly reduced visibility for individuals operating vehicles (e.g., cars, buses, trucks, planes, boats). This creates hazardous travel conditions by obscuring other vehicles, pedestrians, and road markings, therefore, increasing the risk of vehicular accidents for anyone traveling during these events.

[326] San Mateo County Sustainability Department. (n.d.). Extreme Heat. Retrieved from https://www.smcsustainability.org/climate-resilience/climate-risks/extreme-heat/.

Population Exposure		Vulnerability Factor	Weighted Factor	Score
High	30% or more of the population is exposed to the hazard.	3	3	9
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population Exposure Score = Extent Factor x Weighted Factor***				

Property Exposed

Heavy Rainfall: 25% or more of the total assessed property, infrastructure, and resources value is exposed to a heavy rainfall event in San Mateo County. Any property that is prone to flooding is vulnerable to heavy rainfall. This includes any property located on the Pacific Coast and along the Bay that may experience flooding farther inland, extending as far as the Bayshore Freeway to the west and Interstate 880 to the east. In particular, properties and infrastructure in older, densely populated communities developed before modern stormwater regulations were implemented are vulnerable to urban/flash flooding due to inadequate stormwater management capacity. *Refer to Section 4.5.4 (Flood) of this Plan for more information on property exposure due to flooding.*

Property Exposure		Vulnerability Factor	Weighted Factor	Score
High	25% or more of the total assessed property value is exposed to the hazard.	3	1	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property Exposure Score = Extent Factor x Weighted Factor***				

The properties exposed to severe thunderstorms, strong winds, and tornadoes are similar. Although the entire San Mateo County property is vulnerable to severe thunderstorms, strong winds, and tornadoes, properties that are structurally compromised or located in particularly vulnerable areas are more susceptible to their impacts. For example, those in higher elevations and on ridges may be more prone to wind damage. Manufactured homes and properties in poor condition, or located closer to overhead power lines and large trees, may be more vulnerable to damage. In San Mateo County, approximately 1.2% of the occupied housing units are mobile homes.[327] Additionally, all above-ground property, infrastructure, and resources are potentially exposed to tornadoes. This includes, but is not limited to, buildings (i.e., residential, commercial, and industrial), utilities (e.g., power lines, communication towers), transportation systems (e.g., bridges, trains, railways), and critical facilities (e.g., hospitals, fire and police stations, schools).

Severe Thunderstorms: 25% or more of the total assessed property, infrastructure, and resources value is exposed to severe thunderstorms in San Mateo County.

Property Exposure		Vulnerability Factor	Weighted Factor	Score
High	25% or more of the total assessed property value is exposed to the hazard.	3	1	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property Exposure Score = Extent Factor x Weighted Factor***				

[327] United States Census Bureau. (2024). S2504: Physical Housing Characteristics for Occupied Housing Units (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S2504?q=San%20Mateo%20County,%20CA&g=050XX00US36067.

Strong Winds: 25% or more of the total assessed property, infrastructure, and resources value is exposed to strong winds in San Mateo County.

Property Exposure		Vulnerability Factor	Weighted Factor	Score
High	25% or more of the total assessed property value is exposed to the hazard.	3	1	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property Exposure Score = Extent Factor x Weighted Factor***				

Tornado: 25% or more of the total assessed property, infrastructure, and resources value is exposed to tornadoes in San Mateo County.

Property Exposure		Vulnerability Factor	Weighted Factor	Score
High	25% or more of the total assessed property value is exposed to the hazard.	3	1	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property Exposure Score = Extent Factor x Weighted Factor***				

Heat Wave/Extreme Heat: None of the total assessed property, infrastructure, and resources value is exposed to heat waves/excessive heat in San Mateo County. Heat wave/excessive heat is not known for causing significant direct damage to property; however, the following critical infrastructure in San Mateo County can become stressed during extreme/excessive heat events – power grid (e.g., power plants, transmission and distribution lines, substations), transportation (e.g., roads, railways, public transit), dams and levees, and water infrastructure.

Property Exposure		Vulnerability Factor	Weighted Factor	Score
No Vulnerability	None of the total assessed property value is exposed to a hazard.	0	1	0
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property Exposure Score = Extent Factor x Weighted Factor***				

Fog: None of the total assessed property, infrastructure, and resources value is exposed to fog in San Mateo County. Dense fog does not typically cause direct physical damage to property or infrastructure. However, transportation systems (e.g., roadways, public transit, airports) are exposed due to reduced visibility. These conditions can lead to traffic accidents, flight delays, and temporary operational disruptions.

Property Exposure		Vulnerability Factor	Weighted Factor	Score
No Vulnerability	None of the total assessed property value is exposed to a hazard.	0	1	0
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property Exposure Score = Extent Factor x Weighted Factor***				

Changes in Development

Information on changes in development within San Mateo County is provided in **Chapter 3** (Community Profile) of this Assessment.

Changes in development have slightly increased San Mateo County's exposure to heavy rainfall, severe thunderstorms, strong winds, tornadoes, and heat waves/excessive heat. This trend is primarily driven by the concentration of high-value assets and residents in areas where environmental stressors are intensifying. For instance, continued development increases impervious surfaces, which reduces natural water infiltration and can overwhelm aging municipal storm sewer systems, leading to higher flood exposure during heavy rainfall events. However, the County mitigates these risks through strict floodplain and construction regulations.[328] These policies ensure that natural drainage systems remain unaltered to prevent erosion and that new structures are located outside known inundation zones. Additionally, municipalities implement low-impact development techniques and nature-based infrastructure to manage urban and flash flooding.

Exposure to severe thunderstorms, strong winds, and tornadoes has also slightly increased as newer, denser construction and the expansion of critical power infrastructure, particularly above ground, created more targets for wind-related damage. Furthermore, the County's vulnerability to heat waves/excessive heat is unique because San Mateo has the lowest percentage of air-conditioned homes in California.[329] As development increases, the number of people living in older, poorly insulated buildings increases, exposing more residents to heat-related stressors.

Heavy Rainfall: The changes in development have increased San Mateo County's exposure to heavy rainfall by 4% or less.

Changes in Development		Vulnerability Factor	Weighted Factor	Score
Low	Changes in development have increased the community's exposure to the hazard by 4% or less.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Changes in Development Score = Extent Factor x Weighted Factor***				

Severe Thunderstorms: The changes in development have increased San Mateo County's exposure to severe thunderstorms by 4% or less.

Changes in Development		Vulnerability Factor	Weighted Factor	Score
Low	Changes in development have increased the community's exposure to the hazard by 4% or less.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Changes in Development Score = Extent Factor x Weighted Factor***				

Strong Winds: The changes in development have increased San Mateo County's exposure to strong winds by 4% or less.

328 San Mateo County. (2025). 2023-2031 Housing Element of the General Plan. Retrieved from https://www.smcgov.org/planning/san-mateo-county-housing-element-update.
329 San Mateo County Sustainability Department. (n.d.). Extreme Heat. Retrieved from https://smcsustainability.org/climate-resilience/climate-risks/extreme-heat/.

Changes in Development		Vulnerability Factor	Weighted Factor	Score
Low	Changes in development have increased the community's exposure to the hazard by 4% or less.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Changes in Development Score = Extent Factor x Weighted Factor***				

Tornado: The changes in development have increased San Mateo County's exposure to tornadoes by 4% or less.

Changes in Development		Vulnerability Factor	Weighted Factor	Score
Low	Changes in development have increased the community's exposure to the hazard by 4% or less.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Changes in Development Score = Extent Factor x Weighted Factor***				

Heat Wave/Extreme Heat: The changes in development have increased San Mateo County's exposure to heat wave/extreme heat by 4% or less.

Changes in Development		Vulnerability Factor	Weighted Factor	Score
Low	Changes in development have increased the community's exposure to the hazard by 4% or less.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Changes in Development Score = Extent Factor x Weighted Factor***				

Fog: The changes in development have no effect on San Mateo County's exposure to fog.

Changes in Development		Vulnerability Factor	Weighted Factor	Score
No Vulnerability	Changes in development have had no effect and/or have decreased the community's exposure to the hazard.	0	1	0
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Changes in Development Score = Extent Factor x Weighted Factor***				

4.6.7.7. Impacts

Population and Life Safety

Across all severe weather events covered in this LHMP, the most common impacts on population and life safety include the inability to move and loss of critical utilities. Power outages are especially concerning for community members who rely on electricity to power medical devices that sustain life. Failures in telecommunications, common during extreme conditions, lead to delays and inefficiencies in emergency responses, increasing the risk of injuries or fatalities that could otherwise be avoided. These effects are most critical for those in remote areas with limited access routes, as well as for populations in low-lying, flood-prone areas or in high-altitude locations vulnerable to wind damage and utility outages.

Heavy Rainfall: A population that is exposed to heavy rainfall is likely to experience minimal adverse impacts (e.g., ambulatory injuries). The primary life safety impacts during heavy rainfall events include drowning and physical injuries from fast-moving water or vehicles being swept away. Heavy rainfall can also trigger landslides and localized flooding, isolating residents from emergency services and further complicating rescue and response operations. *Refer to Section 4.5.4 (Flood) of this Plan for more information on population and life safety impacts due to flooding.*

Population and Life Safety Impact		Impact Factor	Weighted Factor	Score
Low	Populations exposed to this hazard are likely to experience minimal adverse impacts, such as ambulatory injuries.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population and Life Safety Impact Score = Impact Factor x Weighted Factor***				

Severe Thunderstorms: A population that is exposed to heavy rainfall is likely to experience minimal adverse impacts (e.g., ambulatory injuries). The immediate life safety impacts of severe thunderstorms center on physical trauma from lightning strikes, large hail, and wind-borne debris. These events can also result in a rapid onset of dangerous conditions on the water or in open areas, posing a direct threat to those without immediate access to shelter. When struck by lightning, people can suffer from cardiac arrest at the time of injury, and even though only 10% of individuals who are struck by lightning are killed, the other 90% that survive will live with various degrees of disabilities.[330] These include severe burns, neurological injuries, and other serious health issues. Work-related activities contribute to about 18% of total lightning fatalities.[331] Beyond personal injury, lightning can cause wildfires and electrical outages, further endangering lives and property.

Hail, which can be accompanied by severe thunderstorms, can have several life safety and public health implications. Hail, which varies in size, can inflict bodily injury on those caught outside during severe weather. Such injuries can range from minor bruises to more severe trauma, especially if the hailstones are large. The impacts extend to animals as well, both livestock and pets, which can be severely injured or killed in extreme cases.[332] For the public, hail can pose a significant hazard, prompting advisories for individuals to seek shelter during severe thunderstorms. Beyond direct physical harm, hail can cause substantial property damage, impacting homes, vehicles, and critical infrastructure such as power and communication lines. The debris from damaged structures can pose secondary public health concerns, such as obstructed roadways that impede emergency and medical services.

[330] National Weather Service. (n.d.). How Dangerous is Lightning? Retrieved from https://www.weather.gov/safety/lightning-odds.
[331] Centers for Disease Control and Prevention. (2024). Lightning Strike Victim Data. Retrieved from https://www.cdc.gov/lightning/data-research/index.html.
[332] National Oceanic and Atmospheric Administration, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Hail Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/hail/.

Population and Life Safety Impact		Impact Factor	Weighted Factor	Score
Low	Populations exposed to this hazard are likely to experience minimal adverse impacts, such as ambulatory injuries.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population and Life Safety Impact Score = Impact Factor x Weighted Factor***				

Strong Winds: A population that is exposed to strong winds is likely to experience some adverse impacts (e.g., injuries requiring acute medical care). Strong winds can cause extensive damage to homes and infrastructure, such as power lines and trees, leading to power outages and blocking access to emergency services. The risk extends to personal safety, as strong winds can turn debris into projectiles, posing a threat to life and increasing the likelihood of injury. Also, downed power lines create immediate electrocution hazards for pedestrians and motorists. Those living in manufactured homes or temporary structures are significantly impacted, as these structures can be severely damaged or destroyed by strong winds.

Population and Life Safety Impact		Impact Factor	Weighted Factor	Score
Medium	Populations exposed to this hazard are likely to experience some adverse impacts, such as injuries requiring acute medical care.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population and Life Safety Impact Score = Impact Factor x Weighted Factor***				

Tornado: A population that is exposed to tornadoes is likely to experience minimal adverse impacts (e.g., ambulatory injuries). The immediate threat to life safety from tornadoes can cause fatalities and injuries to humans and animals from flying debris, collapsing structures, and the tornado's sheer force. The risk to individuals in the path of a tornado is exceptionally high, as the warning time/speed of onset of these events often allows minimal time (i.e., less than 15 minutes) to seek adequate shelter. After an event, survivors may face a range of health concerns, including trauma, emotional distress, and the potential for injury during search and rescue efforts or cleanup operations. Since tornadoes are rare in San Mateo County, most residential structures and critical infrastructure are not engineered to withstand the unique structural stresses or wind speeds associated with a tornado, exposing a larger population to its impacts.

Population and Life Safety Impact		Impact Factor	Weighted Factor	Score
Low	Populations exposed to this hazard are likely to experience minimal adverse impacts, such as ambulatory injuries.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population and Life Safety Impact Score = Impact Factor x Weighted Factor***				

Heat Wave/Extreme Heat: A population that is exposed to heat waves/extreme heat is likely to experience minimal adverse impacts (e.g., ambulatory injuries). Individuals exposed to prolonged periods of extreme heat can suffer from heat-related illnesses (i.e., heat stroke, heat exhaustion, heat cramps), and if left untreated, these can result in death. Dehydration is a common and potentially dangerous consequence of high temperatures, leading to symptoms such as dizziness and confusion, and exacerbating the effects of heat-related illnesses. Additionally, extreme heat can aggravate pre-existing health issues such as cardiovascular and respiratory diseases (e.g., asthma, chronic obstructive pulmonary disease (COPD)). Every year, over 700 people die from extreme heat in the United States.[333] Furthermore, extended periods of extreme heat (i.e., heat waves) can strain health and emergency services, strain critical infrastructure (i.e., water, energy, and transportation), and impact food supplies and livelihoods if people lose crops or livestock.[334] During extended periods of extreme heat, the energy infrastructure can be strained by increased electricity demand as people use air conditioning to stay cool. This can result in brownouts or blackouts, which can disrupt critical services and people's ability to keep cool, increasing the likelihood of heat-related illnesses and straining health and emergency services.

Population and Life Safety Impact		Impact Factor	Weighted Factor	Score
Low	Populations exposed to this hazard are likely to experience minimal adverse impacts, such as ambulatory injuries.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population and Life Safety Impact Score = Impact Factor x Weighted Factor***				

Fog: A population that is exposed to fog is likely to experience minimal adverse impacts (e.g., ambulatory injuries). The primary life safety impact is a heightened risk of vehicular accidents and transportation incidents due to reduced visibility. Additionally, dense fog can delay emergency medical services response times, leading to secondary life safety and health complications.

Population and Life Safety Impact		Impact Factor	Weighted Factor	Score
Low	Populations exposed to this hazard are likely to experience minimal adverse impacts, such as ambulatory injuries.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population and Life Safety Impact Score = Impact Factor x Weighted Factor***				

Underserved Population

The underserved population faces disproportionate impacts from severe weather due to systematic barriers. These groups may lack access to accurate and timely information due to limited internet access, language barriers, and remote living. Therefore, critical severe weather advisories may not reach these populations in a timely manner, which results in higher injury and mortality rates within these communities. Financial constraints often force low-income populations into substandard housing that is less resilient to physical damage and more difficult to repair after events. Additionally, individuals living in isolated areas with limited access (e.g., one (1) road in and one (1) road out) are most likely to be cut off from community lifelines (e.g., debris blocking the road). Power outages can be life-threatening for those dependent on electricity for medical support, while the homeless population remains the most exposed to all elements due to a lack of adequate shelter.

Heavy Rainfall: The underserved population exposed to heavy rainfall in San Mateo County is likely to experience some adverse/disproportionate impacts (e.g., injuries requiring acute medical care). Underserved populations in flood-prone areas or low-lying communities are vulnerable to drowning or

333 Centers for Disease Control and Prevention. (2024). Protect Yourself from the Dangers of Extreme Heat. Retrieved from https://www.cdc.gov/climate-health/php/resources/protect-yourself-from-the-dangers-of-extreme-heat.html.
334 World Health Organization. (n.d.). Heatwaves. Retrieved from https://www.who.int/health-topics/heatwaves.

physical injury. This is mainly because many low-income residents reside in older neighborhoods equipped with outdated stormwater systems, making them prone to frequent urban/flash floods that can damage homes and hinder evacuation routes. Those isolated coastal or bayside areas are particularly vulnerable to being cut off from emergency services if a single access road is impassable or blocked by debris. *Refer to Section 4.5.4 (Flood) of this Plan for more information on the impacts on underserved populations due to flooding.*

Underserved Population Impact		Impact Factor	Weighted Factor	Score
Medium	Underserved populations exposed to the hazard are likely to experience some adverse/disproportionate impacts, such as injuries requiring acute medical care.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Underserved Population Impact Score = Impact Factor x Weighted Factor***				

Severe Thunderstorms: The underserved population exposed to severe thunderstorms in San Mateo County is likely to experience some adverse/disproportionate impacts (e.g., injuries requiring acute medical care). The most significant impact is on individuals in substandard housing or mobile homes, which often lack the structural reinforcement to withstand hail, strong winds, and tornadoes associated with severe thunderstorms. Additionally, outdoor workers and the homeless populations are uniquely vulnerable to sudden, severe thunderstorms because they lack immediate access to reinforced shelter.

Underserved Population Impact		Impact Factor	Weighted Factor	Score
Medium	Underserved populations exposed to the hazard are likely to experience some adverse/disproportionate impacts, such as injuries requiring acute medical care.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Underserved Population Impact Score = Impact Factor x Weighted Factor***				

Strong Winds: The underserved population exposed to strong winds in San Mateo County is likely to experience some adverse/disproportionate impacts (e.g., injuries requiring acute medical care). Strong winds pose a significant threat to those in substandard housing because these structures are more likely to fail or sustain major damage. Furthermore, the resulting power outages disproportionately impact those who cannot afford backup generators but rely on electricity for heating and cooling or for essential medication.

Underserved Population Impact		Impact Factor	Weighted Factor	Score
Medium	Underserved populations exposed to the hazard are likely to experience some adverse/disproportionate impacts, such as injuries requiring acute medical care.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Underserved Population Impact Score = Impact Factor x Weighted Factor***				

Tornado: The underserved population exposed to tornadoes in San Mateo County is likely to experience minimal adverse/disproportionate impacts (e.g., ambulatory injuries). Although tornadoes are rare in San

Mateo County, the lack of tornado-resistant construction means residents of mobile homes and substandard housing face a significant risk of structural failure. The sudden nature of these events leave this population with limited mobility or restricted English proficiency at a significant disadvantage for receiving and acting on short-notice warnings.

Underserved Population Impact		Impact Factor	Weighted Factor	Score
Low	Underserved populations exposed to the hazard are likely to experience minimal adverse/disproportionate impacts, such as ambulatory injuries.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Underserved Population Impact Score = Impact Factor x Weighted Factor***				

Heat Wave/Extreme Heat: The underserved population exposed to heat waves/extreme heat in San Mateo County is likely to experience some adverse/disproportionate impacts (e.g., injuries requiring acute medical care). Underserved communities may be particularly at risk of heat waves/extreme heat due to the increased prevalence of preexisting health conditions, greater reliance on public transportation, and a tendency to live in urban areas with limited vegetation, exposing them more acutely to the stresses of heat. In addition to living in hotter neighborhoods, socially vulnerable communities tend to face barriers to adapting to extreme heat events, such as the increased cost of running an in-home air conditioning unit at higher levels or for extended periods, or a lack of access to a cooling center. In addition, socially vulnerable communities may not be able to afford to cool work or living spaces or may be forced to choose between air conditioning and necessities like food and rent. People with limited English proficiency, individuals with access and functional needs, and older adults may be more vulnerable, as they may not receive heat wave/extreme heat outreach information and emergency notifications due to language or other accessibility barriers. Extreme heat-related illnesses and fatalities are preventable if adequately prepared for.

Underserved Population Impact		Impact Factor	Weighted Factor	Score
Medium	Underserved populations exposed to the hazard are likely to experience some adverse/disproportionate impacts, such as injuries requiring acute medical care.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Underserved Population Impact Score = Impact Factor x Weighted Factor***				

Fog: The underserved population exposed to fog in San Mateo County is likely to experience minimal adverse/disproportionate impacts (e.g., ambulatory injuries). The primary impact on underserved populations is the increased risk of vehicular accidents for those who must commute in high-risk transportation corridors during dense fog events.

Underserved Population Impact		Impact Factor	Weighted Factor	Score
Low	Underserved populations exposed to the hazard are likely to experience minimal adverse/disproportionate impacts, such as ambulatory injuries.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Underserved Population Impact Score = Impact Factor x Weighted Factor***				

Property, Facilities, and Critical Infrastructure

Heavy Rainfall: More than $500,000, but less than $5 million in property damage is expected from a *single major* heavy rainfall event, or damages are expected to occur to more than 5% but less than 15% of the property value within San Mateo County. Flooding from heavy rainfall can lead to damage to property, facilities, and critical infrastructure. Often, excessive runoff overwhelms aging stormwater systems, sewers, and levees. Additionally, flooding of key transportation routes can cause disruptions in transit and services. *Refer to Section 4.5.4 (Flood) of this Plan for more information on the impacts on property, facilities, and critical infrastructure due to flooding.*

Property, Facilities, and Critical Infrastructure Impact		Impact Factor	Weighted Factor	Score
Medium	More than $500,000 but less than $5 million in property, facilities, and infrastructure damage is expected from a single significant event, or damages are expected to occur to more than 5% but less than 15% of the property value within the jurisdiction.	2	2	4
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property, Facilities, and Critical Infrastructure Impact Score = Impact Factor x Weighted Factor***				

Severe Thunderstorms: More than $500,000, but less than $5 million in property damage is expected from a *single major* severe thunderstorm event, or damages are expected to occur to more than 5% but less than 15% of the property value within San Mateo County. Damage from severe thunderstorms in San Mateo County is most likely to result from secondary hazards associated with the event, such as flooding, landslides, or damaging winds. *Refer to Section 4.5.4 (Flood) and Section 4.5.5 (Landslides) of this Plan for more information on the impacts on property, facilities, and critical infrastructure due to flooding and landslides, respectively.*

Lightning can ignite fires in buildings, especially if it strikes flammable materials or electrical systems. Furthermore, lightning can cause significant damage to critical infrastructure (e.g., cell towers, communication lines, power lines), resulting in power outages, power surges, communication disruptions, and utility damage. Severe thunderstorms often cause rapid power outages by damaging transformers and substations, leading to secondary failures in cooling or emergency services. Also, hail can break windows, break into homes and businesses, dent vehicles, and damage roofs, resulting in costly repairs and insurance claims.[335] The impact on personal property and commercial assets can be significant, depending on the storm's intensity, hail size, and duration. Critical infrastructure is also

[335] National Oceanic and Atmospheric Administration, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Hail Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/hail/.

vulnerable to hail. For example, hail damage to energy infrastructure (e.g., power lines and solar panels) could cause power outages and disrupt energy production. Communication infrastructure (i.e., cell towers and satellite dishes) can also be impacted during hail events, disrupting communication networks.

