CITY OF SHASTA LAKE

2021 UPDATE

LOCAL HAZARD MITIGATION PLAN

CITY OF SHASTA LAKE
DEVELOPMENT SERVICES DEPARTMENT
PO BOX 777
4477 MAIN STREET
SHASTA LAKE, CA 96019

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FEMA 100-Year Floodplains,
City of Shasta Lake

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City of Shasta Lake

2021 Local Hazard Mitigation Plan

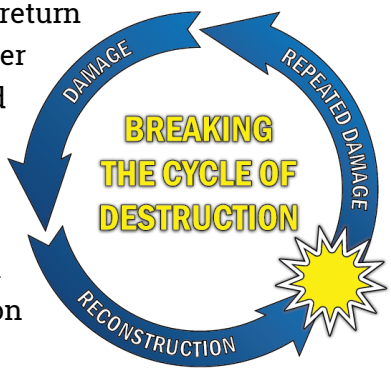
List of Figures

List of Tables

Executive Summary

The City of Shasta Lake ("City") prepared this hazard mitigation plan to guide city officials in protecting the people and property within the city from the effects of natural disasters and hazard events. This plan demonstrates the city's commitment to reducing risk from natural hazards through mitigation and serves as a tool to direct city resources to achieve optimum results with available administrative, technical, and financial resources.

The term **"hazard mitigation"** refers to actions or strategies that can reduce or eliminate long-term risks caused by natural disasters. Mitigation activities can be developed, planned, and implemented before or after a disaster occurs. After disasters, repairs and reconstruction often are completed in such a way as to simply restore damaged property to pre-disaster conditions. These efforts may return property and infrastructure to "the norm," but the replication of pre-disaster conditions may result in a repetitive cycle of damage and reconstruction. Hazard mitigation planning in the City of Shasta Lake can break this repetitive cycle by reducing vulnerability to hazards through smart construction and proper planning of future development and critical infrastructure. Hazard mitigation activities can be conducted through a wide variety of mitigation strategies, such as construction of regional flood control projects or implementing fuel reduction around buildings within high wildfire risk areas.



What is a hazard mitigation plan?

This hazard mitigation plan provides an explanation of potential hazards within the city. It also describes how hazards may impact the city based on various factors such as hazard type and geographic distribution of risk in relation to people and property within the city. This plan identifies risks to vulnerable assets, both people and property. Most importantly, the mitigation strategy presented in this plan responds to the identified vulnerabilities within the community and provides prescriptions or actions to achieve the greatest risk reduction based upon available resources. The city intends to save lives, reduce injuries, reduce property damage, and protect natural resources for future generations through mitigation activities.

Why have a hazard mitigation plan?

A hazard mitigation plan can reduce property damage, injuries, and even deaths when hazard events strike. Mitigating hazards can also help reduce impacts from loss of critical services and lifelines within communities. The purpose of this Hazard Mitigation Plan (HMP) is twofold. First, it provides information for the City and residents wishing to conduct hazard mitigation efforts by identifying areas of extreme risk and financial and technical mitigation resources based upon current gaps.

Second, it provides the city continued access to grant funding from State and Federal funding sources to conduct hazard mitigation activities. The passage of the Disaster Mitigation Act in 2000 (DMA 2000) requires proactive hazard mitigation planning as a condition of receiving certain federal financial assistance under the Robert T. Stafford Act. DMA 2000 encourages state and local authorities to work together on pre-disaster

planning to assist local governments to accurately assess mitigation needs, resulting in faster allocation of funding and more cost-effective risk reduction projects utilizing FEMA's Hazard Mitigation Assistance program.

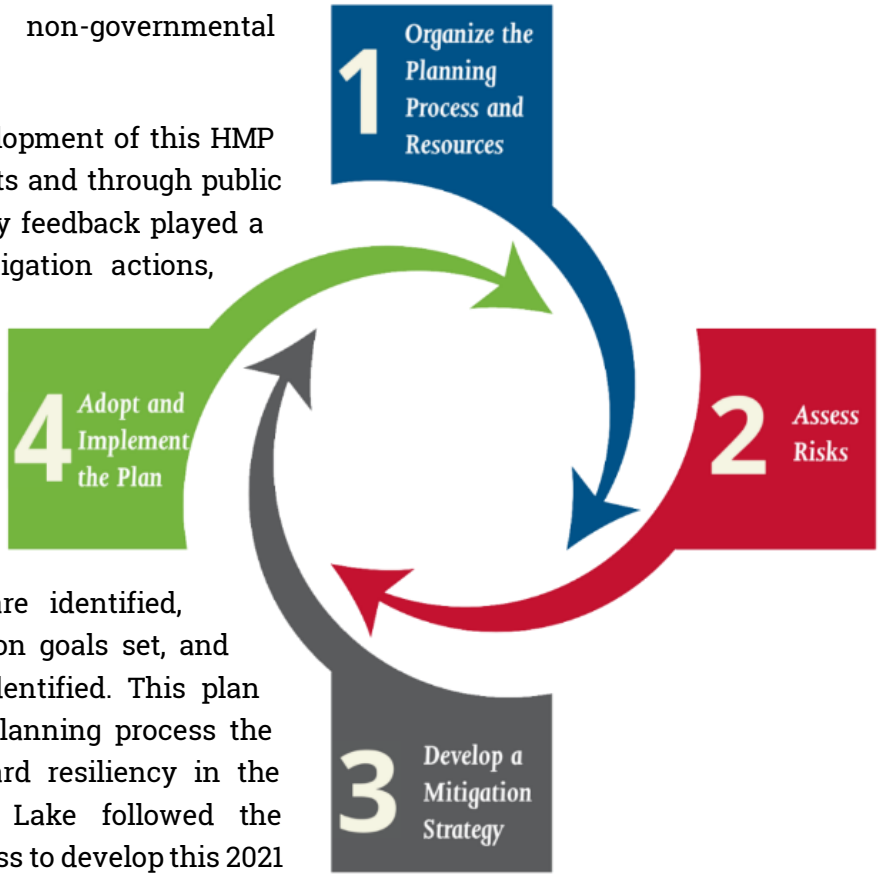
Why is the plan updated so often?

Local agencies must have an active, approved HMP in order to pursue funding under the Robert T. Stafford Act. As a DMA 2000 requirement, the plan must be updated every five years to remain in compliance with federal mitigation grant conditions. Federal regulations require hazard mitigation plans to include a plan for monitoring, evaluating, and updating the hazard mitigation plan. An update process provides an opportunity to reevaluate recommendations, monitor the impacts of actions that have been accomplished, and determine if there is a need to change the focus of mitigation strategies over time. Grant compliance is contingent on meeting the plan update requirements that are contained in the Code of Federal Regulations.

Who participated in this plan?

A Hazard Mitigation Planning Committee was formed to develop and steer content in this plan, including the goals, objectives, mitigation strategies, and implementation methods to reduce risk. Stakeholders included city representatives, local agencies, local businesses, local citizens, and non-governmental organizations.

The public also participated in development of this HMP through an online survey to residents and through public review of the draft HMP. Community feedback played a key role in prioritizing future mitigation actions, goals, and implementation steps in this HMP.



Plan Development and Update Methods

Hazard mitigation planning is the process through which hazards are identified, likely impacts determined, mitigation goals set, and appropriate mitigation strategies identified. This plan documents the hazard mitigation planning process the city used to increase natural hazard resiliency in the community. The City of Shasta Lake followed the recommended FEMA four-step process to develop this 2021

updated plan. The update provides clear delineation of jurisdiction information, development of a new risk assessment, revaluation of goals and objectives, development of new mitigation actions, new enhancements for implementing mitigation actions, updates to all sections of the 2014 plan, and a new website for stakeholder involvement and public information.

Risk Assessment

The risk assessment measures the potential loss of life, personal injury, economic injury, and property or infrastructure damage resulting from natural hazards in order to determine vulnerability. For this update, the risk assessment utilized new data and technologies that have become available since 2014. The city used risk assessment information to rank risks and to gauge the potential impacts of each hazard of concern in the planning area. The risk assessment includes:

- Hazard identification and profiling;
- Assessment of the impact of hazards on physical, social, and economic assets;
- Identification of particular areas of vulnerability;
- Additional impacts of each hazard due to climate change; and
- Estimates of the cost of potential damage.

The following natural hazard threats were identified and profiled as city priority hazards:

Wildfire
SECTION 4.5.1

Extreme Weather
SECTION 4.5.3

Climate Change
SECTION 4.5.5

Flood
SECTION 4.5.2

Drought
SECTION 4.5.4

Hazard Exposure and Damage Estimation

In the City of Shasta Lake, wildfire and flooding have known geographic extents and corresponding spatial information, which make exposure and damage estimation possible. In order to describe vulnerability for each hazard, it is important to understand the total population and total assets at risk. This provides the estimated damage and losses expected during a "worst case scenario" event for each hazard. Figure ES 1 provides a summary of how and what data sources are used to provide exposure and damage estimation results. More detail on the risk assessment analysis is provided in Section 4.4 and Appendix A. Exposure and Damage estimation analysis is briefly described in the sections that follow the summary graphic.