Property, Facilities, and Critical Infrastructure Impact		Impact Factor	Weighted Factor	Score
Medium	More than $500,000 but less than $5 million in property, facilities, and infrastructure damage is expected from a single significant event, or damages are expected to occur to more than 5% but less than 15% of the property value within the jurisdiction.	2	2	4
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property, Facilities, and Critical Infrastructure Impact Score = Impact Factor x Weighted Factor***				

Strong Winds: More than $500,000, but less than $5 million in property damage is expected from a *single major* strong winds event, or damages are expected to occur to more than 5% but less than 15% of the property value within San Mateo County. Strong winds can cause structural damage to buildings by tearing off roofs, breaking windows, and uprooting trees. Building construction plays a significant role in the extent of damage resulting from these wind events. Due to differences in construction, residential structures are generally more susceptible to wind damage than commercial and industrial structures. Wood and masonry buildings, in general, regardless of their occupancy class, tend to experience more damage than concrete or steel buildings. Additionally, mobile homes are especially susceptible to damage, even when secured, offering minimal protection to those inside.

Utility infrastructure could be damaged by strong winds associated with falling tree limbs or other debris, resulting in the loss of power or other utility services. Power outages can impact residents, critical facilities, and business operations. Interruptions in heating or cooling utilities can affect the underserved population (e.g., children, the elderly, individuals with access and functional needs) who are particularly vulnerable to temperature-related health impacts. Furthermore, power outages can impact other public utilities, including potable water, wastewater treatment, and communications systems. A lack of power in emergency facilities (e.g., police, fire, EMS, hospitals) will hinder a community's ability to respond effectively to an event and maintain the safety of its citizens.

Public Safety Power Shutoffs (PSPS) are events in which a major electric power provider (e.g., PG&E) temporarily shuts off electrical power to a selected area to prevent power lines from sparking wildfires and threatening human lives. Utilities usually implement these on days with sustained winds, strong gusts, or other factors. The duration of a shutoff event is tied directly to the weather that triggers it; the shutoff typically ends within 24 hours after the weather conditions have subsided. However, PSPS events may extend beyond the 24-hour timeframe, depending on conditions. PSPS events often target wildland areas with high wildfire risk, but they can impact a much wider region. The targeted area is the area at risk due to weather conditions. Given the long, interconnected nature of power supply systems, a shutoff event targeted at a small at-risk zone can affect power to larger areas beyond it.[336]

[336] California Governor's Office of Emergency Services. (2023). California State Hazard Mitigation Plan. Retrieved from https://www.caloes.ca.gov/wp-content/uploads/Hazard-Mitigation/Documents/2023-California-SHMP_Volume-1_11.10.2023.pdf.

Property, Facilities, and Critical Infrastructure Impact		Impact Factor	Weighted Factor	Score
Medium	More than $500,000 but less than $5 million in property, facilities, and infrastructure damage is expected from a single significant event, or damages are expected to occur to more than 5% but less than 15% of the property value within the jurisdiction.	2	2	4
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property, Facilities, and Critical Infrastructure Impact Score = Impact Factor x Weighted Factor***				

Tornado: Less than $5 million in property damage is expected from a *single major* tornado event, or damages are expected to occur to less than 5% of the property value within San Mateo County. Tornadoes in San Mateo County are very rare, and when they do occur, they tend to be weak. Impacts are expected to be minimal; however, even low-end tornadoes can cause damage to power lines, roofs, windows, and light-framed structures.

Property, Facilities, and Critical Infrastructure Impact		Impact Factor	Weighted Factor	Score
Low	Less than $500,000 in property, facilities, and infrastructure damages is expected from a single significant event, or damages are expected to occur to less than 5% of the property value within the jurisdiction.	1	2	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property, Facilities, and Critical Infrastructure Impact Score = Impact Factor x Weighted Factor***				

Heat Wave/Extreme Heat: Little to no property, facilities, and infrastructure damage is expected from a single major heat wave/extreme heat event in San Mateo County. Heat waves/extreme heat are not known for causing direct damage to property. However, critical infrastructure can be stressed during heat waves/extreme heat events, resulting in secondary impacts.

Property, Facilities, and Critical Infrastructure Impact		Impact Factor	Weighted Factor	Score
No Impact	Little to no property, facilities, and infrastructure damage is expected from a single significant event.	1	2	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property, Facilities, and Critical Infrastructure Impact Score = Impact Factor x Weighted Factor***				

Fog: Less than $5 million in property damage is expected from a *single major* fog event, or damages are expected to occur to less than 5% of the property value within San Mateo County. Dense fog typically does not result in direct physical damage to property or infrastructure. However, transportation systems can be affected by reduced visibility, leading to accidents and disruptions.

Property, Facilities, and Critical Infrastructure Impact		Impact Factor	Weighted Factor	Score
Low	Less than $500,000 in property, facilities, and infrastructure damages is expected from a single significant event, or damages are expected to occur to less than 5% of the property value within the jurisdiction.	1	2	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property, Facilities, and Critical Infrastructure Impact Score = Impact Factor x Weighted Factor***				

Economy

Heavy Rainfall: A single *significant* heavy rainfall event in San Mateo County is likely to result in a total economic impact greater than $100,000 but less than or equal to $10 million. Economic impacts include costs for repairing flood-damaged buildings and critical infrastructure (e.g., roads and levees). Flooding of major corridors (e.g., US Highway 101) disrupts regional supply chains and causes significant business interruptions. Additionally, rising flood insurance premiums can decrease coastal property values and increase the overall cost of housing in flood-prone areas. *Refer to Section 4.5.4 (Flood) of this Plan for more information on economic impacts due to flooding.*

Economic Impact		Impact Factor	Weighted Factor	Score
Medium	Total economic impact is likely to be greater than $100,000, but less than or equal to $10 million.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Economic Impact Score = Impact Factor x Weighted Factor***				

FEMA NRI Expected Annual Loss Estimates

The FEMA NRI does not assess heavy rainfall. However, it assesses inland flooding. *Refer to Section 4.5.4 (Flood) of this Plan.*

Severe Thunderstorms: A single *significant* severe thunderstorm event in San Mateo County is likely to result in a total economic impact greater than $100,000 but less than or equal to $10 million. Severe thunderstorms can result in costly repairs and significant economic losses, not just from physical damage but also from secondary effects, such as business interruptions and loss of service delivery. Additionally, sudden power outages caused by severe thunderstorms can lead to inventory loss for businesses (e.g., spoiled food or medicine) and temporary closures of retail and manufacturing facilities. Furthermore, the insurance and reinsurance industries incorporate this data to evaluate and manage risks associated with lightning and other severe weather events.

Hail events from thunderstorms can have substantial economic impacts, particularly due to the damage they inflict on vehicles, homes, and agriculture. Automobiles exposed to hail can sustain dents and broken glass, leading to expensive repairs and insurance claims. Residential and commercial roofing can be severely damaged, necessitating costly repairs or replacements. In the insurance industry, hailstorms often result in a high volume of claims, which can strain financial reserves and potentially lead to higher insurance premiums for customers in these areas.

Economic Impact		Impact Factor	Weighted Factor	Score
Medium	Total economic impact is likely to be greater than $100,000, but less than or equal to $10 million.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Economic Impact Score = Impact Factor x Weighted Factor***				

FEMA NRI Expected Annual Loss Estimates

The FEMA NRI does not assess severe thunderstorms.

Strong Winds: A single *significant* strong winds event in San Mateo County is likely to result in a total economic impact greater than $100,000 but less than or equal to $10 million. Strong wind events can have economic impacts due to widespread property damage. These impacts can include structural damage to buildings and homes, leading to substantial repair costs and insurance claims. The agricultural sector can be significantly affected, with damage to crops and farming infrastructure potentially leading to lost income for farmers and higher commodity prices. Businesses may experience disruptions to economic activity and incur losses, particularly when power outages affect operations and supply chains.

The costs associated with damaging wind events typically include cleanup and restoration efforts, which can be extensive and require significant local and state resources. Utility companies may incur substantial costs to repair downed power lines and restore service to customers. Moreover, the transportation sector can experience disruptions, including damaged roads, debris, and railway disruptions that impede travel and logistics. The cumulative effect of these events on the economy includes direct costs, such as repair costs and lost revenue, as well as indirect costs, including higher insurance rates and the potential for a long-term economic downturn in severely affected areas.

Economic Impact		Impact Factor	Weighted Factor	Score
Medium	Total economic impact is likely to be greater than $100,000, but less than or equal to $10 million.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Economic Impact Score = Impact Factor x Weighted Factor***				

FEMA NRI Expected Annual Loss Estimates

A strong wind NRI EAL score and rating represent a community's relative level of expected building, population, and agriculture loss each year due to strong winds when compared to the rest of the United States. The EAL score is positively associated with a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-123** outlines the strong winds EAL for San Mateo County.

Table 4-123. Strong Winds Expected Annual Loss *(FEMA National Risk Index)*

Population	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Expected Annual Loss Rating
0.01	$125,195	$97,047	$5	$222,247	28.1	Relatively Low
Population exposure is defined as the estimated number of people determined to be exposed to a hazard according to a hazard type-specific methodology. Expected annual loss scores are calculated using an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

Tornado: A single *significant* tornado event in San Mateo County is likely to result in a total economic impact no greater than $100,000. Tornadoes in San Mateo County are very rare, and when they do occur, they tend to be weak. Impacts are expected to be minimal; however, even low-end tornadoes can cause economic impacts.

Tornadoes can damage buildings, homes, infrastructure, and agricultural fields in a matter of minutes, resulting in repair and reconstruction costs. Damage to commercial and industrial facilities can disrupt local economies, resulting in job losses, business interruptions, and a decline in tax revenues for affected communities. The cost burden is often shared by insurance companies, which face substantial claims following a tornado, potentially increasing premiums for customers and affecting the stability of the insurance market. In addition to property damage, the economic repercussions of tornadoes include the expense of emergency response, debris cleanup, and temporary housing for displaced individuals. Long-term economic impacts can be exacerbated by the loss of public services and utilities, and reduced property values.[337]

Economic Impact		Impact Factor	Weighted Factor	Score
Low	Total economic impact is not likely to be greater than $100,000.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Economic Impact Score = Impact Factor x Weighted Factor***				

FEMA NRI Expected Annual Loss Estimates

A tornado NRI EAL score and rating represent a community's relative level of expected building, population, and agriculture loss each year due to tornadoes when compared to the rest of the United States. The EAL score is positively associated with a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-124** outlines the tornado EAL for San Mateo County.

[337] Burke, A. (2024). The Cost of a Tornado. The Financial Impact on Your Business. Retrieved from https://www.accuweather.com/en/blogs-webinars/the-cost-of-a-tornado-the-financial-impact-on-your-business/1677995.

Table 4-124. Tornado Expected Annual Loss *(FEMA National Risk Index)*

Population	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Expected Annual Loss Rating
0.01	$179,695	$447,712	$66	$627,473	37.3	Relatively Low
Population exposure is defined as the estimated number of people determined to be exposed to a hazard according to a hazard type-specific methodology. Expected annual loss scores are calculated using an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

Heat Wave/Extreme Heat: A single *significant* heat wave/extreme heat event in San Mateo County is likely to result in a total economic impact no greater than $100,000. Heat waves/extreme heat can lead to higher healthcare costs due to a surge in heat-related illnesses requiring medical treatment. Furthermore, high temperatures can reduce productivity across various economic sectors, affecting labor efficiency and overall financial output (e.g., agriculture, construction). During extended extreme heat events (i.e., heat waves), cooling demand significantly increases, driving up energy consumption, elevating utility bills, and straining the power infrastructure. Water resources may also face increased demand, necessitating additional treatment and distribution efforts, which incur associated costs. The tourism and outdoor recreation industries can be adversely affected as extreme temperatures deter tourists and outdoor enthusiasts, thereby impacting local economies that depend on these sectors. Furthermore, prolonged periods of extreme heat increase the risk of wildfires, resulting in costs for property damage, ecosystem disruption, firefighting efforts, and resource allocation. *Refer to Section 4.5.9 (Wildfire) of this Plan for more information on economic impacts due to wildfires.*

Economic Impact		Impact Factor	Weighted Factor	Score
Low	Total economic impact is not likely to be greater than $100,000.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Economic Impact Score = Impact Factor x Weighted Factor***				

FEMA NRI Expected Annual Loss Estimates

A heat wave NRI EAL score and rating represent a community's relative level of expected building, population, and agriculture loss each year due to heat waves when compared to the rest of the United States. The EAL score is positively associated with a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-125** outlines the heat wave EAL for San Mateo County.

Table 4-125. Heat Wave Expected Annual Loss *(FEMA National Risk Index)*

Population	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Expected Annual Loss Rating
0.30	$4.1 Million	$468	$2,171	$4.1 Million	92.6	Relatively Moderate
Population exposure is defined as the estimated number of people determined to be exposed to a hazard according to a hazard type-specific methodology. Expected annual loss scores are calculated using an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

Fog: A single *significant* fog event in San Mateo County is likely to result in a total economic impact no greater than $100,000. Dense fog can severely reduce visibility, leading to delays and closures in air, road, and maritime transport. This disruption affects airline operations (e.g., San Francisco International Airport), causing flight delays and cancellations that, in turn, impact passenger transit and cargo shipments. On roads, reduced visibility increases the risk of accidents, leading to potential human and material losses. In maritime settings, fog can significantly delay shipping operations, affecting the supply chain and causing economic losses.

Economic Impact		Impact Factor	Weighted Factor	Score
Low	Total economic impact is not likely to be greater than $100,000.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Economic Impact Score = Impact Factor x Weighted Factor***				

FEMA NRI Expected Annual Loss Estimates

The FEMA NRI does not assess fog.

Environment

Heavy Rainfall: Environmental impact from a single *significant* heavy rainfall event is likely to be localized, requiring some outside resources and support; and/or repair, cleanup, restoration, or preservation work. Environmental impacts include accelerated soil erosion and increased sedimentation in creeks, which can reduce water flow capacity and damage aquatic habitats. Intense runoff often carries pollutants (e.g., debris, hazardous materials) directly into local waterways without treatment. Furthermore, heavy rainfall following a wildfire significantly increases the risk of landslides, which can destroy vegetation and permanently alter local topography. *Refer to Section 4.5.4 (Flood) and Section 4.5.5 (Landslides) of this Plan for more information on environmental impacts due to flooding and landslides, respectively.*

Environment Impact		Impact Factor	Weighted Factor	Score
Medium	Environmental impact from a single significant event is likely to be minimal, requiring little to no outside resources and support; and/or minimal repair, cleanup, restoration, or preservation work.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Environmental Impact Score = Impact Factor x Weighted Factor***				

Severe Thunderstorms: Environmental impact from a single *significant* severe thunderstorm event is likely to be localized, requiring some outside resources and support; and/or repair, cleanup, restoration, or preservation work. Environmental impacts from a severe thunderstorm often stem from lightning striking dry vegetation, which can cause significant damage to local ecosystems and increase long-term landslide risk by eroding stabilizing plant cover. This was notably observed during the 2020 CZU Lightning Complex wildfire, which devastated large portions of the Santa Cruz Mountains in San Mateo and Santa Cruz counties. In addition to wildfire risks, forest canopies and wildlife habitats may be impacted by hail and strong winds. Furthermore, hail can damage delicate agricultural areas and natural ecosystems, leading to delayed growth and lower yields.

Environment Impact		Impact Factor	Weighted Factor	Score
Medium	Environmental impact from a single significant event is likely to be minimal, requiring little to no outside resources and support; and/or minimal repair, cleanup, restoration, or preservation work.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Environmental Impact Score = Impact Factor x Weighted Factor***				

Strong Winds: Environmental impact from a single *significant* strong winds event is likely to be minimal, requiring little to no outside resources and support; and/or repair, cleanup, restoration, or preservation work. Strong winds generate significant amounts of debris, which can be hazardous to the surrounding landscape. Also, it scatters debris into soil and water systems, increasing environmental pollution. Furthermore, strong winds can devastate natural areas by uprooting trees and causing soil erosion and degradation. Soil erosion can damage plants; eroded soil can be deposited into waterways, impacting water quality, and can be emitted into the air, degrading air quality.[338] Strong winds also contribute to coastal bluff and beach erosion, particularly when combined with storm surge. Wildlife can also be impacted by strong winds.

Environment Impact		Impact Factor	Weighted Factor	Score
Low	Environmental impact from a single significant event is likely to be minimal, requiring little to no outside resources and support; and/or minimal repair, cleanup, restoration, or preservation work.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Environmental Impact Score = Impact Factor x Weighted Factor***				

Tornado: Environmental impact from a single *significant* tornado event is likely to be minimal, requiring little to no outside resources and support; and/or repair, cleanup, restoration, or preservation work. Tornadoes in San Mateo County are very rare, and when they do occur, they tend to be weak. Impacts are expected to be minimal; however, even low-end tornadoes can cause environmental impacts. For instance, tornadoes can produce significant amounts of debris, which can be hazardous to the surrounding landscape. Also, as the tornado moves, it scatters debris into soil and water systems, increasing environmental pollution. Furthermore, household products (e.g., cleaning supplies and automotive products) can contaminate soil and water.

[338] United States Department of Agriculture, Natural Resources Conservation Service. (n.d.). Wind Erosion Prediction System. Retrieved from https://www.nrcs.usda.gov/resources/tech-tools/wind-erosion-prediction-system.

Environment Impact		Impact Factor	Weighted Factor	Score
Low	Environmental impact from a single significant event is likely to be minimal, requiring little to no outside resources and support; and/or minimal repair, cleanup, restoration, or preservation work.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Environmental Impact Score = Impact Factor x Weighted Factor***				

Heat Wave/Extreme Heat: Environmental impact from a single *significant* heat wave/extreme heat event is likely to be minimal, requiring little to no outside resources and support; and/or repair, cleanup, restoration, or preservation work. Extreme/excessive heat can increase the risk of wildfires, drought, and poor air quality. Extreme heat evaporates moisture from soil and vegetation, which in turn dries out trees and grass. As a result, dry vegetation becomes fuel for wildfires. Drought and heat waves/extreme heat are interconnected, as high temperatures can intensify drought conditions, and drought conditions can, in turn, amplify heat waves.[339] Additionally, high temperatures increase pollutant levels and ground-level ozone, resulting in poor air quality.[340] Extreme/excessive heat can also impact wildlife, causing heat stress, dehydration, and difficulty accessing water. *Refer to Section 4.5.2 (Drought) and Section 4.5.9 (Wildfire) of this Plan for more information on environmental impacts due to drought and wildfires, respectively.*

Environment Impact		Impact Factor	Weighted Factor	Score
Low	Environmental impact from a single significant event is likely to be minimal, requiring little to no outside resources and support; and/or minimal repair, cleanup, restoration, or preservation work.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Environmental Impact Score = Impact Factor x Weighted Factor***				

Fog: Environmental impact from a single *significant* fog event is likely to be minimal, requiring little to no outside resources and support; and/or repair, cleanup, restoration, or preservation work. Fog traps pollutants and chemicals close to the ground, resulting in poor air quality during dense fog events. Particularly in urban areas, where haze particle concentrations are elevated due to higher air pollution levels.[341] Subsequently, poor air quality can significantly impact those individuals with chronic respiratory conditions (e.g., asthma, COPD), children, and the elderly.

[339] National Integrated Drought Information System. (2024). Monitor Heat and Drought with New Tools on Drought.gov. Retrieved from https://www.drought.gov/news/monitor-heat-and-drought-new-tools-droughtgov-2024-08-07.
[340] American Public Health Association. (n.d.). Wildfires and Extreme Weather. Retrieved from https://www.apha.org/topics-and-issues/climate-health-and-equity/extreme-weather.
[341] Lakra, K. and Avishek, K. (2022). A Review on Factors Influencing Fog Formation, Classification, Forecasting, Detection, and Impacts. Retrieved from https://pmc.ncbi.nlm.nih.gov/articles/PMC8918085/.

Environment Impact		Impact Factor	Weighted Factor	Score
Low	Environmental impact from a single significant event is likely to be minimal, requiring little to no outside resources and support; and/or minimal repair, cleanup, restoration, or preservation work.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Environmental Impact Score = Impact Factor x Weighted Factor***				

Continuity of Operations/Delivery of Services

Heavy Rainfall: There may be impacts lasting between 24 hours and 72 hours on San Mateo County's ability to meet the essential day-to-day operational demands and needs of the community in the event of a *single major* heavy rainfall event. Heavy rainfall results in flooding, which can have widespread, cascading impacts on a community's ability to deliver day-to-day services and maintain continuity of operations. These impacts include damage to first responders' infrastructure (e.g., fire and police stations, emergency operations centers, hospitals), disruptions to utilities (e.g., power, water, communication), and impassable roads and bridges, hindering the delivery of day-to-day services. Floods can damage power plants, substations, and power lines, resulting in power outages that could last several days. Water treatment facilities can also be compromised, potentially contaminating drinking water supplies. Furthermore, if critical infrastructure (e.g., fire and police stations) is within the flooded area, it can significantly impact response and recovery operations. These impacts may warrant requesting external resources to mitigate their impact on the jurisdiction's continuity of operations/delivery of services.

Continuity of Operations/Delivery of Services Impact		Impact Factor	Weighted Factor	Score
Medium	Impact lasting between 24 and 72 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single significant event.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Continuity of Services/Delivery of Services Impact Score = Impact Factor x Weighted Factor***				

Severe Thunderstorms: There may be impacts lasting less than 24 hours on San Mateo County's ability to meet the essential day-to-day operational demands and needs of the community in the event of a *single major* severe thunderstorm event. Employees responsible for delivering critical services are required to follow safety protocols, including taking cover from hail and seeking immediate shelter when hearing thunder or seeing lightning, and waiting at least 30 minutes after the last sound of thunder.[342] During this time, any essential operations involving outdoor activities are temporarily suspended, which may delay service delivery. These services include, but are not limited to, street and highway maintenance, law enforcement, firefighting, utility management (e.g., water, power, sewer), traffic signal maintenance, and transit operations (e.g., outdoor airport personnel).

[342] National Oceanic and Atmospheric Administration. (2025). Lightning Safety. Retrieved from https://www.noaa.gov/jetstream/lightning/lightning-safety.

Continuity of Operations/Delivery of Services Impact		Impact Factor	Weighted Factor	Score
Low	Impact lasting less than 24 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single significant event.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Continuity of Services/Delivery of Services Impact Score = Impact Factor x Weighted Factor***				

Strong Winds: There may be impacts lasting less than 24 hours on San Mateo County's ability to meet the essential day-to-day operational demands and needs of the community in the event of a *single major* strong winds event. Employees responsible for delivering critical services are required to follow safety protocols, including seeking shelter during a strong wind event. Additionally, these events can significantly impact the safe operation of certain types of equipment, particularly in construction and industrial settings, firefighting, and emergency medical services. For example, some emergency vehicles are not safe to operate when sustained wind speeds reach 35-45 mph or higher. During this time, some essential operations may be temporarily suspended, which could delay service delivery.

Continuity of Operations/Delivery of Services Impact		Impact Factor	Weighted Factor	Score
Low	Impact lasting less than 24 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single significant event.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Continuity of Services/Delivery of Services Impact Score = Impact Factor x Weighted Factor***				

Tornado: There may be impacts lasting less than 24 hours on San Mateo County's ability to meet the essential day-to-day operational demands and needs of the community in the event of a *single major* tornado event. Tornadoes in San Mateo County are very rare, and when they do occur, they are usually weak. As a result, impacts are generally expected to be minimal. However, if a tornado impacts critical facilities or infrastructure (e.g., fire and police stations, emergency operations centers, hospitals, bridges, overpasses, trains, power lines, phone lines, or other communication systems), it could disrupt emergency response and recovery operations by causing damage, service interruptions, or power outages.

Continuity of Operations/Delivery of Services Impact		Impact Factor	Weighted Factor	Score
Low	Impact lasting less than 24 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single significant event.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Continuity of Services/Delivery of Services Impact Score = Impact Factor x Weighted Factor***				

Heat Wave/Extreme Heat: No impacts on San Mateo County's ability to meet the essential day-to-day operational demands and needs of the community in the event of a *single major* heat wave/extreme heat event.

Continuity of Operations/Delivery of Services Impact		Impact Factor	Weighted Factor	Score
No Impact	No impact on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single significant event.	0	1	0
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Continuity of Services/Delivery of Services Impact Score = Impact Factor x Weighted Factor***				

Fog: There may be impacts lasting less than 24 hours on San Mateo County's ability to meet the essential day-to-day operational demands and needs of the community in the event of a *single major* fog event. Dense fog can significantly impact day-to-day operations by reducing visibility and increasing the risk of accidents and delays, especially in the transportation system. However, dense fog tends to last for a short period.

Continuity of Operations/Delivery of Services Impact		Impact Factor	Weighted Factor	Score
Low	Impact lasting less than 24 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single significant event.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Continuity of Services/Delivery of Services Impact Score = Impact Factor x Weighted Factor***				

Future Development

Information on changes in development within San Mateo County is provided in **Chapter 3** (Community Profile) of this Assessment.

Future development in San Mateo County will remain vulnerable to severe weather impacts. However, the ability to withstand these impacts depends on robust land use practices and the consistent enforcement of modern building codes for new construction and redevelopment. San Mateo County and its municipalities have adopted the IBC in compliance with California requirements, specifically to ensure new construction can address the stressors of severe weather. Furthermore, the County and municipal general plans include land use policies designed to mitigate secondary impacts of severe weather (e.g., floods, landslides, and wildfires). Also, 25% of San Mateo County's municipalities participate in the CRS program, which demonstrates a clear incentive to adopt higher regulatory standards throughout the County, particularly in the areas with the highest flood risk. Additionally, all municipal planning partners have committed to maintaining their good standing under the NFIP through initiatives identified in this LHMP. San Mateo County and its municipalities are well-equipped to address future growth and the associated impacts of severe weather.

Heavy Rainfall: Future development trends will increase, but not significantly, the impacts of heavy rainfall in San Mateo County.

Future Development Impact		Impact Factor	Weighted Factor	Score
Medium	Future development trends will increase the impacts of this hazard, but not significantly.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Future Development Impact Score = Impact Factor x Weighted Factor***				

Severe Thunderstorms: Future development trends will increase, but not significantly, the impacts of severe thunderstorms in San Mateo County.

Future Development Impact		Impact Factor	Weighted Factor	Score
Medium	Future development trends will increase the impacts of this hazard, but not significantly.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Future Development Impact Score = Impact Factor x Weighted Factor***				

Strong Winds: Future development trends will minimally increase the impacts of strong winds in San Mateo County.

Future Development Impact		Impact Factor	Weighted Factor	Score
Low	Future development trends will minimally increase the impacts of this hazard.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Future Development Impact Score = Impact Factor x Weighted Factor***				

Tornado: Future development trends will minimally increase the impacts of tornadoes in San Mateo County.

Future Development Impact		Impact Factor	Weighted Factor	Score
Low	Future development trends will minimally increase the impacts of this hazard.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Future Development Impact Score = Impact Factor x Weighted Factor***				

Heat Wave/Extreme Heat: Future development trends will minimally increase the impacts of heat waves/extreme heat in San Mateo County.

Future Development Impact		Impact Factor	Weighted Factor	Score
Low	Future development trends will minimally increase the impacts of this hazard.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Future Development Impact Score = Impact Factor x Weighted Factor***				

Fog: Future development trends will not increase the impacts of fog in San Mateo County.

Future Development Impact		Impact Factor	Weighted Factor	Score
No Impact	Future development trends will not increase the impacts of this hazard, and/or may even decrease it.	0	1	0
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Future Development Impact Score = Impact Factor x Weighted Factor***				

Climate Change

Heavy Rainfall: Climate change trends will increase, but not significantly, the risks and impacts of heavy rainfall. As global average temperatures rise, evaporation increases, adding moisture to the atmosphere and, in turn, leading to more precipitation. Globally, heavy precipitation events are expected to increase as much as three (3) times the historical average by the end of the century. Although heavy precipitation does not necessarily lead to flooding, the risk of flooding increases, and in some locations, even moderate rainfall can cause significant damage.[343]

Atmospheric rivers are a critical component of the water cycle in the western United States, often ending persistent droughts; however, as global temperatures rise, these systems are projected to become more frequent and more severe. Warmer air and oceans fuel stronger atmospheric rivers, which research suggests can become 25% longer and wider, delivering heavy rainfall and strong winds over larger areas for extended periods. This intense rainfall leads to extreme soil saturation and increased runoff, overwhelming river systems and triggering both flooding and landslides. The economic consequences of these shifts are substantial, with studies projecting that annual damages from atmospheric river events could reach $3.2 billion by 2090.[344]

Climate Change Impact		Impact Factor	Weighted Factor	Score
Medium	Climate Change trends will increase the impacts of this hazard, but not significantly.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Climate Change Impact Score = Impact Factor x Weighted Factor***				

Severe Thunderstorms: Climate change trends will minimally increase the risks and impacts of severe thunderstorms. Assessing how climate change affects severe thunderstorms is challenging because these events are complex, short-lived, and localized, and climate models are too coarse to resolve the behavior of small-scale convective events. One way to understand the effects of climate change on severe thunderstorms is to examine its impact on convective available potential energy (CAPE). CAPE is the amount of energy available for warm, rising air (needed for thunderstorm formation). Higher CAPE values indicate greater available energy in the atmosphere, thereby increasing the potential for

343 Denchak, M. (2019). Flooding and Climate Change: Everything You Need to Know. Retrieved from https://www.nrdc.org/stories/flooding-and-climate-change-everything-you-need-know.
344 United States Department of Agriculture Climate Hubs. (n.d.). Atmospheric Rivers in the Northwest. Retrieved from https://www.climatehubs.usda.gov/hubs/northwest/topic/atmospheric-rivers-northwest-0.

thunderstorm development.[345] Research shows that in the western United States, higher-CAPE days have become less frequent annually (since 1979).[346]

Climate Change Impact		Impact Factor	Weighted Factor	Score
Low	Climate Change trends will minimally increase the impacts of this hazard.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Climate Change Impact Score = Impact Factor x Weighted Factor***				

Strong Winds: Climate change trends will minimally increase the risks and impacts of strong winds. Assessing the influence of climate change on strong winds is complex because these events are localized, short-lived, and dynamic. Current climate models lack the resolution to accurately simulate small-scale convective systems, which limits the ability to project long-term changes.

Climate Change Impact		Impact Factor	Weighted Factor	Score
Low	Climate Change trends will minimally increase the impacts of this hazard.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Climate Change Impact Score = Impact Factor x Weighted Factor***				

Tornado: Climate change trends will minimally increase the risks and impacts of tornadoes. The correlation between climate change and tornadoes remains unclear due to the localized nature of tornadoes. These microscale events occur over small geographic areas and brief timeframes, making them difficult to capture in climate models, which operate at a larger scale (macroscale) resolution. Subject matter experts state that rising average temperatures contribute to the formation of severe thunderstorms, which often produce tornadoes. Studies show that warmer, more humid environments increase atmospheric instability, while rising temperatures can decrease wind shear. Since both instability and wind shear are necessary for tornado development, the overall impact of climate change on tornado frequency and intensity remains complex and is an ongoing subject of study.[347]

Climate Change Impact		Impact Factor	Weighted Factor	Score
Low	Climate Change trends will minimally increase the impacts of this hazard.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Climate Change Impact Score = Impact Factor x Weighted Factor***				

Heat Wave/Extreme Heat: Climate change trends will significantly increase the risks and impacts of heat waves/extreme heat. Climate change is impacting the severity and frequency of extreme heat events. As global temperatures rise due to increasing greenhouse gas emissions, extreme heat events are

[345] Climate Central. (2024). Severe Storm Super Hazards. Retrieved from https://www.climatecentral.org/climate-matters/severe-storm-super-hazards.
[346] Climate Central. (2022). Changing Thunderstorm Potential. Retrieved from https://www.climatecentral.org/climate-matters/changing-thunderstorm-potential.
[347] Center for Climate and Energy Solutions. (n.d.). Tornadoes and Climate Change. Retrieved from https://www.c2es.org/content/tornadoes-and-climate-change/

becoming more severe, frequent, and prolonged.[348] Countywide, the estimated number of extreme heat days per year is forecasted to increase by 14 days by mid-century (2035–2064) and by 17 days by late-century (2070–2099).[349] Modeling suggests that the average number of high-heat days will increase in many jurisdictions, with the greatest impacts expected in Atherton, East Palo Alto, Menlo Park, North Fair Oaks, Redwood City, San Carlos, and Woodside.[350]

The compounding effects of climate change on heat waves/extreme heat also have broader ecological impacts, including altering natural ecosystems and increasing wildfire risk. Higher temperatures increase evaporation and soil dryness, which, in turn, can lead to drought conditions, affecting water supplies and agriculture.[351] Lastly, the changing patterns of extreme heat are impacting public health, with increases in heat-related illnesses and fatalities, particularly among the underserved population (e.g., the elderly, children, pregnant women, individuals with pre-existing health conditions, the homeless).

Climate Change Impact		Impact Factor	Weighted Factor	Score
High	Climate Change trends will significantly increase the impacts of this hazard.	3	1	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Climate Change Impact Score = Impact Factor x Weighted Factor***				

Fog: Climate change trends will not increase the risks and impacts of fog.

Climate Change Impact		Impact Factor	Weighted Factor	Score
No Impact	Climate change trends will not increase the impacts of this hazard.	0	1	0
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Climate Change Impact Score = Impact Factor x Weighted Factor***				

Secondary Impacts

The following are cascading or indirect hazards that may follow the primary hazard event. These hazards can occur concurrently with or be triggered by the initial event and may exacerbate its overall impact.

- Flooding
- Bank and Coastal Erosion
- Landslides
- Wildfire
- Drought

[348] Environmental Protection Agency and the Centers for Disease Control and Prevention. (2016). Climate Change and Extreme Heat: What You Can Do to Prepared. Retrieved from https://www.epa.gov/sites/default/files/2016-10/documents/extreme-heat-guidebook.pdf.
[349] San Mateo County. (2026). Safety Element (Draft).
[350] San Mateo County Sustainability Department. (n.d.). Extreme Heat. Retrieved from https://www.smcsustainability.org/climate-resilience/climate-risks/extreme-heat/.
[351] The Nature Conservancy. (2025). Yes, Climate Change is Raising the Risks — and Stakes — of Extreme Wildfires. Retrieved from https://www.nature.org/en-us/what-we-do/our-priorities/tackle-climate-change/climate-change-stories/extreme-wildfires-are-getting-worse-with-climate-change/.

- Public Health Impacts
- Transportation Disruptions
- Power Outage (Public Safety Power Shutoff)

4.6.7.8. Issues

Severe weather (i.e., heavy rainfall, severe thunderstorms, strong winds, tornadoes, heat waves/extreme heat, fog) presents a range of challenges that can impact a community's preparedness, response, recovery, and mitigation efforts. While not exhaustive, the following outlines key issues related to severe weather that the planning team identified San Mateo County may encounter during such events.

- Safe sheltering actions can be hindered due to a lack of community storm shelters, especially in mobile home parks or public areas.
- Severe weather can damage communication systems (e.g., power lines, cell towers), which can leave residents isolated and unable to communicate with first responders.
- Communication barriers related to language, culture, and access to communication can prevent residents and visitors from receiving critical emergency information before, during, and after a severe weather event.
- The homeless population in San Mateo County requires the opening of shelters during heat waves/extreme heat events.
- It is common for members of the community to open fire hydrants to cool down during heat waves/extreme heat events, which leads to loss of water pressure and increased water use.
- The dense and diverse population of San Mateo County presents challenges for shelter and evacuation, which raises the demand for resources and extends response and recovery operations during severe weather events.
- Redundancy of power supply throughout the planning area must be evaluated to better understand what areas may be more vulnerable.
- Although primarily thought of as an urban area, the County has a larger physical land mass containing rural communities and must also consider the needs of these community members (as well as their possible isolation during severe weather events).
- Public education on the impacts of severe weather needs to continue so that community members can be better informed and prepared for these events. In particular, fog should be addressed, as it may be downplayed despite its potential to cause transportation accidents.
- Debris management, such as handling downed trees, is essential because debris can influence the severity of severe weather events, necessitate coordination efforts, and potentially incur additional costs.
- The effects of climate change may result in an increase in heavy rainfall or more intense storm events and will likely lead to increased temperatures and changes in overall precipitation amounts.
- Older building stock in the planning area is built to low code standards or none at all. These structures could be highly vulnerable to the effects of severe winter weather.

- Urban forest management programs need to be assessed to minimize the effects of damage related to forests.

4.6.7.9. Risk Profile

FEMA Risk Index Score

The FEMA Strong Wind Risk Index score and rating represent a community's relative risk for strong winds when compared to the rest of the United States. **Table 4-126** illustrates the Strong Wind Risk Index rating and score for San Mateo County.

Table 4-126. Strong Wind Total Risk Score *(FEMA National Risk Index)*

Rating	Score
Relatively Low	20.6
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability, and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).	

The FEMA Tornado Risk Index score and rating represent a community's relative risk for tornadoes when compared to the rest of the United States. **Table 4-127** illustrates the Tornado Risk Index rating and score for San Mateo County.

Table 4-127. Tornado Total Risk Score *(FEMA National Risk Index)*

Rating	Score
Relatively Low	30.6
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability, and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).	

The FEMA Heat Wave Risk Index score and rating represent a community's relative risk for heat waves when compared to the rest of the United States. **Table 4-128** illustrates the Heat Wave Risk Index rating and score for San Mateo County.

Table 4-128. Heat Wave Total Risk Score *(FEMA National Risk Index)*

Rating	Score
Relatively Moderate	91.6
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability, and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).	

The FEMA NRI does not assess heavy rainfall, severe thunderstorms, or fog.

Overall Risk Score

Table 4-129 represents the Severe Weather Total Risk Score for San Mateo County, based on the Risk Assessment Methodology, as defined in Section 4.3 of this Plan.

Table 4-129. Severe Weather Total Risk Score

Hazard Event	Probability Factor	Sum of Weighted Extent Factors	Sum of Weighted Vulnerability Factors	Sum of Weighted Impact Factors	Consequence Score	Total Risk Score*
Heavy Rainfall	3	12	13	23	48	67
Strong Winds	3	9	13	22	44	61
Heat Wave/Extreme Heat	3	9	10	15	34	47
Severe Thunderstorms	2	12	13	21	46	43
Tornado	1	6	13	13	32	15
Fog	1	6	9	11	26	12

Extent: Sum of the weighted Extent factors.
Vulnerability: Sum of the weighted Vulnerability factors.
Impact: Sum of the weighted Impact factors.

Consequence Score: Extent + Vulnerability + Impact (Sum of all weighted factors).
Total Risk Score = Probability x Consequence
* Normalized to 100

Total Risk Score Legend

Classification	Probability	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 4	0 – 12	0 – 24	0 – 32
Medium (M)	2	7 – 12	5 – 10	13 – 26	25 – 48	33 – 66
High (H)	3	13 – 18	11 – 15	27 – 39	49 – 72	67 – 100

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.8. Tsunami

The term tsunami comes from the Japanese word "harbor wave" because of the devastating effects these waves had on low-lying coastal communities.[352]

A tsunami is a series of extremely long waves caused by seismic activity, volcanic activity, or landslides. However, based on records dating back to 1900, over 80% of tsunamis are generated by earthquakes. Generally, subduction zone earthquakes of magnitude 7.5 or greater at plate boundaries are the most frequent cause of tsunamis.[353] When an earthquake occurs below or near the ocean, waves radiate outward in all directions away from the epicenter, sometimes crossing an entire ocean basin. Additionally, tsunamis may also be generated by submarine and subaerial landslides (which may also be caused by earthquakes), submarine volcanic eruptions, and the collapse of volcanic edifices.[354]

Tsunamis, unlike regular waves, move through the entire water column from the ocean floor to the ocean surface.[355] The speed of a tsunami depends on ocean depth; in the deep ocean, they can move at over 500 mph. The height or amplitude of a tsunami wave in deep water is generally three (3) feet or less, and thus may not be noticeable to people on ships. As tsunami waves approach land, however, and as the ocean shallows, the waves slow to around 20 to 30 miles per hour but grow significantly in height.[356]

Tsunamis are often confused with tidal waves; the three (3) main differences between the two (2) are:[357]

- A tsunami's water level changes occur much faster, 10 to 15 minutes, than a tidal wave, which gradually changes over six (6) to 12-hour periods.
- Tsunami waves travel much faster than tidal waves. A tsunami in the deep ocean can move faster than 500 mph, while a tidal wave moves at approximately 23 mph.
- The incoming waves of a tsunami can be significantly larger than a tidal wave. The world's largest tidal ranges are at 52 feet above low tide, while tsunamis can reach 131 feet, striking coastlines with much lower tidal ranges.

Scientists are beginning to better understand another type of tsunami, called a meteotsunami. These are large waves (six (6) feet or higher) driven by air pressure disturbances associated with fast-moving weather events (e.g., severe thunderstorms, squalls, other storm fronts). Meteotsunamis are amplified by a shallow continental shelf and inlet or other coastal features. The characteristics of meteotsunamis are very similar to a seismic tsunami and, as a result, can be confused with storm surge. Although scientists have identified atmospheric conditions that produce meteotsunamis, the ability to forecast

[352] Exploring our Fluid Earth. (n.d.). Tsunamis. Retrieved from https://manoa.hawaii.edu/exploringourfluidearth/physical/coastal-interactions/tsunamis.
[353] Pacific Northwest Seismic Network. (n.d.). Frequently Asked Questions. Retrieved from https://pnsn.org/outreach/faq.
[354] National Oceanic and Atmospheric Administration. (2023). Tsunamis: Introduction to the Tsunamis. Retrieved from https://www.noaa.gov/jetstream/tsunamis.
[355] National Oceanic and Atmospheric Administration. (n.d.). U.S. Department of Commerce. Tsunamis. Retrieved from https://www.noaa.gov/education/resource-collections/ocean-coasts/tsunamis.
[356] National Oceanic and Atmospheric Administration. (2023). Tsunami Propagation. Retrieved from https://www.noaa.gov/jetstream/tsunamis/tsunami-propagation.
[357] Exploring our Fluid Earth. (n.d.). Tsunamis. Retrieved from https://manoa.hawaii.edu/exploringourfluidearth/physical/coastal-interactions/tsunamis.

and issue advisories remains uncertain.[358] Water-level analyses and meteorological data in the United States indicate that meteotsunamis occur more often than expected; therefore, they should be considered in coastal hazard mitigation planning.[359]

4.6.8.1. Location

A tsunami can occur in all coastal areas of San Mateo County, including the Pacific Ocean coastline and the low-lying areas along the San Francisco Bay. **Figure 4-17** illustrates Tsunami Hazard Areas, which represent areas that could be exposed to tsunami hazards during a tsunami event. Areas in yellow are advised to evacuate immediately after a long-lasting earthquake or upon receiving an official evacuation notification. Residents and visitors are advised to evacuate on foot to a green area. The California Tsunami Hazard Area maps and data were developed using the best available scientific information. They are based on the State of California 2009 Tsunami Inundation Maps for Emergency Planning and on enhanced high-resolution, 975-year return-period probabilistic tsunami inundation model results.[360]

Figure 4-17. Tsunami Hazard Areas

[Map under development…]

The interactive San Mateo County Tsunami Hazard Area Map is available on the California Department of Conservation website.

4.6.8.2. Extent/Severity

The severity of a tsunami is determined by a complex interaction between the characteristics of the advancing wave and the physical environment they encounter. Coastal configuration, shoreline orientation, and bathymetry (the shape of the ocean floor) all play a critical role in determining the extent of landward damage. Geographic features such as bays, inlets, and estuaries can amplify the wave's height, while offshore canyons can focus wave energy through refraction. Conversely, islands may act as natural filters, dissipating some of the energy. Due to these factors, wave heights can vary widely from one location to another (even over relatively short distances). Furthermore, particularly during high tide events, tsunami energy can penetrate flood-control channels and inland waterways for more than a mile.

The size and speed of a tsunami are further defined by the movement of water both onto and away from the shore. In some locations, the advancing turbulent wave front, characterized by high velocity water and immense pressure, is the most destructive force. In other scenarios, the greatest damage occurs during the outflow of water back to the sea, between crests. This receding water can undermine roads, buildings, and bulkheads while sweeping surface structures and vehicles into the ocean. This outflow often carries enormous amounts of highly damaging debris, which acts as a secondary battering ram against remaining infrastructure. Furthermore, ships and boats are at extreme risk (unless they are moved away from the shore), they may be forced against breakwaters, wharves, and other craft, or washed ashore and left grounded after the withdrawal of the seawater.[361]

[358] National Oceanic and Atmospheric Administration, National Ocean Service. (n.d.). What is a Meteotsunami? Retrieved from https://oceanservice.noaa.gov/facts/meteotsunami.html.
[359] Horillo, J., Cheng, W., Joe, A., and Shang, Y. (2022). Tsunami Inundation Maps Development and Continuation of the Meteotsunami Characterization for the GOM. Retrieved from https://www.tamug.edu/tsunami/Files/report_NTHMP_2022_FY21-web.pdf.
[360] California Department of Conservation, California Geological Survey. (2021). California Tsunami Maps. Retrieved from https://www.conservation.ca.gov/cgs/tsunami/maps.
[361] National Tsunami Hazard Mitigation Program. (2001). Designing for Tsunamis. Retrieved from https://www.preventionweb.net/files/1505_DesigningforTsunamis.pdf?startDownload=true.

Tsunami intensity is measured by the Papadopoulos and Imamura Scale (**Table 4-130**). In 2001, the 12-point tsunami scale was proposed by Gerassimos Papadopoulos and Fumihiko Imamura. The scale has 12 levels, and it is consistent with the 12-grade seismic intensity scale (MMI). Additionally, the scale is arranged according to the impacts on people, nature, and objects (e.g., vessels), as well as damage to buildings.[362]

Table 4-130. Papadopoulos and Imamura Tsunami Scale

Intensity	Impacts on People	Impacts on Objects	Damage to Buildings
I (Not Felt)	Not felt even under the most favorable circumstances.	No impact.	No damage.
II (Scarcely Felt)	Felt by a few people on board small vessels. Not observed on the coast.	No impact.	No damage.
III (Weak)	Felt by most people on board small vessels. Observed by a few people on the coast.	No impact.	No damage.
IV (Largely Observed)	Felt by all on board small vessels and by a few people on board large vessels. Observed by most people on the coast.	A few small vessels move slightly onshore.	No damage.
V (Strong)	Felt by all on board large vessels and observed by all on the coast. Few people are frightened and run to higher ground.	Many small vessels move strongly onshore; a few of them collide or overturn. Traces of a sand layer are left behind on the ground under favorable conditions. Limited flooding of cultivated land.	Limited flooding of outdoor facilities (e.g., gardens) of near-shore structures.
VI (Slightly Damaging)	Many people are frightened and run to higher ground.	Most small vessels move violently onshore, crash strongly into each other, or overturn.	Damage and flooding in a few wooden structures. Most masonry buildings withstand.
VII (Damaging)	Most people are frightened and try to run to higher ground.	Many small vessels are damaged. Few large vessels oscillate violently. Sand layer and accumulations of pebbles are left behind. A few aquaculture rafts are washed away.	Many wooden structures were damaged, and a few were demolished or washed away. Slight damage and flooding in a few masonry buildings.
VIII (Heavily Damaging	All people escape to higher ground; a few are washed away.	Most of the small vessels are damaged, and many are washed away. Few large vessels are moved ashore or crash into each other. Big objects drift away. Erosion and littering on the beach. Extensive flooding. Slight damage in the tsunami control forests and stop drifts. Many aquaculture rafts were washed away, and a few were partially damaged.	Most wooden structures are washed away or demolished. Moderate damage in a few masonry buildings. Most reinforced concrete buildings sustain damage.