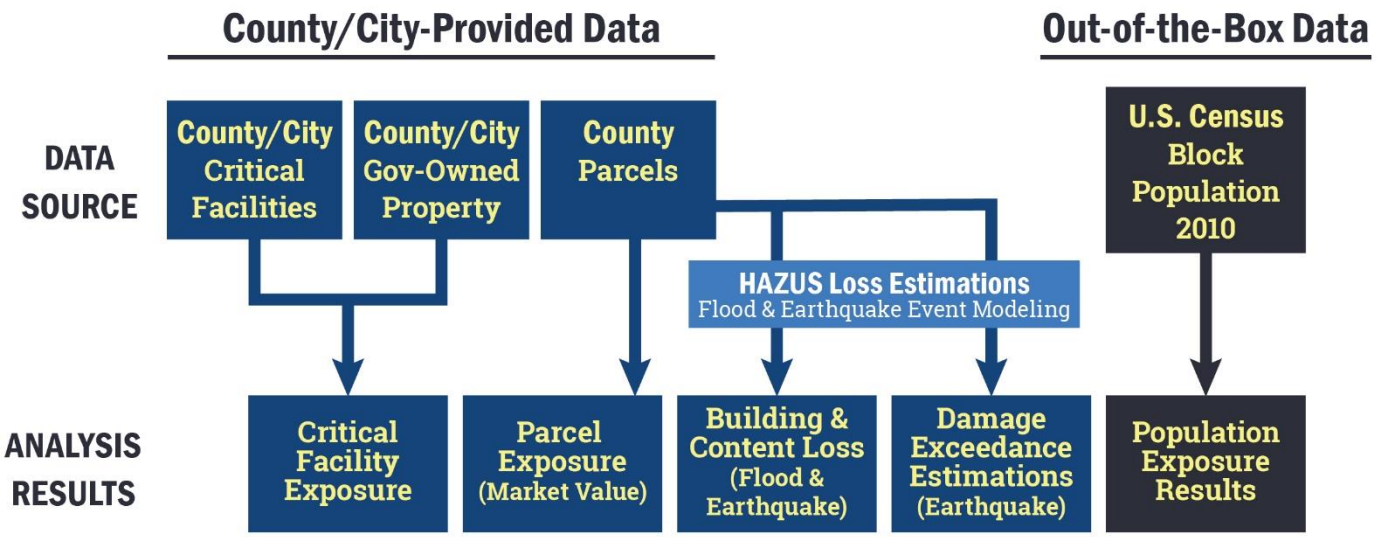


Figure ES 1: Risk Assessment Methodology Summary

Population and Asset Exposure

The total counts of parcels, people, facilities, and assets within the planning area which could be exposed to a hazard event is referred to as the "exposure" in this plan. A natural hazards overlay was developed to reflect the combination of many known natural hazard spatial footprints. The spatial overlay method enables summarization of building values, parcel counts, population exposure, and critical facility exposure within a hazard's geographic extents (see Figure ES 2 exposure example). This method has been used to evaluate exposure flooding, and wildfire. For a more detailed explanation on Risk Assessment Methods, see Section 4.4 and Appendix A.

Figure ES 2: Exposure Explanation Graphic

Damage Assessments

FEMA's Hazus software was used to conduct a detailed loss estimation for flood and wildfire. Hazus is a nationally-applicable, standardized methodology that contains models for estimating potential losses from earthquakes, floods, and hurricanes. Hazus uses Geographic Information Systems (GIS) technology to estimate physical, economic, and social impacts of disasters. For this planning effort, Hazus was used to generate damage estimations due to possible wildfire and flooding. The estimated damage and losses provided by the Hazus Software is a "worst case scenario" event and provides the ability to understand possible widescale damage to buildings and facilities.

In the hypothetical map in Figure ES 3, even though both structures are exposed to flooding, it is predicted that the structure with a first-floor height below the depth of flooding will receive significantly more damage than the structure with a first-floor height above the expected water depth. For a more detailed explanation on risk Assessment Methods, see Section 4.4 and Appendix A.

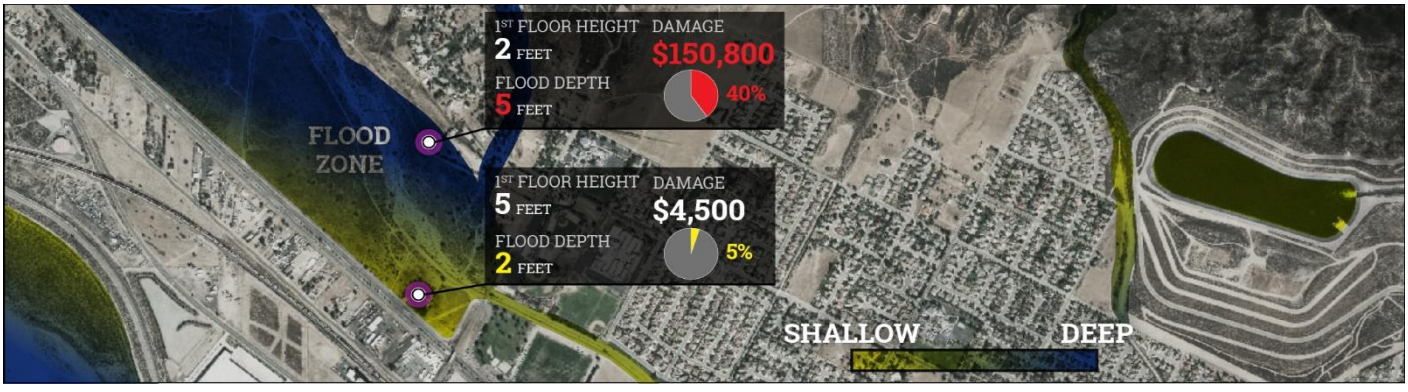


Figure ES 3: Hazus Damage Estimation Example

Summary of Vulnerable Assets: People, Property Value, and Infrastructure

Hazards with spatial boundaries can be analyzed to demonstrate the amount of population, critical infrastructure, and parcels within each hazard's footprint. At-risk populations, critical infrastructure, improved parcels, and loss results for each hazard category are provided in bar chart summary tables throughout this plan to evaluate the percentage of assets exposed to different types of hazards. The side-by-side comparison allows officials to evaluate the impacts of potential hazards to determine toward what hazards to direct energy and financial resource for mitigation activities. For detailed vulnerability assessment information, see the individual hazard specific sections presented in Section 4.5. This Executive Summary provides map summaries (see Figure ES4 below) for hazards with geographic differences in vulnerability: wildfire and flood.

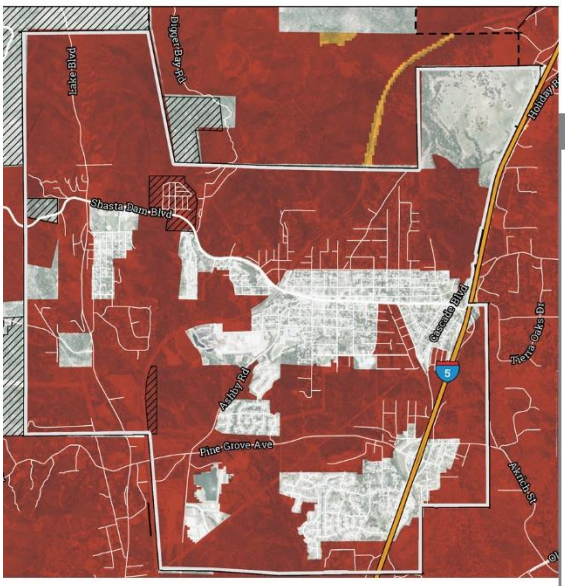
Mitigation Goals

The Hazard Mitigation Planning Committee created a set of goals for this HMP based on review of the City's 2014 HMP, the California HMP, and other more current jurisdictional HMPs. The HMPC elected to closely align with the State's HMP Goals. The following updated goals guided the HMPC in selecting actions contained in this plan update:

GOAL 1	GOAL 2	GOAL 3	GOAL 4
Significantly reduce risk of injuries and loss of life during disaster events.	Minimize damage to critical infrastructure and property and minimize interruption of essential services and activities.	Protect the environment.	Promote community resilience through integration of hazard mitigation with public policy and standard business practices.