[362] UNESCO Intergovernmental Oceanographic Commission. (2001). Papadopoulos Imamura Tsunami Intensity Scale. Retrieved from https://www.ign.es/web/ign/portal/sis-tsunamis/escala-de-intensidad-pi.

Intensity	Impacts on People	Impacts on Objects	Damage to Buildings
IX (Destructive)	Many people are washed away.	Most small vessels are destroyed or washed away. Many large vessels are moved violently ashore; few are destroyed. Extensive erosion and littering of the beach. Local ground subsidence. Partial destruction in the tsunami control forests and stop drifts. Most aquaculture rafts were washed away, and many were partially damaged.	Heavy damage in many masonry buildings, and a few reinforced concrete buildings suffer moderate damage.
X (Very Destructive)	General panic. Most people are washed away.	Most large vessels are moved violently ashore, and many are destroyed or collide with buildings. Small boulders from the sea bottom are moved inland. Cars overturned and drifted. Oil spills and fires start. Extensive ground subsidence.	Many masonry buildings and a few reinforced concrete buildings suffered heavy damage. Artificial embankments collapse; port water breaks are damaged.
XI (Devastating)	--	Lifelines interrupted. Extensive fires. Water backwash drifts cars and other objects in the sea. Big boulders from the sea bottom are moved inland.	Total damage in many masonry buildings. Few reinforced concrete buildings are destroyed, and many suffer heavy damage.
XII (Completely Devastating)	--	--	Practically all masonry buildings are demolished. Most reinforced-concrete buildings are severely damaged.

Extent/Severity		Extent Factor	Weighted Factor	Score
Low	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a low-intensity incident.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Extent/Severity Score = Extent Factor x Weighted Factor***				

Catastrophic Potential

A catastrophic incident can be defined as any natural, human-caused, or technological disaster that results in extraordinary levels of casualties, damage, or disruption, severely affecting the population (including mass evacuations), infrastructure, environment, economy, national morale, or government functions in the area.[363] The catastrophic potential for a tsunami event is low in San Mateo County.

[363] Federal Emergency Management Agency. (2019). National Response Framework (Fourth Edition). Retrieved from https://www.fema.gov/sites/default/files/documents/NRF_FINALApproved_2011028.pdf.

Catastrophic Potential		Extent Factor	Weighted Factor	Score
Low	Low potential that this hazard could be catastrophic.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Catastrophic Score = Extent Factor x Weighted Factor***				

4.6.8.3. Warning Time

In the event of a tsunami, NOAA's Tsunami Warning Centers are responsible for issuing tsunami advisories, watches, and warnings. There are two (2) tsunami warning centers – the Pacific Tsunami Warning Center (PTWC) and the National Tsunami Warning Center (NTWC), which is responsible for the continental United States, Alaska, and Canada. **Table 4-131** outlines the tsunami alerts issued by the NTWC to notify emergency managers, the public, and other partners about the potential for a tsunami following a possible tsunami-generating event.[364]

Table 4-131. NTWC Advisories

Type	Description
Tsunami Information Statement	Issued when an earthquake or tsunami has occurred that is of interest to the message recipients. In most cases, information statements are issued to indicate there is no threat of a destructive basin-wide tsunami and to prevent unnecessary evacuations. Information statements for distant events requiring evaluation may be upgraded to a warning, advisory, or watch as new information and analysis become available.
Tsunami Watch	Issued when a tsunami may later impact the watch area. The watch may be upgraded to a warning, advisory, or canceled based on updated information and analysis. Emergency management officials and the public should prepare to take action.
Tsunami Advisory	Issued when a tsunami with the potential to generate strong currents or waves dangerous to those in or very near the water is imminent, expected, or occurring. The threat may persist for several hours after the initial arrival, but significant inundation is not expected in areas under an advisory. Appropriate actions for local officials may include closing beaches, evacuating harbors and marinas, and repositioning ships to deep water when time allows and it can be done safely. Advisories may be updated, adjusted geographically, upgraded to a warning, or canceled based on updated information and analysis.
Tsunami Warning	Issued when a tsunami with the potential to generate widespread inundation is imminent, expected, or occurring. Warnings alert the public that dangerous coastal flooding, accompanied by powerful currents, is possible and may continue for several hours after the initial arrival. Warnings alert emergency management officials to take action for the entire tsunami hazard zone. Appropriate actions for local officials may include evacuating low-lying coastal areas and, when time allows, and it is safe to do so, repositioning ships to deep water. Warnings may be updated, adjusted geographically, downgraded, or canceled based on updated information and analysis.
A ***cancellation*** *is issued after an evaluation of water-level data confirms that a destructive tsunami will not impact an area under a warning, advisory, or watch or that a tsunami has diminished to a level where additional damage is not expected.*	

The NCEI Tsunami Travel Times to Coastal Locations Viewer displays estimated pre-computed tsunami travel times (in hours) to select coastal locations from any point in the ocean.

[364] National Tsunami Warning Center. (2026). Tsunami Message Definitions. Retrieved from https://www.tsunami.gov/?page=message_definitions.

4.6.8.4. Probability and Frequency

The probability of occurrence for a tsunami in San Mateo County is low because a *significant* event is likely to occur within 100 years. Tsunami probabilities are fundamentally linked to the occurrence of the events that cause them, such as earthquakes, submarine landslides, and volcanic activity, none of which can be predicted with certainty. Also, it is important to note that not all of these geological events will trigger a tsunami.

Probability of Occurrence		Probability Factor	Weighted Factor	Score
Low	A significant hazard event is likely to occur within 100 years.	1	N/A	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology).				

FEMA NRI Annualized Frequency

The tsunami annualized frequency value represents the average number of recorded tsunami hazard occurrences, in event days, per year over the period of record (222 years). **Table 4-132** outlines the annualized frequency for tsunamis, based on FEMA NRI data, for San Mateo County.

Table 4-132. Tsunami Annualized Frequency *(FEMA National Risk Index)*

Events on Record *(1800 – 2021)*	Annualized Frequency
73	0.3
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.	

4.6.8.5. Past Events

Notable tsunamis have occurred in San Mateo County. The California Department of Conservation maintains a list of tsunamis in the State. Some tsunamis have struck San Francisco or other parts of the Bay Area, but not San Mateo County; those events were not identified. **Table 4-133** lists notable tsunami events that affected San Mateo County between 1859 and 2025.[365]

Table 4-133. Notable Tsunami Events

Date	Description
March 11, 2011	A magnitude 8.9 earthquake near Honshu, Japan, generated a tsunami that significantly affected California. Wave heights were recorded at 0.7 meters in Half Moon Bay and one (1) meter in Pacifica. The tsunami damaged six (6) boat slips and three (3) docks, and snapped a wooden piling at the Berkeley Marina. *(DR-1968)*
February 27, 2010	A magnitude 8.8 earthquake in Central Chile triggered a tsunami that reached San Mateo County. Wave heights of 0.6 meters were recorded in Half Moon Bay.
March 28, 1964	A magnitude earthquake off the Gulf of Alaska triggered a tsunami that reached San Mateo County. Wave heights of 1.4 meters were recorded in Pacifica. The tsunami arrived in San Francisco five (5) hours and six (6) minutes after the triggering event.
May 22, 1960	A magnitude 9.5 earthquake in Central Chile triggered a tsunami that reached San Mateo County. Wave heights of 1.2 meters were recorded in Pacifica.

365 The information for this table was sourced from multiple references.

Date	Description
April 1, 1946	A magnitude 7.3 earthquake in the East Aleutian Islands (Alaska) triggered a tsunami that struck California. Wave heights of 2.6 meters were recorded in Half Moon Bay.
September 24, 1859	A tsunami originating in Northern California hit Half Moon Bay, with waves 4.6 meters high.

4.6.8.6. Vulnerability

Population Exposed

14% or less of the population in San Mateo County is exposed to tsunamis. The entire shoreline population in the County is vulnerable to tsunamis, particularly those in Pacific coastal communities and low-lying areas on the Bayside. These neighborhoods include the City of Pacifica, City of Half Moon Bay, Princeton, El Granada, and Pescadero (on the Pacific coast), and the City of Burlingame, Foster City, Redwood City, and City of East Palo Alto (on the Bayside). In addition to permanent residents, a transient population at beaches, marinas, and coastal parks can also be exposed. Additionally, individuals with access and functional needs, the elderly, children, and those who lack access to timely emergency notifications are uniquely vulnerable.

Population Exposure		Vulnerability Factor	Weighted Factor	Score
Low	14% or less of the population is exposed to the hazard.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population Exposure Score = Extent Factor x Weighted Factor***				

Property Exposed

9% or less of the total assessed property, infrastructure, and resources value is exposed to tsunamis in San Mateo County. In general, any property located within the shoreline, particularly within the tsunami hazard areas, is considered vulnerable. A number of roads, bridges, and utilities in San Mateo County may be exposed to tsunamis. There are three (3) major roads that intersect the mapped tsunami hazard areas.

- State Highway 1
- State Highway 92
- US Highway 101

Additionally, 11 bridges in San Mateo County are exposed to tsunamis. Bridges exposed to tsunamis are extremely vulnerable because of the forces transmitted by the wave runup and by the impact of debris carried by the wave action.

Tsunamis can affect both utility systems and supporting infrastructure. Floodwater may back up drainage systems, clog culverts with debris, and cause localized urban flooding. It can also contaminate drinking water supplies and overwhelm sewer systems, resulting in waste spills into homes, neighborhoods, rivers, and streams. Additionally, there are two (2) hazardous material facilities within the tsunami hazard area.

Aboveground utilities are also vulnerable. Tsunami waves can damage power lines and telecommunications towers, while wave action and floodwater inundation can severely impair power generation facilities.

Property Exposure		Vulnerability Factor	Weighted Factor	Score
Low	9% or less of the total assessed property value is exposed to a hazard.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property Exposure Score = Extent Factor x Weighted Factor***				

Changes in Development

Information on changes in development within San Mateo County is provided in **Chapter 3** (Community Profile) of this Assessment.

The changes in development have increased San Mateo County's exposure to tsunamis by less than 4%. The vulnerability to tsunamis is directly related to development along the coastline. However, San Mateo County has implemented existing building and construction regulations to help reduce the impacts of tsunamis.

Changes in Development		Vulnerability Factor	Weighted Factor	Score
Low	Changes in development have increased the community's exposure to the hazard by 4% or less.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Changes in Development Score = Extent Factor x Weighted Factor***				

4.6.8.7. Impacts

Population and Life Safety

A population that is exposed to tsunamis is likely to experience minimal adverse impacts (e.g., ambulatory injuries). A tsunami poses significant threats to the population and life safety along the Pacific and Bayside shorelines in San Mateo County. These areas are subject to tsunami inundation as illustrated in the California Tsunami Hazard Areas Maps. Immediate dangers involve primarily drowning and traumatic injury caused by high-velocity water and large debris (e.g., vehicles, structural remnants, and storage tanks) swept up by the wave. Beyond the initial surge, the powerful receding water can sweep individuals out to sea, leading to further fatalities. A tsunami can also compromise critical infrastructure, contaminating drinking water and food supplies with sewage and hazardous materials, significantly increasing the risk of infection and waterborne illnesses. Additionally, the destruction of medical facilities and the physical isolation of communities like Pescadero and Princeton can severely affect emergency response efforts, potentially causing more secondary fatalities.

Population and Life Safety Impact		Impact Factor	Weighted Factor	Score
Low	Populations exposed to this hazard are likely to experience minimal adverse impacts, such as ambulatory injuries.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population and Life Safety Impact Score = Impact Factor x Weighted Factor***				

Underserved Population

The underserved population exposed to tsunamis in San Mateo County is likely to experience minimal adverse/disproportionate impacts (e.g., ambulatory injuries). The underserved population faces unique impacts from these events. These groups include, but are not limited to, low-income households, individuals aged 65 and older, children, individuals with access and functional needs, and populations living on single access roads. Lower-income populations often reside in housing that is less structurally resilient to the intensity of tsunami waves. In the event of inundation, the foundation of these homes can be severely damaged or completely destroyed, resulting in financial strain for these households. The elderly population (i.e., 65 years old and older), especially those with access and functional needs, may have physical limitations that make rapid evacuation to higher ground difficult, particularly during a local source tsunami with minimal warning time (the tsunami can arrive within 15 to 20 minutes). Furthermore, these individuals may lack the social connections and community support necessary to assist with emergency preparedness, manage specialized medical needs, or navigate complex evacuation orders. Also, individuals living in isolated coastal areas with limited access (e.g., one (1) road in and one (1) road out) are uniquely vulnerable, as tsunami-induced flooding and debris can render roads and bridges impassable, cutting these communities off from critical lifelines for an extended period.

Underserved Population Impact		Impact Factor	Weighted Factor	Score
Low	Underserved populations exposed to the hazard are likely to experience minimal adverse/disproportionate impacts, such as ambulatory injuries.	1	3	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Underserved Population Impact Score = Impact Factor x Weighted Factor***				

Property, Facilities, and Critical Infrastructure

Less than $500,000 in property damage is expected from a *single major* tsunami event, or damages are expected to be less than 5% of the property value within San Mateo County. High velocity waves and the accompanying surge of debris can cause structural failure to residential and commercial buildings, particularly older wood-framed or unreinforced masonry structures located in low-lying areas on the Coastside and Bayside. Maritime facilities (e.g., harbors, marinas) are particularly vulnerable as unrestrained vessels can crash against wharves or wash inland and become secondary hazards that strike other onshore structures. Inundation of industrial zones (e.g., hazardous materials facilities) can result in contamination if the hazardous materials are swept into the environment.

Major transportation corridors, including coastal highways and Bayside artery roads, are susceptible to becoming impassable by floodwaters and large debris, which can significantly impact evacuation efforts and emergency response operations. Utility networks (e.g., wastewater treatment plants) are highly exposed to the corrosive effects of saltwater and the physical force of the water, potentially leading to long-term service outages. Also, if first responder facilities (e.g., emergency operations centers, police stations, fire stations) sustain damage, operational capacity may be severely compromised.

Property, Facilities, and Critical Infrastructure Impact		Impact Factor	Weighted Factor	Score
Low	Less than $500,000 in property, facilities, and infrastructure damages is expected from a single significant event, or damages are expected to occur to less than 5% of the property value within the jurisdiction.	1	2	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property, Facilities, and Critical Infrastructure Impact Score = Impact Factor x Weighted Factor***				

Economy

A single *significant* tsunami event in San Mateo County is likely to result in a total economic impact of less than $100,000. Even so, tsunamis can disrupt the County's economy through business interruption, physical damage to buildings and infrastructure, and recovery-related costs such as relocation, wage loss, and rental expenses during repairs and replacement. Flooded businesses may be unable to reopen until repairs are completed.

The most significant economic effects are expected in the Coastside and Bayside areas directly affected by the tsunami waves. Key impacts may include:

- Damage to commercial buildings that may require renovation and disrupt related services.
- Losses to agriculture, including damage to crops and other farm products.
- Harm to public utilities and interruptions to service delivery.
- Power and communication outages.
- Temporary shutdowns of drinking water and wastewater treatment facilities, along with transportation damage and repair delays that increase economic costs.

Economic Impact		Impact Factor	Weighted Factor	Score
Low	Total economic impact is not likely to be greater than $100,000.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Economic Impact Score = Impact Factor x Weighted Factor***				

FEMA NRI Expected Annual Loss Estimates

A tsunami NRI EAL score and rating represent a community's relative level of expected building and population loss each year due to tsunamis when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-134** outlines the tsunami EAL for San Mateo County.

Table 4-134. Tsunami Expected Annual Loss *(FEMA National Risk Index)*

Population	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Expected Annual Loss Rating
0.00	$0	$7.2 Million	n/a	$7.2 Million	74.8	Relatively Moderate

Population exposure is defined as the estimated number of people determined to be exposed to a hazard according to a hazard type-specific methodology.

Expected Annual Loss scores are calculated using an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).

Environment

Environmental impact from a single *significant* tsunami event is likely to be minimal, requiring little to no outside resources and support; and/or repair, cleanup, restoration, or preservation work. However, tsunami inundation can still create localized environmental damage through flooding, debris deposition, and pollutant transport.

Wildlife and natural habitats within inundated areas are exposed to tsunami impacts. Wildlife and natural habitats within tsunami hazard areas are directly exposed to the physical forces of tsunami waves. Aquatic habitats and associated ecosystems are especially vulnerable in low-lying areas, particularly to saltwater intrusion and sediment shifts. Tsunami waves can erode sensitive coastal areas, deposit sediment and debris, and damage habitat restoration and conservation investments across the County. Industrial buildings and other coastal facilities are also vulnerable. If these structures are damaged, hazardous materials could be released into the environment, contaminating water supplies, soil, and air, threatening public health, and creating significant environmental concerns.

Other potential consequences include permanent changes to beaches and other coastal features, as well as changes in the quality and availability of freshwater. Also, saltwater inundation (short- or long-term) can render agricultural land useless. The forces of water, pollutants and toxic substances, sediment, marine debris, and invasive species can also harm agricultural land and natural resources onshore and offshore. Changes to these resources can affect the services they provide (e.g., biological, ecological, protective, and recreational).[366]

Environment Impact		Impact Factor	Weighted Factor	Score
Low	Environmental impact from a single significant event is likely to be minimal, requiring little to no outside resources and support; and/or minimal repair, cleanup, restoration, or preservation work.	1	1	1

For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology).
Environmental Impact Score = Impact Factor x Weighted Factor

[366] National Oceanic and Atmospheric Administration. (2023). Tsunami Dangers. Retrieved from https://www.noaa.gov/jetstream/tsunamis/tsunami-dangers.

Continuity of Operations/Delivery of Services

There may be impacts lasting less than 24 hours on San Mateo County's ability to meet the essential day-to-day operational demands and needs of the community in the event of a *single major* tsunami. A significant tsunami can have cascading impacts on a community's ability to deliver day-to-day services and maintain continuity of operations, particularly on the coastal communities. These impacts include damage to first responders' infrastructure (e.g., fire and police stations, emergency operations centers, hospitals), disruptions to utilities (e.g., power, water, communication), and impassable roads and bridges, hindering the delivery of day-to-day services. Tsunami inundation can damage power plants, substations, and power lines, resulting in power outages that could last several days. Water treatment facilities can also be compromised, potentially contaminating drinking water supplies. Furthermore, if critical infrastructure (e.g., fire and police stations) is within the inundated area, it can significantly impact response and recovery operations. These impacts might lead coastal communities to seek resources from inland areas to help maintain their operational continuity and service delivery.

Continuity of Operations/Delivery of Services Impact		Impact Factor	Weighted Factor	Score
Low	Impact lasting less than 24 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single significant event.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Continuity of Services/Delivery of Services Impact Score = Impact Factor x Weighted Factor***				

Future Development

Information on changes in development within San Mateo County is provided in **Chapter 3** (Community Profile) of this Assessment.

Future development trends will minimally increase the impacts of tsunamis in San Mateo County. San Mateo County and its coastal cities are prepared to accommodate future growth within tsunami hazard areas. The California Department of Conservation's inundation maps help guide development away from areas at risk of tsunamis. Additionally, each jurisdiction, including San Mateo County, has adopted its own general plans. The safety element of these plans establishes standards to protect coastal communities from tsunamis. Development is controlled through building standards and performance measures designed to minimize tsunami risks. Furthermore, building codes have been updated to account for tsunami loads, thereby enhancing structural resilience in new developments.

Future Development Impact		Impact Factor	Weighted Factor	Score
Low	Future development trends will minimally increase the impacts of this hazard.	1	1	1
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Future Development Impact Score = Impact Factor x Weighted Factor***				

Climate Change

Climate change trends will not increase the risks and impacts of tsunamis. The relationship between climate change and its impacts on tsunamis is indirect, as these events are primarily triggered by geophysical processes such as earthquakes, submarine landslides, and volcanic activity. These core drivers are independent of atmospheric conditions influenced by climate change.

Climate Change Impact		Impact Factor	Weighted Factor	Score
No Impact	Climate change trends will not increase the impacts of this hazard.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Climate Change Impact Score = Impact Factor x Weighted Factor***				

Secondary Impacts

The following are cascading or indirect hazards that may follow the primary hazard event. These hazards can occur concurrently with or be triggered by the initial event and may exacerbate its overall impact.

- Erosion
- Coastal Flooding
- Hazardous Materials Incident
- Transportation Disruptions
- Power Outages

4.6.8.8. Issues

Tsunamis present a range of challenges that can impact a community's preparedness, response, recovery, and mitigation efforts. While not exhaustive, the following outlines key issues that the planning team identified that San Mateo County may encounter during such events.

- To truly measure and evaluate the probable impacts of tsunamis on planning, hazard mapping based on probabilistic scenarios must continue to be updated regularly, as the science and technology in this field continue to emerge. Accurate probabilistic tsunami mapping will need to be a key component for effective tsunami hazard mitigation programs.
- As tsunami warning technologies evolve, the tsunami warning capability within the planning area will need to be enhanced to provide the highest degree of warning to planning partners with tsunami risk exposure.
- Special attention will need to be focused on the underserved communities in the tsunami hazard areas and on hazard mitigation through public education, outreach, and warning capabilities. This issue may be especially important for visitors to San Mateo County.
- Risk from tsunami inundation is not subject to the State of California real estate disclosure law at this time.
- With future impacts from climate change, the issue of sea level rise may become an important consideration as probable tsunami inundation areas are identified through future studies.

4.6.8.9. Risk Profile

FEMA Risk Index Score

The FEMA Tsunami Risk Index score and rating represent a community's relative risk for tsunamis when compared to the rest of the United States. **Table 4-135** illustrates the Tsunami Risk Index rating and score for San Mateo County.

Table 4-135. Tsunami Total Risk Score *(FEMA National Risk Index)*

Rating	Score
Relatively Moderate	70.8
Risk Index Values are calculated by combining the Social Vulnerability and Community Resilience components into a single Community Risk Factor, which is then multiplied by the Expected Annual Loss component (Expected Annual Loss x (Social Vulnerability / Community Resilience) = Risk Index).	

Overall Risk Score

Table 4-136 represents the Tsunami Total Risk Score for San Mateo County, based on the Risk Assessment Methodology, as defined in Section 4.3 of this Plan.

Table 4-136. Tsunami Total Risk Score

Hazard Event	Probability Factor	Sum of Weighted Extent Factors	Sum of Weighted Vulnerability Factors	Sum of Weighted Impact Factors	Consequence Score	Total Risk Score*
Tsunami	1	6	5	12	23	11
Extent: Sum of the weighted Extent factors. **Vulnerability:** Sum of the weighted Vulnerability factors. **Impact:** Sum of the weighted Impact factors.			**Consequence Score:** Extent + Vulnerability + Impact (Sum of all weighted factors). **Total Risk Score =** Probability x Consequence * Normalized to 100			

Total Risk Score Legend

Classification	Probability	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 4	0 – 12	0 – 24	0 – 32
Medium (M)	2	7 – 12	5 – 10	13 – 26	25 – 48	33 – 66
High (H)	3	13 – 18	11 – 15	27 – 39	49 – 72	67 – 100

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.9. Wildfire

Wildfires are unplanned fires that occur in wildlands (e.g., forests, rangelands, or grasslands) and are nearly impossible to prevent and difficult to control. These extreme events are common in the western United States, usually occurring during the summer and fall.[367] Free-burning fires can occur whenever combustible fuel (e.g., grasses, shrubs, trees, dead leaves) in the presence of oxygen at an extremely high temperature becomes gas (flames are the visual indicator of heated gas). Smoldering fires can occur with low-temperature heat sources and, over time, can reach ignition temperature, leading to rapid fire growth. Wildfires can be ignited by natural occurrences (e.g., lightning strike) or by human causes (e.g., unattended campfire, debris burning, or arson). As of 2023, the 10-year average of human-caused wildfires accounts for 88% of all wildfires nationally.[368] Fire behavior is based on three (3) factors – fuel, weather, and terrain.