WILDFIRE RISK EXPOSURE

Dynamic Planning + Science for Shasta Lake, 2021



FRA FEDERAL RESPONSIBILITY AREA
MODERATE
HIGH
VERY HIGH

CAL FIRE, CPUC

HAZARD EXPOSURE SUMMARIES*

POPULATION
COUNT OF PERSONS
5,825 57%

PARCEL
COUNT
1,263 35%

PARCEL VALUE
SUM OF IMPROVEMENT
$480,227,725 36%
SUM OF CONTENT
$305,785,732 37%

CRITICAL INFRASTRUCTURE
POINT COUNT

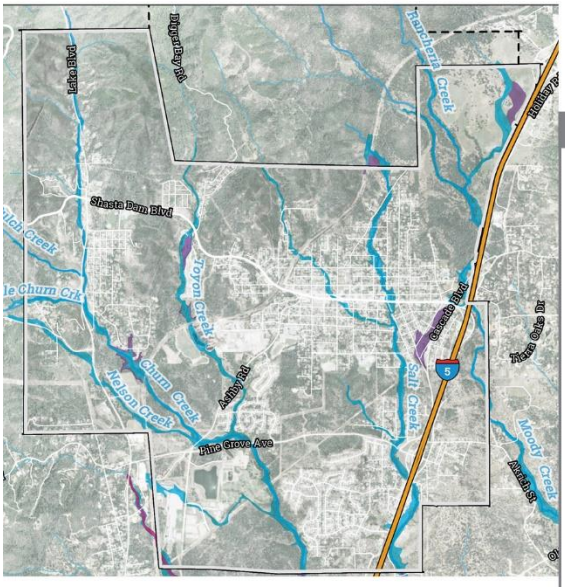
Essential Facilities	0	0%
High Potential Loss	52	47%
Transportation & Lifeline	30	48%

LINEAR MILEAGE

Transportation & Lifeline	109	46%

*Exposure summaries include very high risk areas. Hazard data sources: Cal Fire.

FEMA FLOOD RISK EXPOSURE



100-YR FLOODWAY
500-YR

FEMA

HAZARD EXPOSURE SUMMARIES*

POPULATION
COUNT OF PERSONS
789 8%

PARCEL
COUNT
118 3%

PARCEL VALUE
SUM OF IMPROVEMENT
$49,844,024 4%
SUM OF CONTENT
$32,556,953 4%

CRITICAL INFRASTRUCTURE
POINT COUNT

Essential Facilities	0	0%
High Potential Loss	3	3%
Transportation & Lifeline	16	26%

LINEAR MILEAGE

Transportation & Lifeline	17	7%

*Exposure summaries include 100-year and 500-year flood zone areas. Hazard data sources: FEMA.

Figure ES 4: Wildfire and FEMA Flood Risk Exposure Summaries

Mitigation Strategy

The mitigation strategies and activities designed to reduce or eliminate losses resulting from natura l hazards are the centerpiece of the mitigation planning process. By implementing mitigation actions, the City of Shasta Lake will become more resilient to disasters. Actions identified in this plan are not specifically geared toward obtaining funding under the Hazard Mitigation Assistance (HMA) grant program. Rather, the focus is on actions that can effectively achieve the goals of the plan within the City's resource capabilities.

The HMPC identified mitigation actions to address various vulnerabilities throughout the city, as listed in this plan. New and ongoing mitigation actions are summarized in Table ES 1. The full mitigation action strategy is outlined in Table 5-1. Figure ES-6 provides a key for understanding mitigation action numbering.

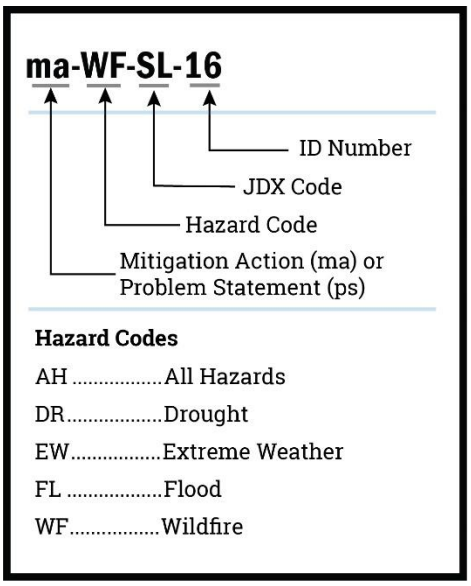


Figure ES-6: Mitigation Action Key

Mitigation actions are designed to address identified vulnerabilities and to confer community benefits, both indirect governmental benefits to protect the broader community and direct public benefits to support landowners, business owners, and other community members.

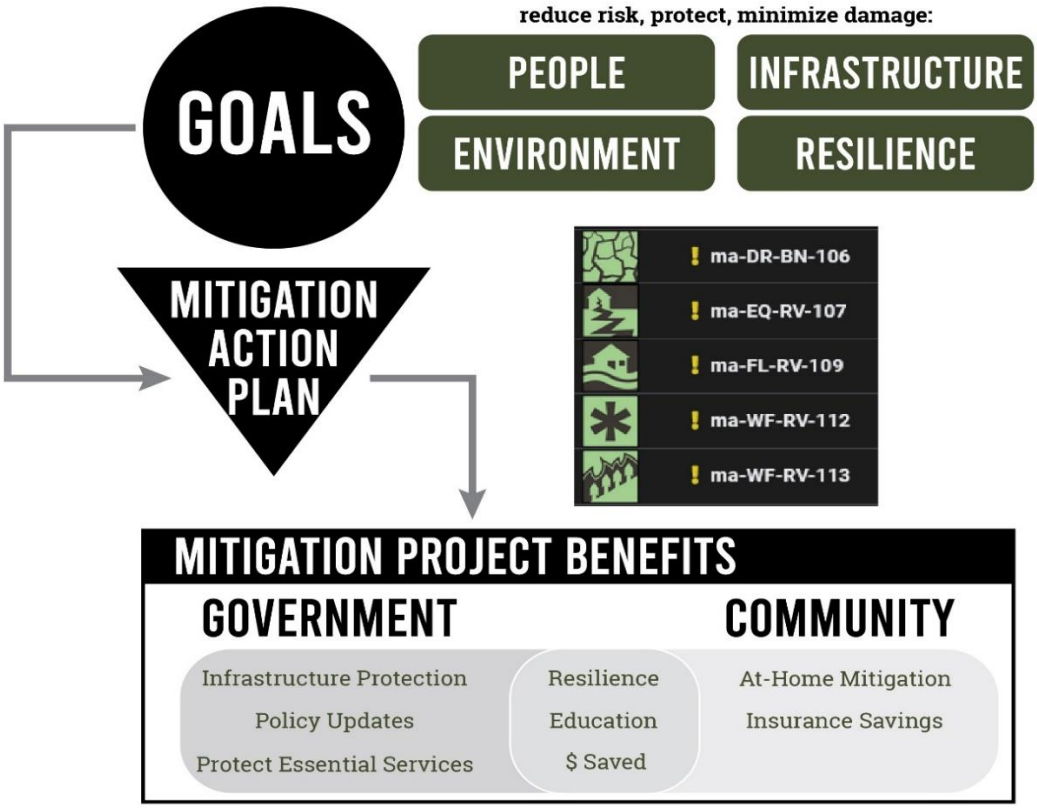


Figure ES-5: Process for Conferring Mitigation Project Benefits

Mitigation Actions

Table ES 1: Mitigation Actions.

Mitigation No.	Hazard Type	Year	Title/Description	Priority
ma-WF-SL-16	All Hazard	2021	Assess emergency access routes for multiple egress options and adequate turn arounds and infrastructure; maintain and improve wildfire emergency access where needed.	High
ma-AH-SL-18	All Hazard	2021	Ensure addresses and locations are easily visible and accessible during emergencies, especially in the Wildland Urban Interface (WUI).	High
ma-AH-SL-19	All Hazard	2021	Partner with the Shasta Lake Fire Protection District (SLFPD) to plan and implement retrofits to main fire station for hazard resiliency.	Medium
ma-AH-SL-20	All Hazard	2021	Implement pre-identified emergency evacuation zones, such as Zone Haven, in coordination with Sherriff and County OES.	High
ma-AH-SL-22	All Hazard	2021	Improve removal of dead or downed trees or those with dead canopies to be more resilient to wildfire, high winds, and extreme rain or snow storms.	High
ma-DR-SL-21	Drought	2021	Review and strengthen the City's water conservation ordinance where needed to limit outdoor watering during drought periods.	High
ma-DR-SL-24	Drought	2021	Develop a robust public education campaign to encourage water conservation during drought periods.	Medium
ma-EW-SL-3	Extreme Weather	2014	Improve HVAC and other weatherization items (insulation, windows/doors) in homes and businesses.	Medium
ma-EW-SL-4	Extreme Weather	2014	Construct back-up power facilities for community-based Cooling Centers.	High
ma-EW-SL-5	Extreme Weather	2014	Harden critical facilities against the effects of a severe rain or winter storm.	High
ma-EW-SL-21	Extreme Weather	2021	Identify alternative debris collection sites and/or removal methods for debris resulting from extreme weather events.	Extreme
ma-EW-SL-23	Extreme Weather	2021	Work with outside agencies to evaluate and prioritize replacement of undersized culverts in the City.	Medium
ma-FL-SL-6	Flood	2014	Increase awareness of flood risk and safety.	Medium
ma-FL-SL-7	Flood	2014	Routinely inspect storm water channels, inlets and outfalls for vegetation build up / encroachment, trash / debris, silt / gravel build up, erosion or bank failure, structural damage and vandalism. Prioritize clean up and repair as needed.	High
ma-FL-SL-8	Flood	2014	Implement drainage improvements from the City of Shasta Lake 2008 Drainage Master Plan.	High