- **Fuel** may include living and dead vegetation on the ground, along the surface as brush and small trees, and above the ground in tree canopies. Lighter fuels (e.g., grasses, leaves, needles) quickly expel moisture and burn rapidly, while heavier fuels (e.g., tree branches, logs, trunks) take longer to warm and ignite. Trees killed or defoliated by forest insects and diseases are more susceptible to wildfire.
- **Weather** conditions, including temperature, relative humidity, wind speed and direction, cloud cover, precipitation amount and duration, and the stability of the atmosphere, impact wildfire behavior. For example, when the temperature is high, relative humidity is low, wind speed is increasing and coming from the east (offshore flow), and there has been little or no precipitation, so vegetation is dry, conditions are very favorable for extensive and severe wildfires. These conditions occur more frequently inland, where temperatures are higher, and fog is less prevalent.
- **Terrain** (i.e., topography), including slope and elevation, of a region influences the amount and moisture of fuel; the impact of weather conditions (e.g., temperature and wind), potential barriers to fire spread (e.g., highways and lakes), and elevation and slope of landforms (fire spreads more easily uphill than downhill).

Wildfires can be classified into three (3) different classes, listed in **Table 4-137**, and it is not uncommon to have all three (3) types of fire.[369]

Table 4-137. Wildfire Types

Type	Description
Ground Fires	Mostly burn in decayed roots below ground and in the duff layer, which is comprised of dead plant materials (e.g., leaves, bark, needles, and twigs). Ground fires are sustained by glowing combustion (without flames) and go undetected for an extended period of time because they produce little to no smoke and spread slowly.

[367] United States Department of Agriculture. (n.d.). Wildfire. Retrieved from https://www.climatehubs.usda.gov/taxonomy/term/398.
[368] National Interagency Fire Center. (n.d.). Wildfire Investigation. Retrieved from https://www.nifc.gov/fire-information/fire-prevention-education-mitigation/wildfire-investigation.
[369] Northwest Fire Science Consortium. (n.d.). What are? Types of Fire. Retrieved from https://www.nwfirescience.org/sites/default/files/publications/Types%20of%20Fire.pdf.

Type	Description
Surface Fires	Burn loose needles, moss, lichen, herbaceous vegetation, shrubs, small trees, and saplings that are located at or near the surface of the ground, mostly by flaming combustion. Surface fires can grow in intensity to scorch or consume the forest canopy, a characteristic that is seen in crown fires depending on the following – amount of surface fuel (high), fuel moisture content (low), slope and/or wind speed (high), resultant surface flame length (high), height of the base of tree crowns (small), and density and compactness of tree crowns (tight).
Crown Fires	Usually ignited by a surface fire, crown fires burn forest canopy fuels, including live and dead foliage/ branches, lichens on trees, and tall shrubs that lie well above the surface fuels. Crown fires can be passive (involving the burning of individual trees or small groups of trees, often called torching) or active (also referred to as running crown fires) and present a solid wall of flame from the surface through the canopy fuel layers, as seen in the photo below.

Wildfires are part of California's natural ecosystem; however, they pose a danger when they become uncontrolled and encroach on developed areas, causing property damage, injuries, or fatalities. Wildfire risk in the United States has increased over the last few decades due to the encroachment of residences and other structures into wildland environments and the growing number of people living in wildland areas.

Ecology

In San Mateo County, several ecosystems are susceptible to wildfires. Ecosystems are dominated by dense second-growth redwood and mixed conifer forests, typically having forest floor accumulations of litter and downed woody material, coastal scrub communities consisting of low vegetation up to six (6) feet in height, typically occurring on coastal hills and bluffs, and wind-swept summits. Scrub vegetation is usually dense and difficult to pass through. Flammable, environmentally sensitive northern maritime chaparral communities, 12 to 20 feet tall and impenetrable at maturity, adapted to and dependent upon periodic crown fires, can be found in isolated areas on southwest facing slopes and at higher elevations. Coastal prairies, thought to have been established and maintained by pre-contact indigenous burning, occupy coastal valleys along the western slopes of the Santa Cruz Mountains and in the southern end of Santa Cruz County (much of this community has been converted to agriculture or urban development). Grasslands can also be found on the western slopes of the Santa Cruz Mountains in rural San Mateo County, especially in upland grazing areas.[370]

Wildfire Protection Responsibility Areas

In California, hundreds of agencies have fire protection responsibility for wildland and wildland urban interface (WUI) fires. Local, state, tribal, and federal organizations have primary legal and financial responsibility for wildfire protection. In many instances, two (2) fire organizations have dual primary responsibility on the same parcel of land (one for wildfire protection, and the other for structural or improvement fire protection). This layering of responsibility and resulting dual policies, rules, practices, and legal ordinances can cause conflict or confusion. As a result, in 1981, the California State Legislature adopted Public Resources Code Section 4291.5 and Health and Safety Code Section 13108.5, establishing the following responsibility areas:

[370] CalFire, Santa Cruz-San Mateo Unit Resource Conservation District. (2022). Santa Cruz and San Mateo County Community Wildfire Protection Plan. Retrieved from https://www.firesafesanmateo.org/projects/19-projects/110-cwpp.

- **Federal Responsibility Areas (FRAs)** are fire-prone wildland areas that are owned or managed by a federal agency (e.g., United States Forest Service, National Park Service, Bureau of Land Management, United States Fish and Wildlife Service, or the United States Department of Defense). Primary financial and rulemaking jurisdictional authority rests with the federal land agency. In many instances, FRAs are interspersed with private land ownership or leases. Fire protection for developed private property is usually not the responsibility of the federal land management agency; structural protection is the responsibility of a local government agency.
- **State Responsibility Areas (SRAs)** are lands in California where the California Department of Forestry and Fire Protection (CalFire) has legal and financial responsibility for wildfire protection and where CalFire administers fire hazard classifications and building standard regulations. SRAs are defined as lands that meet the following criteria:
  - Are county unincorporated areas.
  - Are not federally owned.
  - Have wildland vegetation cover rather than agricultural or ornamental plants.
  - Have watershed or range/forage value.
  - Have housing densities not exceeding three units per acre.
  - Where SRAs contain built environment or development, the responsibility for fire protection of those improvements (non-wildland) is that of a local government agency.
- **Local Responsibility Areas (LRAs)** include land in cities, cultivated agricultural lands, and non-flammable areas in unincorporated areas, and lands that do not meet the criteria for SRA or FRA. LRA fire protection is typically provided by city fire departments, fire protection districts, and counties, or by CalFire under contract to local governments. LRAs may include flammable vegetation and WUI areas, where the financial and jurisdictional responsibility for improvements and wildfire protection rests with a local government agency.

State Codes and Policies for Wildfire Mitigation

Urbanization tends to alter the natural fire regime and can lead to the expansion of urban areas into wildlands. State and local policies and regulations, listed in **Table 4-138**, require landowners to undertake activities, such as maintaining defensible space and reducing vulnerability to wildfire-related damage or loss.

Table 4-138. Wildfire Codes and Policies

Code/Policy	Description
Government Policy 65302.5 (General Plan Safety Element Review)	The Board of Forestry and Fire Protection must provide recommendations to a local jurisdiction's general plan safety element at the time that the general plan is being amended. Board recommendations include goals and policies that provide for contemporary fire prevention standards for the jurisdiction. This is not a direct, binding fire prevention requirement for individuals.

Code/Policy	Description
Chapter 3, Section R313 of the California Residential Code (Sprinkler Systems)	All new dwellings, dwelling units, and one (1) and two (2) family townhomes must be equipped with an automatic fire-sprinkler system that can protect the entirety of the dwelling. Dwellings and homes built prior to January 1, 2011, that do not have a sprinkler system may be retrofitted, but it is not required.
California Public Resources Code 4290 and 14 California Code of Regulations 1270 (Fire Safety Standards)	These regulations govern roads, driveway widths, clearances, turnarounds, signage, and water related to fire safety throughout California. Public Resources Code 4290 is typically implemented through county-level regulations.
California Government Code 51189 (WUI Building Standards)	The Office of the State Fire Marshal is required to create building standards for wildfire resistance. Construction of buildings in the WUI must use fire-resistant materials to save life and property. As of 2011, the standards governing fire-safe construction for all new structures in the SRA are the California Building Code, Chapter 7A (for commercial construction), and the California Residential Code, Chapter 3, Section R327 (for residential construction).
Public Resources Code 4102, 4125-4229, and 14 California Code of Regulations 1220 (State Responsibility Areas)	These statutes and regulations establish the locations in which CalFire is financially responsible for preventing and suppressing fires. These designations define financial arrangements for fire protection services and establish the locations where fire-safe and defensible space laws or regulations apply.
Public Resources Code 4251-4255, and 14 California Code of Regulations 1200 (Hazardous Fire Areas)	These laws and regulations allow petitioners to the Board of Forestry and Fire Protection or CalFire to establish hazardous fire areas, providing for area closures and other restrictions for fire prevention.
Public Resources Code 4291/14 California Code of Regulations 1299 (Defensible Space Vegetation Clearing Around Structures)	The Code regulates fuel management around a property. It states that an individual who owns or controls a building or structure in or adjoining to forest, brush, or grass-covered lands shall follow certain guidelines outlined in the Code. At least 100 feet of defensible space is required. The property owner is liable for making these changes to protect habitable structures. The 100 feet is divided into two (2) zones, with the closer zone, 30 feet from the structure, managed more intensively.

4.6.9.1. Location

CalFire has modeled and mapped wildfire hazard zones using a computer model that designates moderate, high, and very high Fire Hazard Severity Zones (FHSZ). This process is based on fire behavior in a given area and the probability that flames and embers will threaten buildings. For wildland areas, the FHSZ model uses burn probability and expected fire behavior based on weather, fuel (vegetation in the area), and terrain. For urban areas, hazard levels are based on vegetation density, distance from wildlands, and the levels assigned to the surrounding FHSZ. Each gets a score for flame length, embers, and the likelihood of the area burning. Scores of smaller areas are then averaged over larger zones that encompass them. Furthermore, CalFire's model derives fire frequency from 50 years of fire history data.

In San Mateo County, 212,868 acres (in the LRA and SRA) are classified as very high, high, or moderate FHSZ.[371] **Table 4-139** outlines the Fire Hazard Severity Zone (FHSZ) acres in the SRA (adopted in April 2024), and the LRA acres transmitted to the local jurisdictions (in March and April 2025). The geography,

[371] CalFire. (2025). Fire Hazard Severity Zone Acres in SRA and LRA. Retrieved from https://osfm.fire.ca.gov/what-we-do/community-wildfire-preparedness-and-mitigation/fire-hazard-severity-zones.

weather patterns, and vegetation in the Bay Area provide ideal conditions for recurring wildfires. Especially vulnerable are the areas between Shelter Cove, Moss Beach, Half Moon Bay, Sky Londa, and Crystal Springs Lake. The southern half of the County is mostly rated as moderate or high, with a very high section in the State Reserve Año Nuevo area west of State Route 1. Areas rated as very high include land immediately west of Crystal Springs Lake, land near Woodside and Sky Londa, and land about halfway between Half Moon Bay and Moss Beach.

Table 4-139. Fire Hazard Severity Zone Acres in San Mateo County

	Moderate	High	Very High	Total
LRA	14,086	15,240	7,097	**73,488**
SRA	8,422	114,238	53,784	**176,444**
Combined	**22,508**	**129,479**	**60,880**	**212,868**

Figure 4-18 illustrates the FHSZ in San Mateo County.

Figure 4-18. San Mateo County Fire Hazard Severity Zones

[Map under development…]

4.6.9.2. Extent/Severity

Wildfires are considered a natural and necessary component of wildland ecology. As a result, wildfires are not considered a major hazard unless their movement threatens lives, homes, communities, critical infrastructure, and natural and cultural resources.

The extent of a wildfire can be determined by using the Fire Class Size classification system by the National Wildfire Coordinating Group (NWCG), which uses seven (7) fire class categories (**Table 4-140**) to classify the size of wildfires.[372]

Table 4-140. Fire Class Size

Fire Class	Size
Class A	One-fourth of an acre or less.
Class B	More than one-fourth of an acre, but less than 10 acres.
Class C	10 acres or more, but less than 100 acres.
Class D	100 acres or more, but less than 300 acres.
Class E	300 acres or more, but less than 1,000 acres.
Class F	1,000 acres or more, but less than 5,000 acres.
Class G	5,000 acres or more.

The National Interagency Fire Center (NIFC) employs several measures and tools to assess the extent and severity of wildfires. These include the acreage burned, which quantifies the size of the affected area; larger acreage indicates more extensive wildfires. Fire behavior indicators, such as the rate of spread, fireline intensity, and flame length, provide insight into the severity of the wildfire. For example,

[372] National Wildfire Coordination Group. (2025). Size Class of Fire. Retrieved from https://www.nwcg.gov/node/1700607.

rapid spread and high-intensity flames signify a more severe fire. **Table 4-141** outlines the relationship between surface fire flame length and fireline intensity to suppression interpretations.

Table 4-141. Fire Suppression Interpretation of Flame Length and Fireline Intensity

Flame Length *(feet)*	Flame Intensity *(btu/feet/second)*	Suppression Interpretation
< 4	< 100	• Fire can generally be attacked at the head or flanks by people using hand tools. • Handline should hold the fire.
4 – 8	100 – 500	• Fires are too intense for direct attack on the head by people using hand tools. • Hand line cannot be relied on to hold the fire. • Equipment such as dozers, pumpers, and retardant aircraft can be effective.
8 – 11	500 – 1,000	• Fires may present serious control problems—torching out, crowning, and spotting. • Control efforts at the fire head will probably be ineffective.
> 11	> 1,000	• Crowning, spotting, and major fire runs are probable. • Control efforts at the head of the fire are ineffective.

The containment status, measured as the percentage of the wildfire's perimeter under control, tracks the progress in limiting the wildfire's spread. Meteorological data on temperature, humidity, wind speed, and direction are crucial for understanding fire potential, as critical fire weather conditions significantly contribute to the occurrence of severe wildfires. The extent of damage to homes, infrastructure, and communities, as well as the scale of evacuation orders issued, reflects the wildfire's impact. Lastly, resource deployment and fire danger ratings are considered, enabling NIFC to assess wildfire severity and effectively manage response efforts.

The most recent deadly wildfire in San Mateo County was the CZU Lightning Complex fires, which burned in San Mateo and Santa Cruz counties between August and September 2020. This fire destroyed 1,490 structures, damaged 140 structures, and resulted in one (1) injury and one (1) fatality. The wildfire burned in both Butano and Big Basin Redwoods state parks, where a number of historic buildings were destroyed, including the visitor's center at Big Basin. The total acreage burned was 86,509. The CZU Lightning Complex wildfire is considered the 14th most destructive wildfire in California.[373]

Although San Mateo County has not had many significant wildfires, nearby Alameda County has experienced worst-case scenarios that could occur in other Bay Area counties. The October 1991 Oakland/Berkeley Hills "Tunnel Fire" was the most damaging and the second deadliest fire in California at the time. The blaze started from a grass fire in the Oakland Hills. The event burned 1,600 acres of mostly residential neighborhoods, resulting in 25 fatalities, including a fire battalion chief and an Oakland police officer, 150 injuries, and 3,469 homes and apartment units were destroyed. Approximately 10,000

[373] CalFire. (2025). Statistics (Top 20 Most Destructive Wildfires). Retrieved from https://www.fire.ca.gov/our-impact/statistics.

people were evacuated. It is estimated that the fire cost $3.9 billion (in present-day dollars) and is considered the fifth most destructive and third deadliest wildfire in California.[374,375,376]

Extent/Intensity		Extent Factor	Weighted Factor	Score
High	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a high-intensity incident.	3	3	9
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Extent/Severity Score = Extent Factor x Weighted Factor***				

Even if a wildfire is not occurring in San Mateo County, smoke from wildfires can still affect the region's visibility and air quality. Wildfire smoke is a mix of gases and fine particles from burning vegetation, building materials, and other materials. The Air Quality Index (AQI) is used by the United States Environmental Protection Agency (EPA) to communicate air quality (e.g., wildfire smoke). The AQI is divided into six (6) color-coded categories, listed in **Table 4-142**, and provides statements for each category that tell about the air quality in an area, which groups of the population may be affected, and steps people can take to reduce their exposure to air pollution.[377]

Table 4-142. Air Quality Index for Ozone and Particle Pollution

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, while members of sensitive groups may experience more severe health effects.
Purple	Very Unhealthy	201 to 300	Health alert. The risk of health effects is increased for everyone.
Maroon	Hazardous	301 or higher	Health warning of emergency conditions. Everyone is more likely to be affected.
EPA establishes an AQI for five (5) major air pollutants regulated by the Clean Air Act. Each of these pollutants has a national air quality standard set by EPA to protect public health - ground-level ozone, particle pollution (also known as particulate matter, including PM2.5 and PM10), carbon monoxide, sulfur dioxide, and nitrogen dioxide.			

Catastrophic Potential

A catastrophic incident can be defined as any natural, human-caused, or technological disaster that results in extraordinary levels of casualties, damage, or disruption, severely affecting the population

[374] East Bay Regional Park District. (2021). The Oakland Hills Firestorm: Forward. Retrieved from https://www.ebparks.org/about-us/stories/oakland-hills-firestorm-forward.
[375] CalFire. (2025). Statistics (Top 20 Most Destructive Wildfires). Retrieved from https://www.fire.ca.gov/our-impact/statistics.
[376] CalFire. (2025). Statistics (Top 20 Deadliest California Wildfires). Retrieved from https://www.fire.ca.gov/our-impact/statistics.
[377] AirNow. (n.d.). Air Quality Index (AQI) Basics. Retrieved from https://www.airnow.gov/aqi/aqi-basics/.

(including mass evacuations), infrastructure, environment, economy, national morale, or government functions in the area.[378] The catastrophic potential for a wildfire event is high in San Mateo County.

Catastrophic Potential		Extent Factor	Weighted Factor	Score
High	High potential that this hazard could be catastrophic.	3	3	9
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Catastrophic Score = Extent Factor x Weighted Factor***				

4.6.9.3. Warning Time

When weather conditions are conducive to wildfire ignition, the NWS San Francisco Bay Area Forecast Office issues a series of advisories. **Table 4-143** outlines the fire advisories issued by NWS as conditions warrant.[379] NWS offices contact affected dispatch offices, agencies, and their respective Geographic Area Coordination Centers (GACCs) when issuing or updating alerts. Furthermore, all advisories are accessible online via the California Fire Weather website, the issuing NWS office website(s), the NWS National Fire Weather website, and the Weather Information Management System (WIMS).[380]

In addition to the standard NWS immediate advisories (i.e., short-term), NWS and CalFire utilize a tiered decision-support system to provide early awareness before a wildfire starts. NWS issues a daily Fire Weather Planning Forecast (FWF) that analyzes temperature, humidity, and wind trends up to seven (7) days in advance. For long-range situational awareness, the National Interagency Coordination Center (NICC) publishes Monthly Significant Wildland Fire Potential Outlooks that identify areas with above, below, and near normal significant fire potential for the next four (4) months.[381] These tools allow local emergency managers and fire districts to prepare and stage resources well before NWS issues advisories (i.e., Fire Weather Watch, Red Flag Warning).

California's fire protection system is highly integrated, relying on statewide agreements for federal, state, and local agencies to exchange responsibility for protecting specific lands. The California Fire Weather Annual Operating Plan (AOP) formalizes an agreement between the California Wildfire Coordinating Group (CWCG) and NWS, outlining procedures and policies for providing meteorological services to California's fire management community. Its goal is to enhance firefighter and public safety by promoting coordinated efforts across all stages of fire weather forecasting and warnings. This ensures consistent service delivery and addresses any issues before products are delivered to fire agencies.[382]

[378] Federal Emergency Management Agency. (2019). National Response Framework (Fourth Edition). Retrieved from https://www.fema.gov/sites/default/files/documents/NRF_FINALApproved_2011028.pdf.
[379] National Weather Service. (n.d.). Understanding Wildfire Warnings, Watches, and Behavior. Retrieved from https://www.weather.gov/safety/wildfire-ww.
[380] California Wildfire Coordinating Group and National Weather Service. (2026). California Annual Operating Plan. Retrieved from https://www.weather.gov/media/wrh/cafw/2026_CA_FIRE_AOP.pdf.
[381] National Interagency Coordination Center. (2026). Outlooks. Retrieved from https://www.nifc.gov/nicc/predictive-services/outlooks.
[382] California Wildfire Coordinating Group and National Weather Service. (2026). California Annual Operating Plan. Retrieved from https://www.weather.gov/media/wrh/cafw/2026_CA_FIRE_AOP.pdf.

Table 4-143. NWS Fire Advisories

Type	Description
Fire Weather Watch	Issued to alert land managers and the public that upcoming weather conditions (e.g., a combination of strong winds and low humidity, dry and unstable air mass, and/or lightning) could result in extensive wildland fire occurrence or extreme fire behavior. It is issued when critical fire weather conditions are possible but not imminent or occurring. **Goal:** To notify agencies of the *potential* for a Red Flag event. **Timing:** Issued for the 18 to 96 hours timeframe. **Confidence:** Requires at least a 50% confidence.
Red Flag Warning	Issued by NWS, in conjunction with land management agencies, to alert land managers to an ongoing or imminent critical fire weather pattern (e.g., combination of strong winds and low humidity, dry and unstable air mass, and/or lightning). It is issued when fire conditions are ongoing or expected to occur shortly. **Goal:** To inform agencies of impending or current Red Flag conditions. **Timing:** Issued when there is high confidence that the criteria will be met within 48 hours or less, or if the criteria are already being met. Longer lead times are acceptable if confidence is very high or the fire danger is critical.
Extreme Fire Behavior	Issued when a wildfire is likely to run out of control. It is often hard to predict because fires tend to behave erratically and sometimes dangerously. To issue this alert, one (1) or more of the following criteria must be met – moving fast (i.e., high rate of spread), prolific crowning and/or spotting, presence of fire whirls, and/or strong convection column.

4.6.9.4. Probability and Frequency

The probability of occurrence for wildfires in San Mateo County is medium because a *significant* wildfire is likely to occur within 25 years. However, isolated and lower-impact events occur more frequently. On average, the annual probability of a wildfire in San Mateo County is greater than 73% of the counties in the United States, but nearly all of the counties in California have a greater wildfire probability than San Mateo County.[383] Wildfire probability can be determined through fire behavior modeling that simulates numerous potential fire seasons. These simulations incorporate a series of factors, such as weather, topography, and ignition patterns, which vary based on historical data.[384]

Probability of Occurrence		Probability Factor	Weighted Factor	Score
Medium	A significant hazard event is likely to occur within 25 years.	2	N/A	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology).				

FEMA NRI Annualized Frequency

The wildfire annualized frequency value represents the modeled frequency of a wildfire hazard occurrence per year. A higher annualized frequency value results in higher EAL and Risk Index scores.

383 Wildfire Risk to Communities. (n.d.). California: San Mateo County. Retrieved from https://apps.wildfirerisk.org/explore/overview/06/06081/.
384 Wildfire Risk to Communities. (n.d.). Understand Risk. Retrieved from https://wildfirerisk.org/understand-risk/.

Table 4-144 outlines the annualized frequency for wildfires, based on FEMA NRI data, for San Mateo County.

Table 4-144. Wildfire Annualized Frequency *(FEMA National Risk Index)*

Events on Record *(2021 dataset)*	Annualized Frequency
n/a	0.0% chance per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.	