Mitigation No.	Hazard Type	Year	Title/Description	Priority
ma-WF-SL-9	Wildfire	2014	Develop a city-wide implementation plan, in collaboration with SLFPD, for defensible space code administration and enforcement.	High
ma-WF-SL-10	Wildfire	2014	Construct and upgrade city water supply for fire suppression in Wildland Urban Interface (WUI) areas.	Extreme
ma-WF-SL-11	Wildfire	2014	Develop and maintain a Wildfire Preparedness Guide, to provide residents with education and information on defensible space maintenance.	High
ma-WF-SL-12	Wildfire	2014	Ensure properties are cleared in accordance with weed abatement ordinance for Seniors, disabled and low income populations.	High
ma-WF-SL-13	Wildfire	2014	Join and collaborate with local Fire Safe Council to protect homes, the community, and environment from wildfires. (Shasta County Fire Safe Council reestablished 2021)	Extreme
ma-WF-SL-14	Wildfire	2014	Continue to implement projects in City Electric Department Wildfire Vulnerability Plan, County CWPP, and Cal Fire Shasta-Trinity Unit Plan.	Extreme
ma-WF-SL-15	Wildfire	2021	Complete additional fuel break projects focused on north and northeast portions of the City as identified by the CWPP (also see Electric Department Wildfire Mitigation Plan for additional fuel reduction projects).	Extreme
ma-WF-SL-17	Wildfire	2021	Seek funding to develop a cost share program for residential defensible space and fuel reduction mitigation and fireproofing retrofits.	High

Mitigation Action Implementation

No amount of planning or mitigation can prevent disasters from occurring or eliminate the impacts of such events entirely. Natural disasters will occur, and the City will take actions to reduce the risks these hazards pose to life, property, and the economy. While this HMP identifies opportunities for reasonable mitigation actions, each individual has a responsibility to be aware of the potential hazards where they live and to minimize their own household's vulnerability.

The City's ability to carry out mitigation is limited to those facilities over which it has authority. The City does not have direct authority over schools; sanitation districts; private gas, electric and communication utilities; state and federal highways and facilities; private hospitals; or neighboring cities and tribes. The city will focus on actions within its authority while seeking to cooperatively work with other entities to address mutual areas of vulnerability and interdependence.

Full implementation of the plan's recommendations will take time and resources. The measure of the plan's success will be the coordination and pooling of resources within the City's jurisdiction and maintaining these successes over time. Teaming together to seek financial assistance at the state and federal level will be a priority to initiate projects that are dependent on alternative funding sources. This plan was built upon the effective leadership of a multi-disciplined steering committee and a process that relied heavily on public input and support. The plan will succeed for the same reasons.

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Adoption Record

To comply with DMA 2000, the City of Shasta Lake City Council officially adopts this City of Shasta Lake Hazard Mitigation Plan on **DATE TO COME**. The adoption of the HMP in its entirety recognizes the City's commitment to reducing the impacts of natural hazards within the city.

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CITY OF SHASTA LAKE

HAZARD MITIGATION PLAN

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Section 1. Introduction

1.1 Purpose & Scope

The purpose of this plan is to guide hazard mitigation planning to better protect the people and property of the city from the effects of hazard events. This plan demonstrates the commitment of the city towards reducing risks from hazards and serves as a tool to help decision-makers direct mitigation activities and resources. This plan was also developed to ensure the City of Shasta Lake's continued eligibility for certain federal disaster assistance, specifically the FEMA Hazard Mitigation Assistance (HMA) grants, including the Hazard Mitigation Grant Program (HMGP), Building Resilient Infrastructure and Communities (BRIC), and Flood Mitigation Assistance Program (FMA).

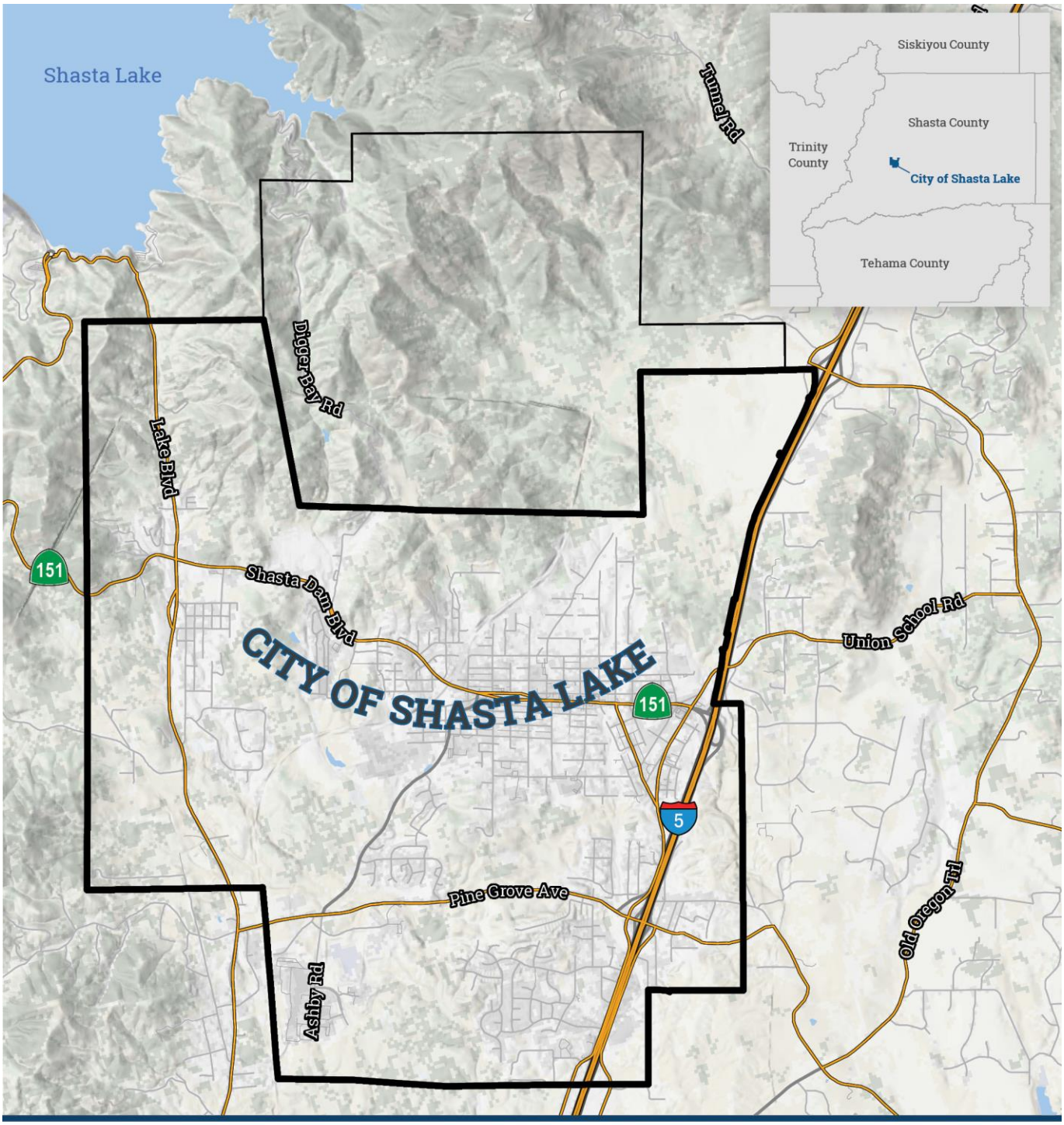
The City of Shasta Lake last updated this Hazard Mitigation Plan (HMP), approved by the Federal Emergency Management Agency (FEMA) in 2014. The plan in its current form reflects a comprehensive update in 2021.

Each year in the United States, natural disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. These monies only partially reflect the true cost of disasters because additional expenses incurred by insurance companies and nongovernmental organizations are not reimbursed by tax dollars. Many natural disasters are predictable, and much of the damage caused by these events can be reduced or even eliminated. Hazard mitigation is defined by FEMA as "any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event." The results of a three-year, congressionally mandated independent study to assess future savings from mitigation activities demonstrates that mitigation activities are highly cost-effective. On average, each dollar spent on mitigation saves society an average of $6 in avoided future losses in addition to saving lives and preventing injuries. (NIBS, 2018)

The City of Shasta Lake Hazard Mitigation Plan covers the entire area within City of Shasta Lake's jurisdictional boundaries (hereinafter referred to as the "planning area"). A planning committee was formed to develop and steer content in this plan, which included both City staff and public safety experts from outside agencies.

1.2 Planning Area

The City of Shasta Lake is approximately 10.9 square miles according to the United States Census Bureau. The city is also referred to as the "planning area" in this HMP. While other jurisdictions provided guidance during the planning process, to obtain Federal Emergency Management Agency (FEMA) approval, each local jurisdiction must meet all requirements of hazard mitigation planning outlined in 44 C.F.R. § 201.6. The City of Shasta Lake's jurisdictional area is displayed in Figure 1-1.



Geographic Overview
Shasta Lake

City of Shasta Lake

Sphere of Influence

Figure 1-1: Location of the City of Shasta Lake

1.3 Why Update This Plan?

Hazard mitigation is a way to reduce or alleviate the loss of life, personal injury, and property damage that can result from a disaster through long and short-term strategies. It involves strategies such as planning, policy changes, programs, projects, and other activities that can mitigate the impacts of hazards. The responsibility for hazard mitigation lies with many parties, including private property owners, business and industry, and local, state, and federal governments.

The Federal Disaster Mitigation Act of 2000 (DMA 2000) requires state and local governments to develop hazard mitigation plans as a condition of federal disaster grant assistance. (Pub. L. No. 106-390; 42 U.S.C. § 5121 *et seq.*) Prior to 2000, federal disaster funding focused on disaster relief and recovery, with limited funding for hazard mitigation planning. DMA 2000 increased the emphasis on planning for disasters before they occur.

DMA 2000 encourages state and local authorities to work together on pre-disaster planning and promotes sustainability. Sustainable hazard mitigation includes the sound management of natural resources and the recognition that hazards and mitigation must be understood in the broadest possible social and economic context. The enhanced planning network called for by DMA 2000 helps local governments articulate accurate mitigation needs, resulting in faster allocation of funding and more cost-effective risk reduction projects.

1.3.1 Purposes for Planning

This hazard mitigation plan identifies resources, information, and strategies for reducing risk from natural hazards. The City of Shasta Lake initiated this planning effort for several key reasons. The planning area has significant exposure to numerous natural hazards that have caused millions of dollars in past damage. The city wants to be proactive in preparing for the probable impacts of natural hazards. Limited local resources make it difficult to implement proactive risk-reduction measures. Federal and State financial assistance is paramount to successful hazard mitigation in the area.

Elements and strategies in the plan were selected because they best meet the needs of the city and its citizens. The plan was developed to meet the following objectives:

- Meet or exceed requirements of the DMA 2000 and the California legislation requiring the incorporation of climate adaptation strategies into hazard mitigation planning (SB 379).
- Enable the city to continue using federal grant funding to reduce risk through mitigation.
- Meet the needs of the city as well as state and federal requirements.
- Create a risk assessment that focuses on the city's hazards of concern.
- Coordinate existing plans and programs so that high-priority initiatives and projects to mitigate possible disaster impacts are funded and implemented.

1.4 Who Will Benefit from This Plan?

All residents and businesses of City of Shasta Lake are the ultimate beneficiaries of this HMP. The plan reduces risk for those who live in, work in, and visit the city, and it provides a viable planning framework for all foreseeable natural hazards that may impact the city. City stakeholder participation helped ensure that plan outcomes will be mutually beneficial. The resources and background information in the plan are applicable citywide, and the plan's goals and recommendations can lay the groundwork for the development and implementation of local mitigation activities and partnerships.

1.5 How to Use This Plan

This plan includes all federally-required elements of a hazard mitigation plan that apply to the entire planning area. This volume includes the description of the planning process, public involvement strategy, goals and objectives, citywide hazard risk assessment, citywide mitigation initiatives, and a plan maintenance strategy. Volume 1 includes **Appendix A**, the Annex Methodology and **Appendix B**, Planning Process Documentation

Section 2. What's New

This section includes background information on the 2014 HMP and this HMP Update. The 2014 mitigation actions were reviewed and have been changed, updated, and revised to reflect new priorities in this HMP. Only the information and data still valid from the 2014 Plan were carried forward as applicable to this HMP update. The sections below describe the planning process for this update. This update profiles the following five hazards: wildfire, flood, extreme weather, drought, and climate change hazards.

2.1 2014 HMP vs 2021 HMP Update Background

In March of 2014, the city met all approval requirements from the DMA and officially adopted an update to the 2005 HMP. The city and the Hazard Mitigation Planning Committee (HMPC) instituted a series of improvements for this 2021 HMP, including:

- **More narrowly-focused priority hazards**. When the HMPC revisited its priorities for the 2021 HMP update, it chose to focus on a narrower set of hazards than the 2014 HMP, primarily to focus on mitigation actions and implementation more meaningfully for priority hazards. See the risk prioritization, Section 4.2.
- **Local mitigation progress.** This 2021 HMP Update includes a revisiting of progress on local mitigation efforts, especially since the 2014 HMP. See Section 2.4.
- **Changes in development.** The city and HMPC considered any changes of development that occurred since the 2014 HMP. Importantly, those development changes include proactive revisions to the City municipal code, outlined in Section 2.4, that ensure permitted development is considering and mitigation impacts from hazard events. See also Section 4.3.6.
- **Hazard Profiles incorporate Vulnerability Assessments.** This update includes incorporating the vulnerability assessment for each hazard into the individual hazard profile sections of Section 4.5. This change means all hazard information is now included in one place, without the need to flip back and forth in the Plan.
- **New interactive vulnerability and mitigation information.** Perhaps most importantly, this HMP Update takes this static plan into interactive forms. First, the **Risk Assessment Mapping Platform** (RAMP) will be available to the city, HMPC, and public to deepen understanding of hazard geographic extents overlaid with critical facilities, parcels, and population. See also Section2.3. The **Mitigation Action Support Tool** (MAST) provides real-time updating of mitigation actions, implementation strategies, funding sources, responsible parties, next steps, or other fields for city upkeep over the next five years. See Section 6.3.2.

2.2 Mitigation Actions

During this HMP update process, each of the 2014 city-wide mitigation actions were examined for relevancy and the potential for future implementation and then evaluated for potential follow-up. Some mitigation

actions developed during the 2014 HMP effort are an inherent part of the HMP update process or were not detailed enough for implementation at a local jurisdiction level, and thus were not included in this update. The city has made significant changes to other 2014 Mitigation Actions because of the updated risk assessment and implementation strategy, to include more detail, or to update based on current mitigation practices.

Table 2-1 provides a record of *cancelled* Mitigation Actions and an explanation for why the mitigation action was cancelled. *Ongoing or pending* mitigations actions from previous HMPs are included within the Mitigation Action Plan in Table 5-6.

Table 2-1: Cancelled Previous Mitigation Actions

Mitigation No.	Hazard Type	Status	Year	Title/Description	Responsible Party	Reason Cancelled
ma-EQ-SL-1	Earthquake	Cancelled	2014	Develop and maintain an earthquake hazard community education program.	Primary: Gateway School District / SLFPD, COSL Chamber of Commerce, SLFPD, COSL Development Services Dept.	While earthquakes are certainly possible in Shasta Lake, the City did not prioritize earthquakes to focus on higher priority hazard mitigation.
ma-EQ-SL-2	Earthquake	Cancelled	2014	Strengthen critical facilities and infrastructure from earthquake hazards.	Primary: SLFPD (Project Management); Support: Building Division (Routine Inspections)	While earthquakes are certainly possible in Shasta Lake, the City did not prioritize earthquakes to focus on higher priority hazard mitigation.

2.3 New Analysis and Risk Assessment Methodology

The city strengthened this plan by using new research methods and web-based information systems. Most import to the risk assessment was the development of a web-based and interactive Risk Assessment Mapping Platform (RAMP), which has allowed interactive discovery of risk, vulnerability, and exposure data developed especially for the City of Shasta Lake. In addition to RAMP, Geographic Information Systems (GIS) mapping and analysis provided the city with the tools and data to develop more comprehensive data sets than those in the 2014 HMP. The city also used a platform, Mitigation Action Support Tool (MAST), to record and update their problem statements, and create associated mitigation actions. .

2.4 Successful Mitigation Activities

The 2014 City of Shasta Lake HMP guiding principle, goals, objectives, and mitigation actions have been implemented through various on-going projects, plans, and programs. The city has made improvements toward reducing natural hazard risks to life and property, with significant risk reduction efforts for floodplain management, flood damage prevention, and fire hazard reduction. Exemplary policies, programs,

and projects with significant risk reduction are summarized below. These mitigation success stories are an examples of city departments and stakeholders making the City of Shasta Lake more resilient to the hazards within the planning area.

Shaded Fuel Break Projects. The City partnered with local agencies to conduct defensible space and forest health projects throughout the city. The largest completed project was a 20-acre, 20-foot wide shaded fuel break extending 0.8 miles across the northwest side of the city. Western Shasta Resource Conservation District (RCD) was awarded a grant for this fuel break project from the California Fire Safe Council, funded by the U.S. Forest Service, to construct the break. Methods of treatment for this project include chipping, piling and burning, and browsing with goats.