4.6.9.5. Past Events

San Mateo County's past wildfire events have not caused significant damage to trigger a state or federal declaration. Since the 1940s, there have been very few large fires within San Mateo County.[385] Notable fires within the County include the November 1929 wildfire near Montara and the 2020 CZU Lightning Complex wildfire in San Mateo and Santa Cruz counties. **Table 4-145** lists all wildfire events included in this analysis that have been recorded in San Mateo County, as reported by NCEI, between 1996 and 2025.

Table 4-145. Wildfire Past Events (1996 – 2025)

Event Type	Total Events	Total Deaths	Total Injuries	Total Property Damage	Total Crop Damage
Wildfire	7	1	3	$0	$0
Note: *Events listed in this table are based on impacts to an area (zone) of San Mateo County; as such, impacts to more than one area (zone) will result in multiple entries. When determining probability estimates, efforts were made to distinguish single events from events affecting multiple areas.*					

Table 4-146 summarizes significant wildfire events within San Mateo County.

[385] Fire Safe San Mateo County. (2017). San Mateo's History of Fire. Retrieved from https://www.firesafesanmateo.org/resources/fire-history.

Table 4-146. Significant Past Events

Date	Description
August 16, 2020 – September 22, 2020	A prolonged and oppressive heat wave swept the Central Coast and Bay Area for almost a week from August 14th through the 19th, with widespread record-breaking temperatures observed across the region. This was caused by a strong high pressure system over the Desert Southwest that expanded westward into California. This dome of heat brought hot temperatures to the area for several days. Multiple days of triple-digit afternoon highs were recorded inland, with some coastal locations even reaching the mid-90s. Several days of hot, dry weather further dried fuels across the area, elevating fire danger. During this event, a surge of monsoonal and tropical moisture from a former Tropical Storm advected northward with sufficient instability to generate multiple high-based and dry thunderstorms that produced several thousand lightning strikes over the Greater Bay Area. Many locations saw wind gusts between 40 and 50 mph, with isolated areas reaching 60 to 75 mph. This prompted the San Francisco Bay Area forecast office to issue a rare Severe Thunderstorm Warning. These lightning strikes, combined with gusty, erratic winds, sparked hundreds of wildfires across California, including in San Mateo County.[386] On August 16th, lightning started multiple wildfires in Santa Cruz and San Mateo counties that combined to form the CZU Lightning Complex. This fire destroyed 1,490 structures, damaged 140 structures, and resulted in one (1) injury and one (1) fatality. The wildfire burned in both Butano and Big Basin Redwoods state parks, where a number of historic buildings were destroyed, including the visitor's center at Big Basin. The total acreage burned was 86,509. The CZU Lightning Complex wildfire is considered the 14th most destructive wildfire in California.[387] Tens of thousands of residents were also forced to evacuate. Additionally, all of these wildfires burning simultaneously across the State gave the Bay Area the worst air quality in the world at one point. The event resulted in a Major Disaster Declaration (DR-4558).
November 1929	The wildfire that occurred near Montara destroyed 25 homes, a church, and cattle.

4.6.9.6. Vulnerability

Population Exposed

15% to 29% of the population in San Mateo County is exposed to wildfires. The population in San Mateo County's WUI areas has greater exposure to wildfires. Additionally, the populations living in FHSZ and people working or recreating in resource lands (e.g., hikers) are exposed to the wildfire risk. Firefighting crews are exposed as they work to combat fires and to protect property. Low-income families, the elderly, individuals with disabilities, and those without adequate access to emergency transportation resources are uniquely vulnerable during a wildfire event. **Table 4-147** summarizes the underserved population in San Mateo County. Everyone in the County is vulnerable to wildfire smoke, but the elderly, children, individuals with pre-existing respiratory and cardiovascular disease, outdoor workers, and pregnant women are uniquely vulnerable. These groups are also at a higher risk of experiencing the health effects associated with exposure to wildfire smoke.

386 National Centers for Environmental Information. (2022). Storm Events Database (Event ID: 908492). Retrieved from https://www.ncei.noaa.gov/stormevents/eventdetails.jsp?id=908492.
387 CalFire. (2025). Statistics (Top 20 Most Destructive Wildfires). Retrieved from https://www.fire.ca.gov/our-impact/statistics.

Table 4-147. Underserved Population in San Mateo County

Category	Estimate	Percent
Population Below Poverty Level[388]	49,359	6.7%
Income Below $25,000 (Households)[389]	18,773	7.1%
Spanish Spoken at Home[390]	124,233	17.6%
Speak English Less Than "Very well"[391]	120,715	17.1%
Language Other Than English[392]	322,325	45.8%
Foreign Born[393]	265,258	35.7%
Household Without a Vehicle[394]	11,869	3.1%
65 Years and Over[395]	132,242	17.8%
Senior (65 Years and Over) Living Alone[396]	8,355	3.2%

Population Exposure		Vulnerability Factor	Weighted Factor	Score
Medium	15% to 29% of the population is exposed to the hazard.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population Exposure Score = Extent Factor x Weighted Factor***				

Property Exposed

10% to 24% of the total assessed property, infrastructure, and resources value is exposed to wildfire in San Mateo County. The property, infrastructure, and resources in San Mateo County's WUI areas and FHSZ are more exposed to wildfires. This is due to the proximity of flammable vegetation and structures, which creates an environment where fires can easily spread between wildlands and communities. Structures not built to standards designed to protect a building from wildfire may be especially vulnerable. As of 2008, the California State Building Code requires minimum standards to be met for new buildings in the FHSZ. Over 90% of the housing in San Mateo County was built before 2008, prior to this

388 United States Census Bureau. (2024). S1701: Poverty Status in the Past 12 Months (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S1701?g=050XX00US06081.
389 United States Census Bureau. (2024). S1901: Income in the Past 12 Months (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S1901?g=050XX00US06081.
390 United States Census Bureau. (2024). S1601: Language Spoken at Home (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S1601?g=050XX00US06081.
391 Ibid.
392 Ibid.
393 United States Census Bureau. (2024). DP02: Selected Social Characteristics in the United States (2024: ACS 5-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP5Y2024.DP02?g=050XX00US06081.
394 United States Census Bureau. (2024). S0801: Commuting Characteristics by Sex (2024: ACS 5-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST5Y2024.S0801?g=050XX00US06081.
395 United States Census Bureau. (2024). DP05: ACS Demographics and Housing Estimates (2024: ACS 5-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP5Y2024.DP05?g=050XX00US06081.
396 United States Census Bureau. (2024). DP02: Selected Social Characteristics in the United States (2024: ACS 5-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP5Y2024.DP02?g=050XX00US06081.

code requirement.[397] Additionally, areas heavily used for recreational activities are vulnerable to human-caused wildfires (intentional or unintentional).

Property Exposure		Vulnerability Factor	Weighted Factor	Score
Medium	10% to 24% of the total assessed property value is exposed to a hazard.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property Exposure Score = Extent Factor x Weighted Factor***				

Changes in Development

Information on changes in development within San Mateo County is provided in **Chapter 3** (Community Profile) of this Assessment.

The changes in development have increased San Mateo County's exposure to wildfire between 5% and 9%. Urbanization tends to alter the natural fire regime and can lead to the expansion of urbanized areas into WUI areas. The placement of additional housing in WUI areas within high and very high FHSZ can increase wildfire exposure, particularly in historical wildfire corridors. Additionally, wildfire risk can be exacerbated by other hazards, such as drought and extreme heat. However, San Mateo County continues to manage development through strong land use and building codes designed to mitigate the impacts of wildfires. Therefore, as the County experiences growth, it is anticipated that exposure will remain managed within the levels currently assessed.

Changes in Development		Vulnerability Factor	Weighted Factor	Score
Medium	Changes in development have increased the community's exposure to the hazard between 5% and 9%.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Changes in Development Score = Extent Factor x Weighted Factor***				

4.6.9.7. Impacts

Population and Life Safety

A population that is exposed to wildfire is likely to experience some adverse impacts (e.g., injuries requiring acute medical care). Wildfires can have significant impacts on life safety and public health. In a worst-case scenario, rapidly moving and unpredictable flames may trap people in their homes or cars, leading to burn injuries or fatalities. Communities may face repeated, temporary power outages due to PSPS by utility companies. These shutoffs can be life-threatening when people cannot operate medical devices, refrigerate food or medication, or have access to running water. Furthermore, without power, people cannot charge their cellphones or access television or radio, limiting basic communication and impeding emergency notifications.[398]

[397] United States Census Bureau. (2025). S2504: Physical Housing Characteristics for Occupied Housing Units. Retrieved from https://data.census.gov/table/ACSST5Y2024.S2504?g=050XX00US06081.
[398] Climate Ready San Mateo. (n.d.). Wildfire and Climate Change Fact Sheet. Retrieved from https://www.smcsustainability.org/wp-content/uploads/Climate-Ready-SMC-Hazard-Factsheet-Wildfire.pdf.

Wildfire smoke and ash can travel for miles, affect communities not directly impacted by the wildfires, and reduce air quality to unhealthy levels. The population exposed to wildfire smoke can have significant health effects, which can range from eye and respiratory tract irritation to more serious disorders (e.g., reduced lung function, bronchitis, exacerbation of asthma and heart failure, and premature death) and exacerbate pre-existing conditions.[399] Children, the elderly, people with respiratory conditions, and outdoor workers are particularly vulnerable to high levels of airborne particulate matter that comes from wildfire smoke. Furthermore, wildfires often require evacuations, temporarily displacing residents from their homes. This displacement can result in stress, anxiety, and potential health risks, particularly for underserved populations. Additionally, wildfires can severely impact water quality through soil erosion, increased flooding, and debris flows that may carry contaminants.[400]

Population and Life Safety Impact		Impact Factor	Weighted Factor	Score
Medium	Populations exposed to this hazard are likely to experience some adverse impacts, such as injuries requiring acute medical care.	2	3	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Population and Life Safety Impact Score = Impact Factor x Weighted Factor***				

Underserved Population

The underserved population exposed to wildfires in San Mateo County is likely to experience significant adverse/disproportionate impacts (e.g., fatalities and severe injuries). This population faces unique vulnerabilities and impacts as a result of wildfire. These groups include, but are not limited to, low-income families, the elderly, individuals with disabilities, those with limited English proficiency, and those without adequate access to emergency resources or transportation. These groups may lack access to accurate and timely information due to limited internet access, language barriers, and geographical isolation. Therefore, critical wildfire advisories may not reach these groups in a timely manner, which results in higher injury and mortality rates within these communities. Additionally, in the event of an evacuation order, those without access to transportation may be unable to evacuate, and people with access and functional needs may face challenges finding accessible evacuation routes or places to bring assistive devices and service animals.

Low-income residents tend to be renters and have limited control over how or when their housing is repaired or rebuilt after a fire. Homeowners may not be able to afford fire insurance or create defensible space, either physically or financially. In the aftermath of a fire, low- to moderate-income homeowners may be unable to rebuild.[401]

The elderly, children, individuals with pre-existing respiratory and cardiovascular disease, outdoor workers, and pregnant women are at a higher risk of experiencing the health effects associated with wildfire smoke exposure. Wildfire smoke and ash can travel for miles, affect communities not directly impacted by the wildfires, and reduce air quality to unhealthy levels. Short term exposure (i.e., over a few

[399] United States Environmental Protection Agency. (2025). Wildland Fire Research: Health Effects Research. Retrieved from https://www.epa.gov/air-research/wildland-fire-research-health-effects-research.
[400] United States Environmental Protection Agency. (2023). Wildfires and Water Quality Research. Retrieved from https://www.epa.gov/water-research/wildfires-and-water-quality-research.
[401] Climate Ready San Mateo. (n.d.). Wildfire and Climate Change Fact Sheet. Retrieved from https://www.smcsustainability.org/wp-content/uploads/Climate-Ready-SMC-Hazard-Factsheet-Wildfire.pdf.

days) can irritate the eyes and respiratory tract, respiratory symptoms (e.g., coughing, phlegm, wheezing, difficulty breathing), respiratory effects (e.g., bronchitis, reduced lung function, increased risk of asthma exacerbation and aggravation of other lung diseases, increased risk of emergency room visits and hospital admissions), cardiovascular effects (e.g., heart failure, heart attack, stroke, increased risk of emergency room visits and hospital admissions), and increased risk of premature death. Cumulative short-term exposure (i.e., over multiple days to a few weeks) can reduce lung function, and studies have not evaluated the health effects attributed to wildfire smoke exposure over multiple wildfire seasons (i.e., long-term exposure).[402]

Underserved Population Impact		Impact Factor	Weighted Factor	Score
High	Underserved populations exposed to the hazard are likely to experience significant adverse/disproportionate impacts, such as fatalities and severe injuries.	3	3	9
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Underserved Population Impact Score = Impact Factor x Weighted Factor***				

Property, Facilities, and Critical Infrastructure

More than $5 million in property damage is expected from a *single major* wildfire event, or damages are expected to occur to 15% or more of the property value within San Mateo County. When a wildfire is in the immediate vicinity, it can cause extensive destruction to homes, buildings, infrastructure, and resources, resulting in significant financial losses. Homes and properties located within WUI areas or near the path of a wildfire are especially vulnerable, and despite firefighting efforts, many structures may still be lost. In San Mateo County, on average, homes (including all housing units such as single-family homes, condominiums, apartments, and other residences) face a greater risk than those in 72% of counties in the United States. However, homes in nearly all California counties face a greater risk than those in San Mateo County. Therefore, the wildfire risk for homes in the County is high.[403]

Critical infrastructure (e.g., transportation, communications, power and gas services, sewage collection, and water supply) is highly susceptible to direct impacts and intentional shutdowns such as PSPS used to prevent further ignitions. Facilities not built to modern wildfire protection standards or those containing hazardous materials (e.g., fuel storage) face the highest risk of catastrophic failure or toxic release. During a wildfire, these sites could rupture from excessive heat, releasing flammable materials and fueling the fire, causing rapid spread and escalating it to unmanageable levels. In addition, they could leak into surrounding areas, saturating soils and seeping into surface waters, causing disastrous environmental effects. If communication facilities are damaged and become inoperable, the loss of service would exacerbate already difficult communication in the planning area. Furthermore, while the physical structures of roads and bridges may survive, debris, smoke, and heat-damaged pavement can render critical evacuation routes impassable, isolating communities and crippling supply chains.

These physical impacts create a cascading burden on emergency services. For example, law enforcement is called for traffic and evacuation assistance, paramedics are required for impacted communities and shelters, and hospitals are at risk of evacuation or could become overwhelmed due to

[402] United States Environmental Protection Agency. (n.d.). Wildfire Smoke and Your Patients' Health. Retrieved from https://www.epa.gov/wildfire-smoke-course/health-effects-attributed-wildfire-smoke.
[403] Wildfire Risk to Communities. (n.d.). Risk to Homes. Retrieved from https://apps.wildfirerisk.org/explore/risk-to-homes/06/06081/.

heightened service needs.[404] A wildfire in San Mateo County represents not only a threat to individual property but a systemic challenge to the County's financial stability, public health, and operational continuity.

Public Safety Power Shutoffs (PSPS) are events in which a major electric power provider (e.g., PG&E) temporarily shuts off electrical power to a selected area to prevent power lines from sparking wildfires and threatening human lives. Utilities usually implement these on days with sustained winds, strong gusts, or other factors. The duration of a shutoff event is tied directly to the weather that triggers it; the shutoff typically ends within 24 hours after the weather conditions have subsided. However, PSPS events may extend beyond the 24-hour timeframe, depending on conditions. PSPS events often target wildland areas with high wildfire risk, but they can impact a much wider region. The targeted area is the area at risk due to weather conditions. Given the long, interconnected nature of power supply systems, a shutoff event targeted at a small at-risk zone can affect power to larger areas beyond it.[405]

Property, Facilities, and Critical Infrastructure Impact		Impact Factor	Weighted Factor	Score
High	More than $5 million in property, facilities, and infrastructure damage is expected from a single significant event, or damages are expected to occur to 15% or more of the property value within the jurisdiction.	3	2	6
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Property, Facilities, and Critical Infrastructure Impact Score = Impact Factor x Weighted Factor***				

Economy

A single *significant* wildfire event in San Mateo County is likely to result in a total economic impact greater than $100,000 but less than or equal to $10 million. Some of the primary economic impacts of a wildfire include property damage and loss, firefighting costs, and recovery and rebuilding expenses. Property damage encompasses homes, businesses, and infrastructure, resulting in insurance claims and financial burdens for individuals and organizations. The cost of deploying firefighting resources, including personnel, equipment, and air support, is another significant economic factor. Additionally, post-fire efforts such as erosion control, reforestation, and repair of damaged infrastructure contribute to the economic toll. Disruption of economic activities, such as agriculture, tourism, and outdoor recreation, can further affect local and regional economies. Even if wildfires are not occurring within San Mateo County, wildfire smoke can travel long distances and affect air quality in the County. Due to severe air quality, restaurants and businesses closed, and outdoor events and recreational and tourism activities were canceled, resulting in economic losses.

Wildfires have negative economic impacts by displacing or disrupting the day-to-day activities of residents, tourists, employees, and businesses. For many small businesses, the impact of closure or loss of property may prove too great to recover from, leading to permanent closure. Historically underserved populations are more likely to lose jobs or income, experience prolonged unemployment, and face

[404] Cybersecurity & Infrastructure Security Agency. (n.d.). Critical Infrastructure Sectors. Retrieved from https://www.cisa.gov/topics/critical-infrastructure-security-and-resilience/extreme-weather-and-climate-change/wildfires.
[405] California Governor's Office of Emergency Services. (2023). California State Hazard Mitigation Plan. Retrieved from https://www.caloes.ca.gov/wp-content/uploads/Hazard-Mitigation/Documents/2023-California-SHMP_Volume-1_11.10.2023.pdf.

challenges finding affordable housing when attempting to return to their communities. Increased displacement risk disrupts vital social support networks, further isolating community members from resources.[406]

Economic Impact		Impact Factor	Weighted Factor	Score
Medium	Total economic impact is likely to be greater than $100,000, but less than or equal to $10 million.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Economic Impact Score = Impact Factor x Weighted Factor***				

FEMA NRI Expected Annual Loss Estimates

A wildfire NRI EAL score and rating represent a community's relative level of expected building and population loss each year due to wildfires when compared to the rest of the United States. The EAL score is positively associated with a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-148** outlines the wildfire EAL for San Mateo County.

Table 4-148. Wildfire Expected Annual Loss *(FEMA National Risk Index)*

Population	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Expected Annual Loss Rating
0.01	$100,856	$2.1 Million	$261	$2.2 Million	93.2	Relatively Moderate
Population exposure is defined as the estimated number of people determined to be exposed to a hazard according to a hazard type-specific methodology. *Expected Annual Loss scores are calculated using an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).*						

Environment

Environmental impact from a single *significant* wildfire event is likely to be substantial, requiring extensive outside resources and support; and/or repair, cleanup, restoration, or preservation work. Although wildfires are a natural and critical ecosystem process in most terrestrial ecosystems, affecting the types, structure, and spatial extent of native vegetation. However, in some circumstances, it can also cause severe environmental impacts.

- **Damaged Fisheries:** Critical fisheries can suffer from increased water temperatures, sedimentation, and changes in water quality.
- **Soil Erosion:** The protective covering provided by foliage and dead organic matter is removed, leaving the soil fully exposed to wind and water erosion. Accelerated soil erosion causes landslides and threatens aquatic habitats.
- **Spread of Invasive Plant Species:** Non-native woody plant species frequently invade burned areas. When weeds become established, they can dominate the plant cover over broad landscapes and become difficult and costly to control.

[406] Climate Ready San Mateo. (n.d.). Wildfire and Climate Change Fact Sheet. Retrieved from https://www.smcsustainability.org/wp-content/uploads/Climate-Ready-SMC-Hazard-Factsheet-Wildfire.pdf.

- **Disease and Insect Infestations:** Unless diseased or insect-infested trees are swiftly removed, infestations and disease can spread to healthy forests and private lands. Timely active management actions are needed to remove diseased or infested trees.
- **Destroyed Endangered Species Habitat:** Wildfire can have negative consequences for endangered species by degrading their habitat.
- **Soil Sterilization:** Some wildfires burn so hot that they can sterilize the soil. Topsoil exposed to extreme heat can become water repellent, and soil nutrients may be lost.
- **Reduced Timber Harvesting:** Timber can be destroyed, leading to smaller available timber harvests.
- **Reduced Agriculture Resources:** Wildfires can have disastrous consequences on agricultural resources, removing them from production and necessitating lengthy restoration programs.
- **Damaged Cultural and Historical Resources:** The destruction of cultural and historic resources may occur, scenic vistas can be damaged, and access to recreational areas can be reduced.

Parks and recreational areas in San Mateo County are more vulnerable to wildfires than more developed regions. San Bruno Mountain Park, a landmark of local and regional significance, is one of the more noteworthy of this type of area. It stands as an open space island amid the peninsula's urban northern end of the Santa Cruz Mountain Range. Its ridgeline has numerous slopes exceeding 50% and elevations from 250 feet to over 1,300 feet. There are 14 species of rare or endangered plants, along with numerous endangered and threatened butterflies, that make their home on San Bruno Mountain.

Environment Impact		Impact Factor	Weighted Factor	Score
High	Environmental impact from a single significant event is likely to be substantial, requiring extensive outside resources and support; and/or repair, cleanup, restoration, and/or preservation work.	3	1	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Environmental Impact Score = Impact Factor x Weighted Factor***				

Continuity of Operations/Delivery of Services

There may be impacts lasting more than 72 hours on San Mateo County's ability to meet the essential day-to-day operational demands and needs of the community in the event of a *single major* wildfire event. In the event of a significant wildfire incident, the County's ability to maintain daily operations and deliver essential services can be severely compromised. A major wildfire will require immediate diversion of local resources toward emergency response, evacuation, and traffic control, which can paralyze routine government and business services. For example, law enforcement is called for traffic and evacuation assistance, paramedics are required for impacted communities and shelters, and hospitals are at risk of evacuation or could become overwhelmed due to heightened service needs.[407] Also, widespread utility failures and transportation bottlenecks along critical corridors (e.g., Interstate 280, State Route 1, State Route 92) could significantly impact the County's continuity of operations/delivery of services, as they can isolate communities and prevent essential staff and resources from reaching these areas.

[407] Cybersecurity & Infrastructure Security Agency. (n.d.). Critical Infrastructure Sectors. Retrieved from https://www.cisa.gov/topics/critical-infrastructure-security-and-resilience/extreme-weather-and-climate-change/wildfires.

Emergency medical services and health professionals may become rapidly overwhelmed due to increases in injuries and respiratory illnesses caused by extreme smoke, while first responders may be required to prioritize life safety missions over standard service calls. These compounding conditions will significantly strain the County's capacity to maintain normal delivery of services and meet immediate community needs.

Continuity of Operations/Delivery of Services Impact		Impact Factor	Weighted Factor	Score
High	Impact lasting more than 72 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single significant event.	3	1	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Continuity of Services/Delivery of Services Impact Score = Impact Factor x Weighted Factor***				

Future Development

Information on changes in development within San Mateo County is provided in **Chapter 3** (Community Profile) of this Assessment.

Future development trends will increase, but not significantly, the impacts of wildfires in San Mateo County. Any development within or near areas prone to wildfires will increase the impact, as more property and people will be at risk. However, San Mateo County and its municipalities proactively mitigate these risks by strengthening and enforcing land use policies and building codes. These regulations specifically address development management within FHSZ and WUI areas, ensuring that, as the County grows, new structures are built to higher standards of ignition resistance and defensible space. Additionally, public and private property shall be designed and maintained to minimize the risk of wildfire damage; infrastructure systems will be hardened and designed with redundancy; and emergency management plans and practices for wildfires will be responsive to the needs of underserved communities. Strategies like this should help reduce the impacts of future development in wildfire hazard areas.