Figure 2-1. Fuel Breaks Underway along Pine Grove Avenue, February 2020. Photo Credit: DP+S

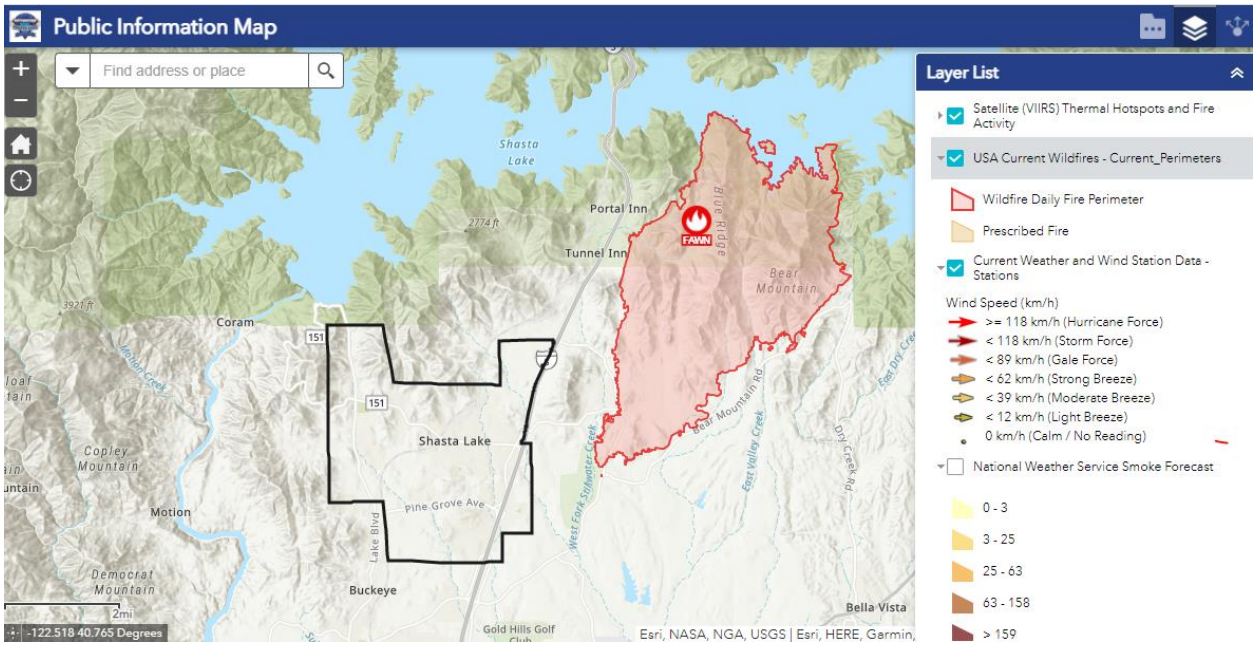
Storm Debris Disposal Site. After a significant snow event in Shasta County that impacted the city with up to 14 inches of snow, commonly referred to "Snowmaggeden," the City opened up a free debris disposal site for residents. The disposal site was for wooded storm debris only (trees, branches, limbs, etc). This type of service assists residents with safely removing debris and clearing away fallen hazardous objects in a timely manner after a significant storm event, a practice the City plans to continue implementing as needed in the future.

Hazard-Related Plan Updates. This city updated its Urban Water Management Plan (UWMP) in 2021 and drafted its first Wildfire Mitigation Plan (WMP) for its electric utility in 2020. The UWMP outlines important water quality and water conservation measures that will protect the city in times of drought or extreme rain events, among other important aspects of the plan. The wildfire mitigation plan helps guide the city's electric utility in minimizing the risk of catastrophic wildfire posed by its electrical lines and equipment. The WMP is consistent with Cal. Pub. Util. Code § 8387 for publicly owned electric utilities to prepare a wildfire mitigation plan by January 1, 2020, and annually thereafter.

Shasta County Community Wildfire Protection Plan (2016; 2021 update). Shasta County and the Western Shasta RCD partnered to help develop the County's first Community Wildfire Protection Plan (CWPP) in 2016. The Plan identifies key portions of Shasta Lake that warrant prioritization for defensible space and forest

health projects, and as such is incorporated into mitigation actions for the City. The newly-formed Shasta County Fire Safe Council is spearheading a 2021 update to the CWPP; this update may extend into 2022.

Interactive Public Information Map. The City developed a public information map that displays information about current wildfires, smoke forecasts, wind and other weather warnings, traffic closures, and other important public information related to hazard events. The map is updated on a daily basis from public data sources. The map is accessed through the City website and partner websites including the Shasta Lake Fire Protection District (SLFPD) site.



Hazard-related Municipal Code Revisions. The City instituted many hazard-related municipal code revisions over the past five years to increase resiliency in the face of wildfire, drought, and other hazards. Revisions include:

- **Tree Conservation Ordinance Exemptions for Fire Protection (Ch. 12.36).** The City amended its Tree Conservation Ordinance in its entirety in 2020. Amendments focused on facilitating and providing for increased protection from wildfire on private property. Trees may be removed from properties for the creation of defensible space and other fire prevention and safety purposes, at the direction of Shasta Lake Fire Protection District (SLFPD) and according to Cal. Pub. Res. Code § 4291 *et. seq.* The fire department also may remove trees while engaged in firefighting in order to prevent the spread of fire or to prevent a dangerous situation to life or property. Tree removal and trimming within one hundred feet of a residence or structure as required by an insurance provider is also exempted from the tree ordinance.
- **Grading, Erosion Control, and Hillside Development (Ch. 15.08) Updates.** In 2015, the city instituted several code revisions to its grading, erosion control, and hillside development ordinance to further safeguard life, health, property, the environment, and the public welfare. The revisions further regulate additional clearing and grading on private and public property and provide standards and

design criteria to implement stormwater best management practices to control water pollution and erosion.

- **Water Efficient Landscaping (15.10).** The City continued to enforce and utilize its 2010 water efficient landscaping ordinance over the five-year life span of the HMP, which comprised many years of extreme and exceptional drought in the Shasta Lake area.

SLFPD Hazard Abatement Ordinance. In 2019, the SLFPD passed an ordinance giving the Fire Chief authority to inspect and enforce fire abatement requirements on private and public properties. This is a particularly important success given the very high wildfire severity surrounding the city.

Resident Vegetation Management Exemptions to Tree Ordinance. During 2020 the City Council approved updates to the Tree Conservation Ordinance to allow an expedited exemption process for residents needing to address vegetation management for fire safety purposes. The City of Shasta Lake and Shasta Lake Fire Protection District (SLFPD) are partners in fuel reduction projects around the City. Both the City and SLFPD take the matter of educating property owners regarding the need for fire fuel reduction activities to protect structures and to prevent the spread of fire on vacant land. The goal of the SLFPD and City efforts is to work with property owners to reduce wildfire risk, and ultimately protect resident's lives and property. SLFPD is the lead agency on the weed abatement notices, and the City is working proactively with the District to ensure fuel reduction projects meet the standards set forth within the City of Shasta Lake Municipal Code. The City supports the District's efforts to bring properties into compliance with state law on maintaining defensible space and vegetation management, while also considering environmental impacts and tree conservation. To clarify property owner responsibilities and expedite fuel reduction projects, the City and District developed a project "exemption" checklist to outline the standards for exempt vegetation management activity on property where SLFPD has issued an abatement order for fire safety. This effort provided significant benefits to residents and the community in achieving additional fire fuel reduction benefits.

Water Demand Reduction Programs: Since 2009, Tantalus remote-read meters have been rolled out to nearly every Shasta Lake water customer. It is anticipated that this remote meter reading system would allow the City to implement an interruptible load program, time-of-use metering, and other such programs.

Shasta Lake Safety and Emergency Preparedness Committee: The City continues to convene the Shasta Lake Safety and Emergency Preparedness Committee, including regular meetings throughout the planning period.

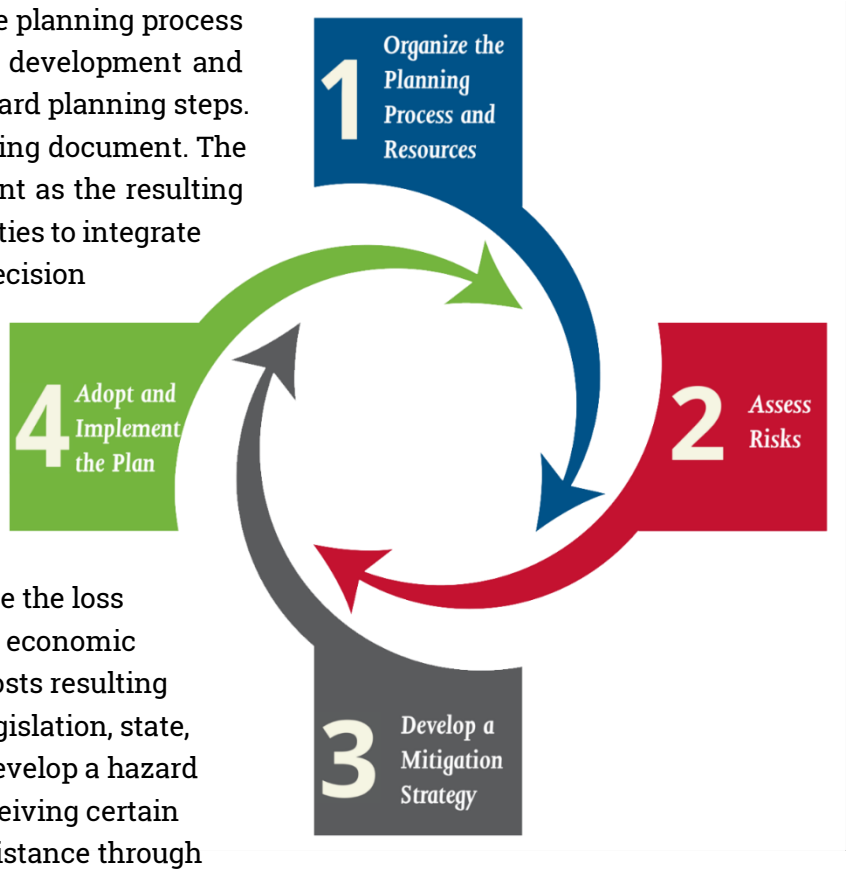
Shasta County CODE RED Alert System. The City continues to partner with Shasta County to provide residents and visitors with an emergency alert system. These updates were particularly important to the community during the nearby 2021 Fawn Fire, which occurred during the formation of this HMP Update.

2.5 Incorporation into other Planning Mechanisms

Over the past five years, the 2014 HMP was incorporated into other planning mechanisms as a demonstration of progress in local hazard mitigation efforts. This newly updated HMP will be referenced in the City of Shasta Lake's General Plan Safety Element, which is undergoing update. The HMP will be considered as the City also works to adopt other elements of the HMP for a complete General Plan update in 2022. This update also will be incorporated into planning documents such as the Capital Improvement Plan and Urban Water Management Plan along with regional planning documents such the county Community Wildfire Protection Plan (CWPP) in the future. Section 6.3.6 outlines planning mechanisms to integrate with the HMP and the process for such integration in more detail.

Section 3. Planning Process

This section describes each stage of the planning process used to develop the HMP. The planning process provides a framework for document development and follows the FEMA recommended hazard planning steps. This HMP is a community-driven, living document. The planning process itself is as important as the resulting plan because it encourages communities to integrate mitigation with day-to-day decision making. This section describes each stage of the planning process.



The Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended by the Disaster Mitigation Act of 2000 (DMA 2000, 42 U.S.C. § 5165), is intended to "reduce the loss of life and property, human suffering, economic disruption, and disaster assistance costs resulting from natural disasters." Under this legislation, state, tribal, and local governments must develop a hazard mitigation plan as a condition for receiving certain types of non-emergency disaster assistance through FEMA Hazard Mitigation Assistance. FEMA regulations implementing the DMA 2000 are located at 44 C.F.R. § 201.6 *et seq.*

FEMA prescribes four major planning steps:

- Step 1: Organize Resources
- Step 2: Assess Risk
- Step 3: Develop a Mitigation Strategy
- Step 4: Adopt and Implement the Plan

The City of Shasta Lake followed the FEMA four-step process. Figure 3-1 provides a detailed, phased breakdown of the planning process that the city completed. These four steps are integrated with a ten-step planning process that FEMA's Community Rating System uses to establish floodplain management credit in addition to Flood Mitigation Assistance programs.

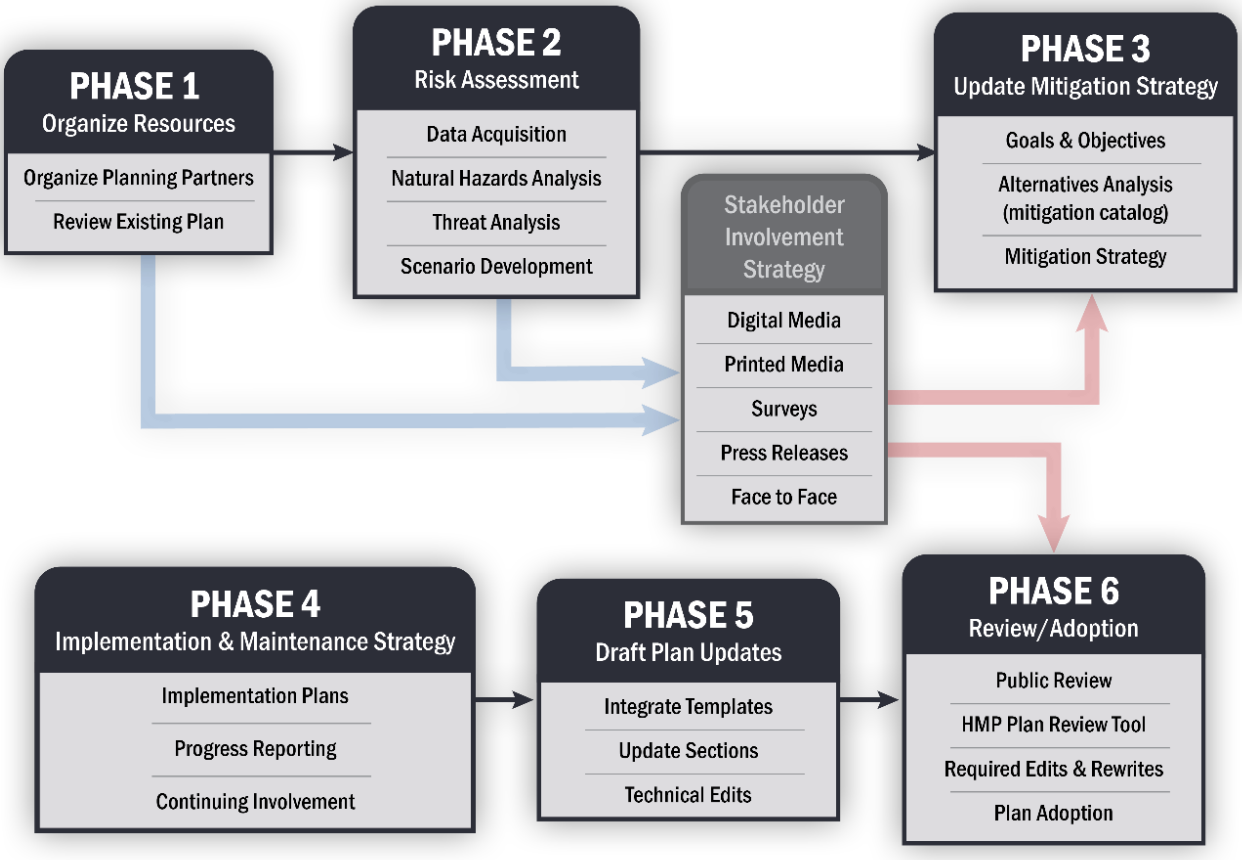


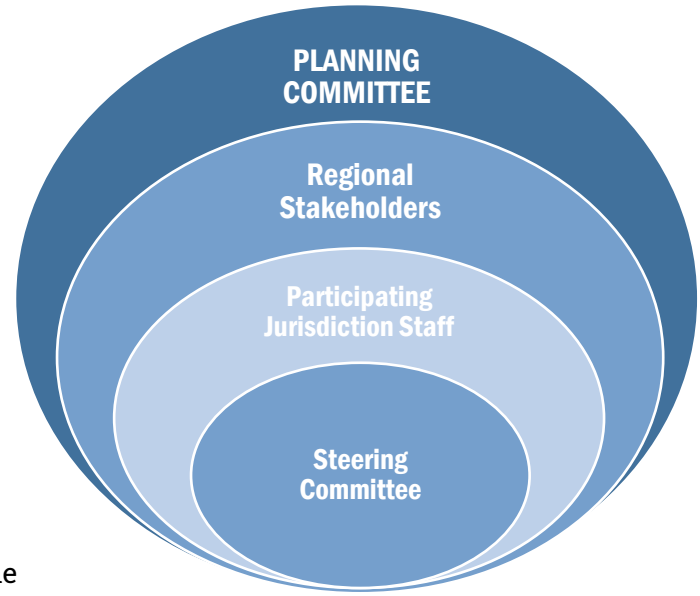
Figure 3-1: City of Shasta Lake HMP Planning Process

STEP 1: Organize Resources

The first step of the HMP planning process was organizing resources, consisting of developing the Planning Committee, reviewing relevant existing documents, and organizing public outreach.

Building the Planning Committee

The Hazard Mitigation Planning Committee (HMPC or "Planning Committee") was comprised of participants from the city and stakeholders who worked together to develop the HMP. The HMPC consisted of a Steering Committee, staff from the city, a broader group of regional stakeholders, agencies, and members of the public, and an HMP consultant used for plan development and facilitation.



Steering Committee

The Steering Committee was at the core of the HMP planning process and was integral to ensuring the success of the planning process, its implementation, and future maintenance. Members of the Steering Committee, listed in Table 3-1 below, consisted of city leads from each department and was a part of the HMPC, discussed below.

Table 3-1: HMP Steering Committee

Jurisdiction	Point of Contact	Title
City of Shasta Lake	Jessaca Lugo	City Manager
City of Shasta Lake	Peter Bird	Associate Planner
City of Shasta Lake	William Bond	Assistant City Engineer
City of Shasta Lake	Jim Hamilton	City DS Staff
City of Shasta Lake	James Takehara	Electric Utility Director
City of Shasta Lake	Jeff Tedder	City Engineer (retiring)

Hazard Mitigation Planning Committee

The HMPC consisted of key decisionmakers with specific expertise to contribute to the planning process from the City of Shasta Lake and regional stakeholders such as relevant agencies, neighboring jurisdictions, and members of the public. The Planning Committee served as liaisons to the greater community.