Future Development Impact		Impact Factor	Weighted Factor	Score
Medium	Future development trends will increase the impacts of this hazard, but not significantly.	2	1	2
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Future Development Impact Score = Impact Factor x Weighted Factor***				

Climate Change

Climate change trends will significantly increase the risks and impacts of wildfires. Climate change is creating warmer, drier conditions, leading to longer, more active wildfire seasons. Studies have shown that the number of large wildfires has more than doubled in the western United States. Furthermore, projections show that a one (1) degree Fahrenheit increase in the average annual temperature could increase the average burned area per year by as much as 600% (in some types of forests) in the western

United States.[408] Excessive heat and dry conditions have already contributed to the rapid spread of wildfires in the region.

The frequency, intensity, and duration of wildfire events impacting San Mateo County are expected to increase due to climate change. Wildfires can claim lives, destroy property, force mass evacuations, and expose large populations to unhealthy levels of smoke for days to weeks at a time (e.g., the 2017 Napa and Sonoma-based Tubbs, Nuns, Atlas, and Pocket fires). Simulations of large wildfires using statistical models developed for the Fourth California State Climate Assessment show that the probability of a large fire (burning more than 1,000 acres) in San Mateo County increases rapidly as the climate warms, reaching an eightfold increase by 2070. The probabilities of even larger wildfires occurring, or of two (2) fires that burn more than 1,000 acres occurring in the same year, are also projected to increase to over 4% per year by 2070. Decadal probabilities rise substantially for the region around the City of Half Moon Bay and the towns of Woodside and Portola Valley for the years 2040-2049, and continue to rise in the decades thereafter. Note: Decadal wildfire probability refers to the probability that a single grid cell, which represents an area of six (6) square kilometers, will experience at least one (1) wildfire during a 10-year period. [409]

Climate Change Impact		Impact Factor	Weighted Factor	Score
High	Climate Change trends will significantly increase the impacts of this hazard.	3	1	3
For more information on the methodology used to determine these values, please refer to Section 4.3 (Risk Assessment Methodology). ***Climate Change Impact Score = Impact Factor x Weighted Factor***				

Secondary Impacts

The following are cascading or indirect hazards that may follow the primary hazard event. These hazards can occur concurrently with or be triggered by the initial event and may exacerbate its overall impact.

- Poor Air Quality
- Erosion
- Landslides
- Urban/Flash Flooding
- Water Quality Degradation
- Public Safety Power Shutoffs

4.6.9.8. Issues

Wildfire presents a range of challenges that can impact a community's preparedness, response, recovery, and mitigation efforts. While not exhaustive, the following outlines key wildfire-related issues the planning team identified that San Mateo County may encounter during such events.

[408] National Oceanic and Atmospheric Administration. (2023). Wildfire Climate Connection. Retrieved from https://www.noaa.gov/noaa-wildfire/wildfire-climate-connection.
[409] Climate Ready San Mateo. (n.d.). Wildfire and Climate Change Fact Sheet. Retrieved from https://www.smcsustainability.org/wp-content/uploads/Climate-Ready-SMC-Hazard-Factsheet-Wildfire.pdf.

- Public education and outreach to people living in or near the FHSZ should include information about and assistance with mitigation activities, such as defensible space and advanced identification of evacuation routes and safe zones.
- Future growth into WUI areas should continue to be managed through strengthened land use planning and building code enforcement, and wildfire mitigation programs (e.g., defensible space).
- Fire districts in San Mateo County need to continue their training on WUI incidents and should aim to broaden certifications and qualifications for their personnel. Additionally, all firefighters should be trained in basic wildfire behavior and fire weather, while company officers and chief-level personnel should receive training in wildland command and strike team leadership.
- Vegetation management activities should include enhancement through expansion of the target areas as well as additional resources.
- Regional consistency is needed for higher building code standards, such as residential sprinkler requirements and prohibitive combustible roof standards.
- Firefighters in remote and rural areas face limited water supplies and a lack of hydrant taps. These areas are adapting to these conditions by developing a secondary water source. Areas that were once considered rural could become urban through incorporation, annexation, and development.

4.6.9.9. Risk Profile

FEMA Risk Index Score

The FEMA Wildfire Risk Index score and rating represent a community's relative risk for wildfires when compared to the rest of the United States. **Table 4-149** illustrates the Wildfire Risk Index rating and score for San Mateo County.

Table 4-149. Wildfire Total Risk Score *(FEMA National Risk Index)*

Rating	Score
Relatively Moderate	92.0
Risk Index Values are calculated by combining the Social Vulnerability and Community Resilience components into a single Community Risk Factor, which is then multiplied by the Expected Annual Loss component (Expected Annual Loss x (Social Vulnerability / Community Resilience) = Risk Index).	

Overall Risk Score

Table 4-150 represents the Wildfire Total Risk Score for San Mateo County, based on the Risk Assessment Methodology, as defined in Section 4.3 of this Plan.

Table 4-150. Wildfire Total Risk Score

Hazard Event	Probability Factor	Sum of Weighted Extent Factors	Sum of Weighted Vulnerability Factors	Sum of Weighted Impact Factors	Consequence Score	Total Risk Score*
Wildfire	2	18	10	34	62	57

Extent: Sum of the weighted Extent factors.
Vulnerability: Sum of the weighted Vulnerability factors.
Impact: Sum of the weighted Impact factors.

Consequence Score: Extent + Vulnerability + Impact (Sum of all weighted factors).
Total Risk Score = Probability x Consequence
* Normalized to 100

Total Risk Score Legend

Classification	Probability	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 4	0 – 12	0 – 24	0 – 32
Medium (M)	2	7 – 12	5 – 10	13 – 26	25 – 48	33 – 66
High (H)	3	13 – 18	11 – 15	27 – 39	49 – 72	67 – 100

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.10. Hazards of Interest

The Steering Committee identified several *hazards of interest* (human-caused and technological) that have the potential to impact San Mateo County. Although FEMA hazard mitigation guidelines focus on natural hazards and do not require the evaluation of non-natural hazards, the Committee included them to provide a comprehensive view of the County's risk landscape.

Since these hazards were not formally assessed in this LHMP, the profiles provide quantitative recognition rather than qualitative data. These summaries serve as a foundational resource for planning partners to monitor risks, implement practical risk reduction measures, and enhance public awareness and education.

Aircraft Incidents

The National Transportation Safety Board (NTSB) defines an aircraft incident as an occurrence other than an accident associated with the operation of an aircraft that affects or could affect the safety of operations. As opposed to an *aircraft accident,* which is defined as an occurrence associated with the operation of an aircraft that takes place between the time any individual boards the aircraft with the intention of flight and all such individuals have disembarked, and in which any person suffers death or serious injury, or in which the aircraft receives substantial damage. *Substantial damage* means damage or failure that adversely affects the structural strength, performance, or flight characteristics of the aircraft and that would normally require major repair or replacement of the affected component.[410]

On July 6, 2013, Asiana Airlines Flight 214 from Incheon International Airport in South Korea, a Boeing 777-200ER, crashed on final approach into San Francisco International Airport. Three (3) of the 291 passengers were fatally injured; 40 passengers, eight (8) of the 12 flight attendants, and one (1) of the four (4) flight crew members received serious injuries. Four (4) flight attendants were thrown onto the runway while still strapped in their seats when the tail section broke off after striking the seawall short of the runway. The other 248 passengers, four (4) flight attendants, and three (3) flight crew members received minor injuries or were not injured.[411]

Communication Failure

Communication systems commonly fail during extreme events. When telecommunications infrastructure is partially or fully disrupted, emergency relief and response efforts become less efficient and more delayed, increasing the risk of fatalities and preventable injuries. Although these systems have become more resilient to disasters and harsh conditions, society's growing reliance on them means the risk of communication failure remains significant.[412]

- Disruptions can slow emergency assessment, coordination, and relief operations.

[410] Code of Federal Regulations. (1988). 49 CFR Part 830. Retrieved from https://www.ecfr.gov/current/title-49/part-830.
[411] National Transportation Safety Board. (2014). Aircraft Accident Report: Descent Below Visual Glidepath and Impact With Seawall, Asiana Airlines Flight 214. Retrieved from https://www.ntsb.gov/investigations/accidentreports/reports/aar1401.pdf.
[412] Khaled, Z. E. and Mcheick, H. (2019). Case Studies of Communications Systems During Harsh Environments: A Review of Approaches, Weaknesses, and Limitations to Improve Quality of Service. Retrieved from https://doi.org/10.1177/1550147719829960.

- Severely damaged telecommunications infrastructure can increase confusion and uncertainty during an incident.
- Poor communication among responders can hinder response efforts and prevent affected residents from contacting emergency personnel or family members.

The San Mateo County Public Safety Communications Command Staff directly reports to the Communications Center Director. The Operations Division, led by the Assistant Director and three (3) managers, oversees all Communications Center functions and staff. Each manager specializes in a specific area – personnel, police, or fire/emergency medical services operations and communications.

Cyberattacks

A cyberattack is an attempt by cybercriminals, hackers, or other digital adversaries to access a computer network or system, usually to alter, steal, destroy, or expose information. Public and private computer systems can experience a variety of cyberattacks, from blanket malware infection to targeted attacks on system capabilities. Cyberattacks specifically seek to breach information technology security measures designed to protect individuals or organizations. The initial attack is followed by more severe attacks aimed at causing harm, stealing data, or achieving financial gain. Organizations are prone to various types of attacks, some automated, others targeted.[413]

In December 2019, the Grand Jury sent an online survey to all 68 public entities in San Mateo County, received 37 survey responses (a 54% response rate), and interviewed several responders, for a total of 38 responses via survey and interview. More than 25% of the public entities responding to the Grand Jury reported being victims of one (1) or more ransomware attacks (malware designed to encrypt files on a device). Experts agree that there will be more attempts to violate the integrity of the County's electronic infrastructure.[414]

Hazardous Materials Release

The improper leak, spillage, discharge, or disposal of hazardous materials or substances (e.g., explosives, toxic chemicals, and radioactive materials) poses a significant threat to public health and safety, property, and the surrounding environment.

Hazardous material releases in San Mateo County may result from industrial accidents, transportation incidents, or deliberate criminal acts. According to the California Health and Safety Code, a hazardous material is any substance that, due to its quantity, concentration, or physical and chemical characteristics, poses a significant hazard to human health and safety or the environment if released. These releases often occur simultaneously with natural disasters (e.g., earthquakes, floods), creating compound hazards that can expand contamination zones and severely impede emergency response efforts.[415]

[413] Baker, K. (2023). 10 Most Common Types of Cyber Attacks. Retrieved from https://www.crowdstrike.com/cybersecurity-101/cyberattacks/most-common-types-of-cyberattacks/.
[414] San Mateo County Civil Grand Jury. (2020). Ransomware: It Is Not Enough To Think You Are Protected. Retrieved from https://sanmateo.courts.ca.gov/system/files/ransomware.pdf.
[415] Federal Emergency Management Agency. (2019). Hazardous Materials Incidents: Guidance for State, Local, Tribal, Territorial, and Private Sector Partners. Retrieved from https://www.fema.gov/sites/default/files/2020-07/hazardous-materials-incidents.pdf.

The Unified Hazardous Waste and Hazardous Materials Management Regulatory Program (Unified Program), established in 1993, aims to safeguard public health and safety, improve environmental quality, and support economic vitality. San Mateo County Environmental Health Services was designated by the State Secretary for Environmental Protection in 1996 as the Certified Unified Program Agency (CUPA) for San Mateo County. Compliance is achieved through routine inspections of regulated facilities and investigation of citizen-based complaints and inquiries regarding improper handling and/or disposal of hazardous materials and/or hazardous waste. A complete list of active and inactive hazardous waste CUPA-regulated facilities is currently available on the County's Open Data site and is updated monthly. Site-specific information can be found on the State's Regulated Site Portal, which includes activities related to hazardous materials and waste, state and federal cleanups, impacted ground and surface waters, and toxic materials. The California Environmental Protection Agency maintains it, and the information is updated monthly.[416]

Pipeline and Tank Failure

Pipeline failures most commonly result from equipment failure. An equipment failure involves a pipeline component or device other than the pipe. Sometimes a part of the equipment fails, resulting in a release; sometimes the equipment itself fails to perform its function properly, resulting in a release. The following are typical types of equipment that can be involved:[417]

- **Pumps and Compressors:** Pumps and compressors are used to move hazardous liquid and natural gas through pipelines.
- **Meters and Metering Equipment:** Meter stations are used on pipelines to measure the amount of product being received or delivered. In addition to the meters themselves, many pieces of specialized equipment are required at these facilities.
- **Remote or Manually Operated Block and Control Valves:** Pipelines feature many valves of various types, located along the pipeline and at stations, terminals, and tank farms.
- **Relief Valves and Other Overpressure Control Devices:** These devices are installed on pipelines to prevent ruptures caused by unexpected pressure surges. Usually, failures occur in the seals or gaskets, leading to minor seepage or leaks; rarely, the device's body itself may fail. Sometimes the device may not function correctly, causing failures elsewhere in the pipeline system.
- **Tanks:** Most pipeline systems feature multiple aboveground storage tanks for hazardous liquids. Tanks are equipped with level gauges that warn operators that the tank is near its maximum capacity. Instrumentation can fail, and tanks can overfill, resulting in a spill of hazardous liquid to the environment. While extremely rare, catastrophic failures of the storage tanks themselves have occurred.
- **Miscellaneous Components and Devices:** Flanges, fittings, couplings, instrument tubing, gauges, thermowells, samplers, and chemical analyzers are among the pipeline components that can seep or leak (or very occasionally rupture).

[416] San Mateo County Health. (n.d.). Certified Unified Program Agency (CUPA). Retrieved from https://www.smchealth.org/hazardous-materials-cupa.
[417] Pipeline and Hazardous Materials Safety Administration. (2014). Fact Sheet: Equipment Failure. Retrieved from https://primis.phmsa.dot.gov/stakeholder-comms/factsheets/FSEquipmentFailure/.

Federal and state regulations require operators to conduct periodic inspections of mainline and other critical valves, test relief valves, and examine breakout tanks. Mitigation measures must also be implemented to manage potential leaks. For example, storage tank containment areas must maintain a free volume equal to the capacity of the largest tank. Additionally, facilities housing pumps must be equipped with alarm systems that warn of hydrocarbon buildup within enclosed spaces. Beyond physical protection, operators must conduct rigorous risk assessments of critical pipeline facilities to identify potential failure modes, assess their likelihoods and consequences, and establish robust preventive and mitigation strategies.[418] In San Mateo County, these activities are monitored by the CUPA, which ensures local compliance with these rigorous standards to protect the public and the environment.

On September 9, 2010, at approximately 6:11 PM, a 30-inch diameter natural gas transmission pipeline owned and operated by PG&E ruptured in the City of San Bruno. Gas escaping from the rupture ignited, resulting in eight (8) fatalities and 58 injuries. The incident destroyed 38 homes, caused moderate-to-severe damage to 17, and minor damage to 53.[419]

Public Health and Pandemic

The World Health Organization (WHO) defines pandemics, epidemics, and endemic diseases based on the rate of disease spread. An epidemic is an unexpected increase in the number of disease cases in a specific geographical area, and it does not have to be contagious (e.g., yellow fever, smallpox, measles, and polio). Additionally, epidemics can refer to a disease or to other specific health-related behaviors (e.g., smoking) whose rates are above the expected occurrence in a community or region. A pandemic is declared when a disease growth rate is exponential; in other words, when the number of cases each day grows more than the prior day. During a pandemic, the virus has nothing to do with virology, population immunity, or disease severity; rather, it spreads widely, affecting multiple countries and populations. The difference between an epidemic and a pandemic is not in the severity of the disease but in the degree to which it spreads. A disease is considered endemic when it is consistently present, but limited to a particular region (e.g., malaria).[420]

CDC has established a national list of nationally notifiable diseases. A notifiable disease is one that, by law, must be reported by health providers to federal, state, or local public health officials. Reportable diseases are those of public interest due to their communicability, severity, or frequency. The CDC National Notifiable Infectious Diseases list can be found via the following link: ndc.services.cdc.gov/search-results-year.

This list of human diseases that could contribute to a serious epidemic in the State is codified in Title 17, Section 2500 of the California Code of Regulations. This law mandates that healthcare providers report these specific conditions to local health departments to enable early detection and investigation.

San Mateo County Health safeguards the public by regulating potential sources of disease, promoting healthier communities, and controlling the spread of illness. The San Mateo County Health Alert Center

[418] Code of Federal Regulations. (1981). 49 CFR Part 195. Retrieved from https://www.ecfr.gov/current/title-49/subtitle-B/chapter-I/subchapter-D/part-195.
[419] California Public Utilities Commission. (n.d.). San Bruno Incident. Retrieved from https://www.cpuc.ca.gov/regulatory-services/safety/gas-safety-and-reliability-branch/san-bruno-incident.
[420] Columbia University Mailman School of Public Health. (2021). Epidemic, Endemic, Pandemic: What are the Differences? Retrieved from https://www.publichealth.columbia.edu/news/epidemic-endemic-pandemic-what-are-differences.

serves as the central hub for community members to view current public health alerts and emergencies issued by the County Health Department. Residents can also subscribe to SMC Alert to receive instant notifications of public health alerts and emergencies.

Terrorism

Terrorism can take many forms, but its overall goal is to cause as much disruption and fear as possible within the targeted population. The Federal Bureau of Investigation (FBI) defines terrorism as the unlawful use of force or violence against people or property to intimidate or coerce a government or civilian population in protest of political or social objectives.[421] Additionally, the FBI further defines international and domestic terrorism, depending on the origin, base, and objectives of the terrorist organization.[422]

- **Domestic Terrorism:** Activities involving acts dangerous to human life that are a violation of the criminal laws of the United States or any State. These acts appear to be intended to intimidate or coerce a civilian population, influence the policy of government by intimidation or coercion, or affect government conduct by mass destruction, assassination, or kidnapping. Domestic terrorism primarily occurs within the territorial jurisdiction of the United States.
- **International Terrorism:** Activities involving violent acts or acts dangerous to human life that are a violation of the criminal laws of the United States or any state, or that would be a criminal violation if committed within the jurisdiction of the United States or any state. These acts appear to be intended to intimidate or coerce a civilian population, influence the policy of government by intimidation or coercion, or affect government conduct by mass destruction, assassination, or kidnapping. International terrorism primarily occurs outside the territorial jurisdiction of the United States or transcends national boundaries in terms of the means by which they are accomplished, the persons it is intended to intimidate or coerce, or the locale in which its perpetrators operate or seek asylum.

Typically, terrorist events involve mass casualty incidents and take place without warning. The most common methods of these incidents include mass shootings, explosive devices, and bladed instruments.[423] For example, weapons of mass destruction (WMD), which include nuclear, biological, and chemical weapons, are capable of causing widespread death and destruction. Additionally, cars, buses, trains, aircraft, and marine vessels have been used as conveyances and as weapons in terrorist acts. In recent years, terrorists have utilized additional methods, including kidnappings, biological weapons, and cyberattacks, to inflict terror on the targeted population. Cyber terrorism is a type of terrorism capable of attacking the systems upon which the lives of individuals and society depend.[424] Attacks on financial, business, and governmental computer networks are being considered as technological terrorist-related acts.

[421] U.S. Department of Justice Office of Justice and Programs. (1987). FBI and Terrorism. Retrieved from: https://www.ojp.gov/ncjrs/virtual-library/abstracts/fbi-and-terrorism.
[422] Federal Bureau of Investigation. (n.d.). Terrorism. Retrieved from https://www.fbi.gov/investigate/terrorism.
[423] Counter Terrorism Ethics. (n.d.). Terrorist Group: Al Qaeda Weapons Use. Retrieved from https://counterterrorismethics.tudelft.nl/the-past-present-and-future-weapon-use-of-al-qaeda/.
[424] Colling, B. (1997). Future of Cyberterrorism: The Physical and Virtual Worlds Converge. Retrieved from https://www.ojp.gov/ncjrs/virtual-library/abstracts/future-cyberterrorism-physical-and-virtual-worlds-converge.

The San Mateo County Sheriff's Office Homeland Security Division works 24/7 to prevent, prepare for, and protect the community against acts of terrorism. These efforts are managed through the Area Office of Emergency Services and the Emergency Services Bureau.

CHAPTER 5. MITIGATION STRATEGY

The heart of a hazard mitigation plan is the mitigation strategy, which serves as the long-term blueprint for reducing the potential losses identified in this Plan's risk assessment. The Stafford Act requires hazard mitigation plans to describe hazard mitigation actions and establish a strategy for implementing them. Therefore, all other requirements for a hazard mitigation plan lead to and support the mitigation strategy as a means to reduce risk and vulnerabilities over the long term. In this chapter, mitigation goals and objectives were reevaluated and updated, and the mitigation strategy and action plan are outlined.

5.1. Mitigation Goals

The Hazard Identification and Risk Assessment chapter of this LHMP identified that San Mateo County is prone to nine (9) natural hazards (**Table 4-1**). The Steering Committee and community stakeholders recognize that, while hazards cannot be completely eliminated, the many communities within San Mateo County can work together to build disaster-resilient communities. **Table 5-1** lists San Mateo County's five (5) goals and eight (8) objectives. The goals represent the County's long-term strategic vision for achieving successful mitigation efforts. The associated objectives are specific strategies and steps identified to assist the communities in attaining the listed goals.

Table 5-1. San Mateo County Mitigation Goals and Objectives

Goal 1	
Protect life, property, the environment, and the health and safety of communities.	
Objectives	
1.A	Encourage life and property protection measures for all communities, particularly underserved communities with limited capacity to adapt and strengthen structures and community lifelines (critical infrastructure) in hazard-prone areas.
1.B	Establish and maintain partnerships across all levels of government, neighboring communities, businesses, academia, private interests, and nonprofit organizations (including community-based organizations) to improve and implement hazard mitigation.
Goal 2	
Engage the County's diverse communities to increase understanding and awareness of hazards and build resilience.	
Objectives	
2.A	Implement inclusive and transparent community outreach activities that enhance awareness of hazard risk, mitigation strategies, and preparedness, and enable community input into risk assessments, project prioritization, and resilient investments.
2.B	Strengthen the capacity of the County, planning partners, and community-based organizations to foster meaningful engagement and ensure equitable outcomes.

Goal 3	
Minimize vulnerabilities to climate change impacts.	
Objectives	
3.A	Develop and disseminate climate risk data and mitigation strategies to public agencies, private-sector partners, and community groups to inform land use planning, building codes, and zoning ordinances, while ensuring equitable outcomes.
Goal 4	
Develop and implement mitigation strategies that support equitable outcomes.	
Objectives	
4.A	Incorporate hazard mitigation measures into all phases of development (repairs, alterations, new construction, and redevelopment), especially in underserved and marginalized communities.
4.B	Prevent or reduce mitigation-related disparities through equitable investments and inclusive engagement.
Goal 5	
Promote hazard mitigation as an integrated public policy and standard practice.	
Objectives	
5.A	Coordinate local and regional hazard mitigation initiatives among state agencies, cities, counties, special districts, tribal organizations, councils of governments, community-led planning efforts, metropolitan planning organizations, and regional transportation organizations.

5.2. Mitigation Strategies and Action

The mitigation strategy must include an analysis of a comprehensive range of actions that San Mateo County and its plan participants (municipalities and special districts) considered to address vulnerabilities identified in this LHMP's risk assessment. A mitigation action is a measure, project, plan, or activity proposed to reduce current and future vulnerabilities described in the risk assessment of this Plan. The mitigation actions considered by each plan participant emphasize risk reduction to existing buildings, structures, and infrastructure, as well as limiting risk to new development and redevelopment. Additionally, the mitigation actions support the population with access and functional needs.

San Mateo County and its plan participants analyzed a comprehensive set of actions, evaluating a diverse range of solutions, including local plans and regulations, structure and infrastructure projects, natural systems protection, and education and awareness programs. This process enabled each plan participant to produce actions based on its capabilities and on the social, technical, and economic feasibility of each action.

Each plan participant evaluated and updated existing mitigation actions carried over from previous plan updates and, as appropriate, identified new mitigation actions. This process incorporated recommendations from FEMA guidance documents, previous plan updates, and input from County and municipal departments, stakeholders, neighboring jurisdictions, and the community, gathered through a series of surveys, workshops, and outreach conducted throughout the County between September 2025 and June 2026.

The mitigation actions for each plan participant are outlined in their respective annexes. Supporting documentation for stakeholder and public engagement is also provided in the corresponding annex.

5.2.1. Action Status

FEMA requires that all existing mitigation actions (i.e., actions identified in previous plan updates) be reviewed and updated. The plan participants reviewed their existing mitigation actions and provided a status, as outlined in **Table 5-2**, for each existing action. The actions that were indicated as *Continuing*, *In Progress*, and *Not Yet Started* have been carried forward in the plan participant's updated mitigation strategy. Those actions identified as *Completed* have been included in this Plan update for tracking purposes, but will be removed in the next Plan update. Actions marked as *No Longer Needed* were also included in this Plan update with a brief explanation stating why the action is no longer relevant or applicable; these will be removed in the next Plan update.

Additional actions were identified during this Plan update through review of the updated hazard risk assessment, input from County and municipal departments, the Steering Committee, other regional agencies, and public and stakeholder outreach. The actions that were added during this Plan update are identified as *New*.

Table 5-2. Action Status

Action Status	Description
Continuing	These ongoing actions were included in the previous update(s) and have no definitive end. During this Plan update, the ongoing mitigation actions were modified and/or amended, as needed, to better define the action.
In Progress	These actions were included in the previous update(s) and are underway during this Plan update. These actions are underway but have not yet been completed.
Not Yet Started	These actions were included in the previous update(s) but have not been started. During this Plan update, these mitigation actions were modified and/or amended as needed to better define them.
Completed	These actions have been completed since the previous plan update.
No Longer Needed	These actions are no longer relevant or applicable because other mitigation actions have addressed the mitigating need, or the hazard vulnerability has changed, resulting in reduced risk. A brief explanation was provided for each action that was no longer needed.
New	These actions were included for the first time in the 2026 Plan update.

5.3. Mitigation Action Plan

The mitigation action plan helps prioritize mitigation initiatives according to a benefit cost analysis of the proposed actions and their associated cost. Additionally, the action plan provides the framework for implementing and administering the proposed actions and initiatives by San Mateo County and its plan participants over the next five (5) years. The parameters (i.e., prioritization, benefits, potential funding sources, and estimated timelines) used for each mitigation action are outlined in this section.

5.3.1. Mitigation Action Prioritization

Mitigation actions should be prioritized in accordance with FEMA requirements. For this Plan update, mitigation actions will be prioritized and evaluated using the STAPLEE+E method (Social, Technical, Administrative, Political, Legal, Economic, Environmental, Equity). This is a standardized, systematic approach that considers the opportunities and constraints associated with implementing a particular mitigation action.

Each plan participant applied an action evaluation and prioritization methodology that includes an expanded set of eight (8) criteria, as outlined in **Table 5-3**, to consider cost-effectiveness, availability of funding, anticipated timeline, and whether the action addresses multiple hazards.

Table 5-3. Prioritization Score (STAPLEE+E Method)

Criteria		Description
S	Social	Mitigation actions are acceptable to the community if they do not adversely affect a particular segment of the population, do not cause relocation of lower-income people, and are compatible with the community's social and cultural values. **Guiding Questions** • Will the proposed action adversely affect one (1) segment of the population? • Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower-income people?
T	Technical	Mitigation actions are technically most effective when they deliver a long-term reduction in losses and have minimal secondary adverse impacts. **Guiding Questions** • How effective is the action in avoiding or reducing future losses? • Will it create more problems than it fixes? • Does it solve the problem or only a symptom? • Does the action reduce the risk to multiple hazards? • Does the mitigation action address continued compliance with the NFIP?
A	Administrative	Mitigation actions are easier to implement if the jurisdiction has the necessary staffing and funding. **Guiding Questions** • Does the jurisdiction have the capability (e.g., staff, technical experts, and/or funding) to implement the action, or can it be readily obtained? • Can the community provide the necessary maintenance? • Can it be accomplished in a timely manner (i.e., within five (5) years, within the lifespan of this Plan)?
P	Political	Mitigation actions are more likely to succeed when all stakeholders have an opportunity to participate in the planning process, and there is public support for the action. **Guiding Questions** • Is there political support to implement and maintain this action? • Is there a local champion willing to help see the action to completion? • Is there enough public support to ensure the success of the action? • Can the mitigation action be accomplished at the lowest "cost" to the public?

Criteria		Description
L	Legal	It is critical that the jurisdiction, or implementing agency, has the legal authority to implement and enforce the mitigation action. **Guiding Questions** • Does the community have the authority to implement the proposed action? • Are the proposed laws, ordinances, and resolutions in place to implement the action? • Are there any potential legal consequences? • Is there any potential community liability? • Is the action likely to be challenged by those who may be negatively affected? • Does the mitigation strategy address continued compliance with the NFIP?
E	Economic	Budget constraints can significantly deter the implementation of mitigation actions. It is critical to evaluate whether the mitigation action is cost-effective, as determined by a benefit cost review, and is possible to fund. **Guiding Questions** • Are there currently funding sources that can be used to implement the action? • Does the cost seem reasonable for the size of the problem and the likely benefits? • Will burden be placed on the tax base or local economy to implement this action? • Does the action contribute to other community economic goals (e.g., capital improvements or economic development)? • Should the proposed action be considered but be "tabled" for implementation until outside sources of funding are available?
E	Environmental	Sustainable mitigation actions that do not have adverse effects on the environment, comply with federal, state, and local environmental regulations, and are consistent with the community's environmental goals, have mitigation benefits while being environmentally sound. **Guiding Questions** • How will this action affect the environment (i.e., land, water, endangered species)? • Will this action comply with local, state, and federal environmental laws and regulations? • Is this action consistent with community environmental goals?
E	Equity	Mitigation actions should promote the fair distribution of resources and avoid negatively impacting underserved populations, including communities of color, individuals with disabilities, and those with Limited English Proficiency, among others.

5.3.1.1. Implementation Priority

Priorities were assessed by requesting that every mitigation action be ranked by each of the eight (8) criteria factors (i.e., STAPLEE+E). Each criterion is evaluated on a scale from one (1) to five (5), with one (1) defined as strongly disagree and five (5) as strongly agree. Therefore, the highest favorable score would be 40, meaning the action scored five (5) in all eight (8) categories. The numerical results were totaled and used to help identify the implementation priority as low, medium, or high for each mitigation action, as outlined in **Table 5-4**. While this provided a consistent, systematic methodology to support the evaluation and prioritization of mitigation actions, plan participants may have additional considerations that could influence their overall prioritization.

Table 5-4. Implementation Priority

Implementation Priority	Prioritization Score
Low	8 – 18 points
Medium	19 – 29 points
High	30 – 40 points

5.3.2. Mitigation Action Benefit Cost Review

Although a complete benefit cost analysis (e.g., FEMA Benefit-Cost Analysis (BCA) Module) is not necessary, the Plan must demonstrate that proposed mitigation actions will be prioritized by weighing the cost of the action versus the benefits the action will produce, in addition to other prioritization factors outlined in this section (i.e., STAPLEE+E method).

Although the ideal approach is to provide definitive cost figures (e.g., dollar amounts) for each mitigation action, this is often not feasible without detailed project scoping or engineering studies. Therefore, a review of the apparent benefits versus the apparent costs of each project was performed. Parameters were established for assigning subjective ratings (i.e., high, medium, and low) to the costs and benefits of these projects. When cost and benefit estimates were available, the ratings outlined in **Table 5-5** were used. The estimated costs presented include the total project estimate, which may encompass administrative, construction (e.g., engineering, design, permitting), and maintenance costs.

Table 5-5. Estimated Cost (Numerical Estimate) Parameters

Rating	Parameter
Low	Less than $10,000
Medium	$10,000 to $100,000
High	Greater than $100,000

When quantitative cost estimates were unavailable, qualitative ratings were used, following the parameters outlined in **Table 5-6**.

Table 5-6. Estimated Cost (Qualitative) Parameters

Rating	Parameter
Low	The action could be funded under the existing budget, incorporated into an existing program, or already part of one.
Medium	The action could be implemented with existing funding, but would require a budget re-apportionment or an amendment, or the cost would have to be spread over multiple years.
High	Existing funding will not cover the cost of the action; implementation would require new revenue from alternative sources (e.g., bonds, grants, and fee increases).

Additionally, the criteria must include an emphasis on the extent to which benefits are maximized, in relation to the associated costs of the mitigation action. **Table 5-7** delineates the parameters associated with benefits (i.e., loss avoided) utilized for each mitigation action.

Table 5-7. Benefits (Loss Avoided) Parameters

Rating	Parameter
Low	Long-term benefits of the action are difficult to quantify in the short term.
Medium	The action will either have a long-term impact on reducing risk exposure for life and property or provide an immediate reduction in property risk exposure.
High	The action will provide an immediate reduction of risk exposure for life and property.

If San Mateo County and its plan participants seek financial assistance through FEMA's Hazard Mitigation Assistance programs, a detailed benefit cost analysis may be required as part of the planning process. A further, more thorough analysis (e.g., the FEMA BCA Module) will be conducted when funding applications are prepared. All plan participants are committed to implementing mitigation strategies with benefits that exceed costs.

Projects not seeking financial assistance through federal grant programs may not require this sort of analysis. Therefore, each plan participant reserves the right to define benefits in accordance with parameters that meet the needs, goals, and objectives of this Plan.

5.3.3. Mitigation Action Administration

Each mitigation action must specify the position, office, department, or agency responsible for implementing/administering the identified mitigation action. Names are not required; however, the aforementioned details must be included to provide enough detail for the reader to determine who within the jurisdiction will be responsible for the mitigation action. Adding specific names was discouraged to ensure continuity and long-term implementation.

5.3.4. Mitigation Action Potential Funding Source

The jurisdiction must identify the applicable potential funding source(s) for each mitigation action. Details must go beyond generic terms (e.g., federal funds, state grants, local). The identified funding sources must be relevant to the implementation of the associated action.

5.3.5. Mitigation Action Estimated Timeline

Mitigation actions must specify the timeline for completion of the project upon implementation. Although providing exact completion dates is preferred, this is not always feasible for all mitigation actions. As a result, timelines were categorized into estimated ranges, such as 1 to 3 months, within 6 months, or 1 to 5 years. Furthermore, mitigation actions identified as *Continuing* were assigned an estimated timeline of *Ongoing*.

5.4. Changes in Priority

A community's mitigation priorities may change over time for a number of reasons. Addressing these changes enables a community to adapt its actions to reflect current conditions, including financial and political realities, as well as shifts in conditions or priorities following disasters. Changes in the priority of a hazard mitigation plan are often dynamic and reflect the evolving understanding of risk, the availability of resources, and the needs of the community. This helps ensure that the Plan remains relevant and effective in reducing the community's vulnerability to the hazards identified in the Plan. San Mateo County has identified the following changes in priorities for the 2026 LHMP.

- The goals and objectives were updated as follows: the goals were broadened to apply across all hazards and reflect the overall vision for minimizing or avoiding losses, and the objectives were streamlined and aligned with specific goals.
- There was one (1) new plan participant – Silicon Valley Clean Water.
- All mitigation actions from the previous Plan iteration were updated, and a more concerted effort to achieve equitable outcomes for all communities, including underserved communities and socially vulnerable populations, has been implemented.
- There were some notable changes to the hazard risk assessment methodology.
    - The new methodology includes 14 factors (versus five (5) in the 2021 update), which align with FEMA's risk assessment criteria. *Refer to Section 4.3 for further details on the 2026 risk assessment methodology.*
    - The flood hazard was ranked individually and not as a whole category. Riverine flooding, urban/flash flooding, and coastal flooding were ranked individually, even though these are grouped under the flood hazard profile.
    - Severe weather hazards were ranked individually and not as a whole category. Heavy rainfall, severe thunderstorms, strong winds, tornadoes, heat wave/extreme heat, and fog were ranked individually, even though these are grouped under severe weather in the hazard profile.

The changes in priority for each plan participant are outlined in their respective annexes.

CHAPTER 6. PLAN MAINTENANCE

Plan maintenance means keeping the plan accurate, current, and relevant over the five (5) year approval period. The Plan is a living document that guides actions over time, and consistently documenting the process facilitates the next update to the Plan. Establishing a maintenance plan recognizes that conditions evolve over time. Not only is there a need to track progress in implementing mitigation strategies, but new information may become available, and disaster events may occur. The hazard mitigation plan needs to be revisited at regular intervals to remain relevant, and the Core Planning Team needs to determine its implementation. At a minimum, this must be done every five (5) years, but it should also be done after major disaster events or if new conditions significantly change hazard risk.

6.1. Monitoring, Evaluating, and Updating the Plan

To ensure the San Mateo County Local Hazard Mitigation Plan continues to provide an appropriate path for risk reduction throughout the County, it is necessary to monitor, evaluate, and update this document. The Hazard Mitigation Coordinator, part of the San Mateo County Department of Emergency Management staff, is assigned to manage the Plan's maintenance, evaluation, and updates during its performance period.

6.1.1. Monitoring

The Hazard Mitigation Coordinator will manage monitoring of the Plan's status and the collection of mitigation action status reports from the appropriate entities (i.e., county departments, agencies, and participating jurisdictions). On an annual basis, beginning one (1) year after plan adoption, the Hazard Mitigation Coordinator will engage county departments, agencies, and participating jurisdictions (i.e., plan participants) responsible for implementing the mitigation actions outlined in this Plan. This will be accomplished by contacting the plan participants responsible for initiating and/or overseeing the mitigation actions and requesting that they review and update the progress of their respective mitigation actions. For the purposes of this section of the Plan, participating members include county departments and agencies designated as lead agencies in mitigation actions, as well as plan participants with designated annexes in this Plan.

It is anticipated that all participating jurisdictions will update the progress of the mitigation plan annually. This process encourages plan participants to refine mitigation strategies and advance the implementation of mitigation actions. Additionally, participating jurisdictions will document efforts to obtain funding and any obstacles or challenges encountered in implementing actions. Each plan participant should be expected to document the following:

- Any grant applications filed on behalf of the participating jurisdiction.
- Hazard events and losses that occurred within the jurisdiction.
- Additional (i.e., new) mitigation actions believed to be appropriate and feasible.
- Public and stakeholder input.

6.1.2. Evaluating

Evaluation of the hazard mitigation plan assesses whether the planning process and actions have been effective, whether the mitigation goals are being achieved, and whether changes are needed. The Hazard Mitigation Coordinator will consult with the participating jurisdictions to evaluate the effectiveness of the plan implementation and to reflect changes that could affect mitigation priorities or available funding. The status of the LHMP will be discussed and documented with the plan participants.

The Hazard Mitigation Coordinator will ask the participating members to assess progress toward meeting the Plan's goals. These evaluations will assess the following:

- Goals address current and expected conditions.
- Changes to the nature or magnitude of the hazard risks.
- Current resources are appropriate for implementing the LHMP, and if different or additional resources are available.
- Actions were cost-effective.
- Schedules and budgets are feasible.
- Implementation problems, such as technical, political, legal, or coordination issues with other agencies, are present.
- Outcomes have occurred as expected.
- Changes in county, city, town, or district resources impacted plan implementation (e.g., funding, personnel, and equipment).
- New agencies, departments, and/or staff should be added, including other local governments as defined under FEMA's Local Mitigation Planning Policy Guide.

Throughout the five (5) year period, the Hazard Mitigation Coordinator will evaluate how other programs and policies have conflicted or augmented planned or implemented measures, and shall identify policies, programs, practices, and procedures that could be modified to accommodate mitigation actions. Other programs and policies can include those that address:

- Economic development
- Environmental preservation
- Historic preservation
- Redevelopment
- Health and safety
- Recreation
- Land use and zoning
- Public education and outreach
- Transportation

Refer to the jurisdictional annexes for further details on how each plan participant has integrated hazard mitigation principles, risk information, and mitigation actions into other planning mechanisms, and on how each plan participant intends to integrate this LHMP into existing and new planning mechanisms.

The Plan will be evaluated and revised following any major disaster (i.e., a presidential disaster declaration) to determine whether the recommended actions remain relevant and appropriate. The hazard risk assessment will also be revisited to determine whether any changes are necessary based on the pattern of disaster damage, and whether the data listed in this Plan have been collected to facilitate the risk assessment. This is an opportunity to increase the community's resilience to disasters and build a stronger, better community.

6.1.2.1. Implementation and Integration Through Existing Plan and Programs

Hazard mitigation practices must be incorporated within existing plans, projects, and programs. Therefore, the involvement of all departments, private non-profits, private industry, and appropriate jurisdictions is necessary to identify mitigation opportunities within existing or planned projects and programs. To execute this, the Steering Committee will assist in coordinating resources for the mitigation actions and provide strategic outreach to implement them, ensuring they meet the goals and objectives identified in this Plan. The information on hazard, risk, vulnerability, and mitigation included in this LHMP update is based on the best science and technology available at the time this Plan was completed. Plan integration involves incorporating hazard mitigation into other relevant planning mechanisms (e.g., general planning and capital improvement planning).

The LHMP is essential to understanding the hazards facing San Mateo County. The resulting prioritized list of hazards is used across County, municipal, and district plans, as well as by community partner organizations, creating a shared understanding of the hazards facing the County.

The results of this Plan will be incorporated into ongoing planning efforts throughout the County. San Mateo County, its municipalities, and special districts will update zoning plans and related ordinances, as necessary, and as part of regularly scheduled updates. Each plan participant will be responsible for updating and integrating elements of the Plan into their respective community plans, ordinances, and initiatives.

Refer to the jurisdictional annexes for further details on how each plan participant has integrated hazard mitigation principles, risk information, and mitigation actions into other planning mechanisms, and on how each plan participant intends to integrate this LHMP into existing and new planning mechanisms.

6.1.2.2. Continued Public Engagement

San Mateo County Department of Emergency Management, the Hazard Mitigation Steering Committee, and plan participants are dedicated to involving the public directly in the review and updates of the Plan. The public will have the opportunity to provide feedback on the Plan throughout its performance period, including revisions and updates. The appropriate County departments, cities, towns, and special districts will keep copies of the Plan.

To further facilitate continued public engagement, San Mateo County will ensure the following:

- San Mateo County Department of Emergency Management will keep a copy of the Plan readily available in the office for review and comment from the public (by appointment). The Plan will also be maintained on the County website, along with an online form for the public to submit feedback.
- Encourage municipalities and special districts to include and maintain links to the Plan on their respective websites.
- San Mateo County Department of Emergency Management will conduct outreach (in person and through social media) after a disaster event to remind members of the public of the importance of mitigation and to solicit mitigation ideas to be included in the Plan.

Public meetings will be held when deemed necessary by the Hazard Mitigation Coordinator. The meetings will provide a forum for the public to express concerns, opinions, or new alternatives, which can then be included in the Plan. The San Mateo County Department of Emergency Management, with support from the Steering Committee and plan participants, will be responsible for using appropriate resources to publicize the public meetings and maintain public involvement.

6.1.2.3. The Five-Year Action Plan

This section outlines the implementation agenda that the Hazard Mitigation Coordinator and San Mateo County Department of Emergency Management should follow five (5) years after adoption of this Plan, and then every five (5) years thereafter.

The Hazard Mitigation Coordinator will consider the following action plan for the five (5) year planning cycle. It should be noted that the schedule in **Table 6-1** can be modified as necessary and does not include any meetings and/or activities that would be necessary following a disaster event (e.g., reconvening the Hazard Mitigation Steering Committee within 90 days of a disaster or emergency to determine what mitigation projects should be prioritized during the community recovery). If an emergency meeting of the Hazard Mitigation Steering Committee is called, this proposed schedule may be adjusted to accommodate any new needs.

Table 6-1. Five-Year Action Plan

Year 0	
2026	• Update the 2021 LHMP and submit it to Cal OES and FEMA Region 9 for approval. Adopt the 2026 LHMP upon APA status.
Year 1	
2027	• Work on mitigation actions. • San Mateo County Department of Emergency Management will stay in contact with its key stakeholders and plan participants to keep track of project status. • Encourage LHMP integration efforts. • Discuss opportunities for LHMP integration with other planning documents. • Discuss recent hazard events. • Update the status of projects. • Identify additional hazards of concern that should be considered for the next update, if any, and provide an update and obtain input on mitigation projects occurring within the community from the Steering Committee and plan participants.
Year 2	
2028	• Work on mitigation actions. • San Mateo County Department of Emergency Management will stay in contact with its key stakeholders and plan participants to keep track of project status. • Encourage LHMP integration efforts. • Discuss opportunities for LHMP integration with other planning documents. • Discuss recent hazard events. • Update the status of projects. • Identify additional hazards of concern that should be considered for the next update, if any, and provide an update and obtain input on mitigation projects occurring within the community from the Steering Committee and plan participants.

Year 3	
2029	• Work on mitigation actions. • San Mateo County Department of Emergency Management will stay in contact with its key stakeholders and plan participants to keep track of project status. • Encourage LHMP integration efforts. • Apply for hazard mitigation grant funds (e.g., HMGP) to update the next iteration of the LHMP. • Discuss opportunities for LHMP integration with other planning documents. • Discuss recent hazard events. • Update the status of projects. • Identify additional hazards of concern that should be considered for the next update, if any, and provide an update and obtain input on mitigation projects occurring within the community from the Steering Committee and plan participants.
Year 4	
2030	• Work on mitigation actions. • San Mateo County Department of Emergency Management will stay in contact with its key stakeholders and plan participants to keep track of project status. • Encourage LHMP integration efforts. • Begin the update process for the 2031 LHMP and conduct a series of meetings with stakeholders, plan participants, and the public.
Year 5	
2031	• Update the 2031 LHMP and submit it to Cal OES and FEMA Region 9 for approval. Adopt the 2031 LHMP upon APA status. • Repeat.

6.1.3. Plan Update

FEMA requires the Plan to be reviewed, revised, and updated every five (5) years to remain eligible for certain Federal disaster assistance and hazard mitigation funding programs (e.g., Hazard Mitigation Grant Program).

The San Mateo County Department of Emergency Management will be responsible for contacting the Steering Committee members and organizing the update process. Members of the Steering Committee will be responsible for the update on the progress of the mitigation strategies in the Plan. Additionally, the goals and actions will be reviewed by the Steering Committee to determine their relevance to changing situations in the County and to changes in Federal policy, and to ensure they address current and expected conditions. Furthermore, the Steering Committee will review the hazard risk assessment portion of the Plan to determine whether this information should be updated or modified in light of any new data. The department, agencies, and jurisdictions responsible for the various action items will report on the status of the projects, the success of various implementation processes, difficulties encountered, the success of coordination efforts, and which strategies should be revised or removed.

The San Mateo County Department of Emergency Management, along with the Steering Committee, will be responsible for leading the five (5) year update of the Plan. Also, the Department will notify all stakeholders and plan participants when changes have been made. Upon completion, the Plan will be updated and submitted to Cal OES and to FEMA Region 9 for review and approval. San Mateo County and each participating jurisdiction will adopt the LHMP and its respective annex, upon APA status.

APPENDIX A. STAKEHOLDER ENGAGEMENT

[Information and supporting documentation will be added after the Public Comment Period concludes.]

APPENDIX B. PUBLIC ENGAGEMENT

[Information and supporting documentation will be added after the Public Comment Period concludes.]

APPENDIX C. PLAN ADOPTION

[Placeholder for adoption documentation after State and FEMA approval]