The Planning Committee was involved in the following planning processes:

- Structured coordination and meetings
- Collection of valuable local information and other requested data
- Decision making on plan process and content
- Development of mitigation actions
- Review and comment on plan drafts
- Coordination of the public input process

All Planning Committee members were included in regular communications about the HMP and were invited to all Planning Committee meetings. However, not all members attended stakeholder group meetings; some participated by reviewing draft documents, assisting in the vulnerability assessment, with public outreach, or at other stages of the process. Table 3-2 provides a list of the Planning Committee Members. Documentation of Planning Committee invitations and attendance is provided in Appendix B.

Table 3-2: HMP Planning Committee

NAME	TITLE	DEPARTMENT
CITY OF SHASTA LAKE		
Jessaca Lugo	City Manager	City Manager's Department
Peter Bird	Associate Planner	Development Services
William Bond	Ass't City Engineer, City Engineer as of 2022	Public Works
James Takehara	Electric Utility Director	Electric Department
Jim Hamilton	Planner	Development Services Department
Jeff Tedder	City Engineer	Public Works (retiring)
STAKEHOLDERS		
Sara Acrige	USFS District Ranger	Shasta Lake Ranger District
Ryan Bailey	Public Works Director	City of Redding Public Works
Lily Toy	Planning Manager	City of Redding Planning Department
Dennis Beck	Fire Chief	City of Shasta Lake Fire Protection District
Roger Moses	Fire Captain	City of Shasta Lake Fire Protection District
Robert Sandbloom	Emergency Manager Coordinator	Shasta County Sheriff's Office
Lt. Caleb MacGregor	Lieutenant	Shasta County Sherriff Office
David Coxey	General Manager	Bella Vista Water District

NAME	TITLE	DEPARTMENT
Marci Gonzales	Caltrans Planner	Caltrans Planning
Elizabeth Hadley	Deputy Area Manager	US Bureau of Reclamation
Amy Pendergast	Healthy & Safe Families Program Manager	Shasta County Public Health
Gary Rickert	Chairman	Wintu Tribe of Northern California
Ross Perry	Project Manager	Western Shasta Resource Conservation District
Carla Thompson	Member of the Public; consultant to General Plan update	EnPlan Consultants
Janice Powell	City Council Member	City Council Member
Rose Smith	Member of Public ; Shasta Lake Fire District Board Member	General Plan Advisory Committee member
Don Spurgeon	Member of Public	General Plan Advisory Committee member
Shane Vargas	Cal Fire Captain	Land Use Planning Program
Nick Wallingform	Cal Fire Battalion Chief	Land Use Planning Program

Consultant Team

The city enlisted consulting firm Dynamic Planning + Science (DP+S) due to its expertise in assisting public sector entities with developing hazard mitigation plans. DP+S facilitated the planning process, collected and analyzed data, produced meeting materials, and produced drafts of the HMP for review. The HMP Consultant Team, as shown in Table 3-3, consisted of a variety of hazard mitigation and certified urban planning professionals.

Table 3-3: HMP Update Consultant Team

HMP Update Project Team	Role
Ethan Mobley, AICP	Project Manager
Brian Greer	GIS Manager/Spatial Analyst
Torie Jarvis	Outreach Manager, Planning Manager
Raini Ott	Hazard Mitigation Planner
Daniel Spivak	Hazard Mitigation Planner
Clare Peabody	Hazard Mitigation Planner
Alex Krebs	GIS Associate

Planning Committee Meetings

The HMPC met throughout the development of the updated HMP. Table 3-4 charts those meetings, including date, type, and topics discussed. Meeting documentation, including agendas, hazard maps, PowerPoint presentations, minutes, sign-in sheets, and other relevant handouts, are provided in Appendix B. Along with these large group meetings, City staff and key stakeholders met several times to review and discuss the draft HMP, new mitigation actions, and vulnerability assessment data.

Table 3-4: Planning Committee Meeting Summary

Date	Meeting Type	Topics
March 18th, 2021	Meeting #1	▪ *Review Planning Team activities* ▪ *Review Scope of Work* ▪ *Review expectations of Steering Committee and jurisdictional planning committees* ▪ *2014 Mitigation Plan Review*
May 13th, 2021	Meeting #2	▪ *Meeting #1 Recap* ▪ *Risk Assessment/Community Vulnerability Review* ▪ *Hazard Prioritization Exercise* ▪ *Project and Website Review* ▪ *Review Outreach Materials*
June 23rd, 2021	Meeting #3	▪ *Review of progress to date* ▪ *Linking vulnerabilities and Mitigation* ▪ *Review of Mitigation Action Support Tool (MAST)* ▪ *Setting Plan Goals* ▪ *Developing a Nexus to HMA Funding*

Review and Incorporation of Existing Documents

The Planning Committee and Consulting Team reviewed and incorporated existing plans, studies, reports, and technical information in the formation of this HMP. The review of past documents is described more in Section 4.1. Those documents are cited throughout the hazard profiles (Section 4.5) and are examined more closely both in the Capabilities Assessment (Section 5.3) and in each hazard profiles' plans, policies, and regulatory environment section.

All documents cited in this HMP are included in Section 7, Works Cited.

Public Involvement and Outreach

Public involvement is an important and requisite component of any HMP. The public outreach strategy for this HMP maximized public involvement throughout the planning process and utilized websites,

local media, and community efforts. Due to the unfolding COVID-19 pandemic during the development of this HMP, all outreach was conducted digitally.

As required by FEMA, the general public was given an opportunity to be involved in the planning process while developing the HMP through surveys, a project website, and public review periods. Each is described below.

Public Survey

An eight-question community survey was distributed by the city via multiple online platforms, resulting in a total of total of 85 survey responses. The results of the survey were used to ensure that city priorities reflect those of the community.

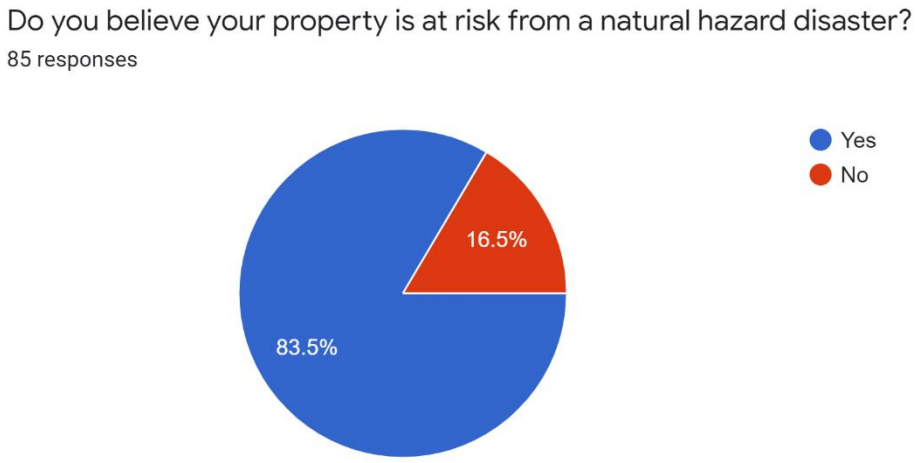


Figure 3-2: Sample Graphic from Survey

HMP Update Website

For this HMP, a project portal at mitigatehazards.com/shastalakehmp/ served and will continue to serve as a centralized project information and file-sharing platform. This website provides a tool for project management, collaborative content, and a one-stop-shop for mitigation planning resources.

In addition to internal coordination, the project portal played a critical role in public involvement throughout the planning process and documenting public involvement, including the community survey, meetings, and working sessions. Resources such as the Risk Assessment Mapping Platform (RAMP) and links to all meeting summaries are available to the public via the website. Project participants and stakeholders used the website as a project resource for the duration of the planning process and will continue to have access during the five-year update cycle and beyond.

Public Review of Draft HMP

This placeholder will be updated upon completion of the public draft.

The public reviewed the draft MJHMP during November of 2021. The draft was available at mitigatehazards.com/shastalakehmp/. The public was able to provide comment via collaborative PDF, online submission form, or direct email correspondence with City staff. The City made considerable changes to the HMP and mitigation actions in particular based on productive public feedback. Feedback includes [to be updated].

STEP 2: Assess the Risk

In accordance with FEMA requirements, the HMPC identified and prioritized the natural hazards affecting the City of Shasta Lake. It also assessed the vulnerability of to those identified hazards in terms of both exposed population and property. The risk assessment informed the development of appropriate mitigation actions. The process is described in this section, and the substance of this risk assessment is detailed in.

Identify and Profile Hazards

Based on a review of past hazard events, existing plans, reports, and other technical studies, data, and information, the Planning Committee determined if regional hazards could affect the planning area. The Planning Committee completed screening and prioritization processes to determine priority hazards to be assessed. A risk assessment finalized the prioritization process by ranking hazards according to the impact and threat to the city.

Assess Vulnerabilities

Assessing vulnerabilities exposes the unique characteristics of individual hazards and begins the process of narrowing down which areas within the City of Shasta Lake are vulnerable to specific hazard events. The vulnerability assessment included a GIS overlaying method for examining such vulnerabilities in greater detail. The city reviewed its GIS vulnerability information and completed this exercise. It also supplemented information by meeting and discussing areas of concern regarding each prioritized hazard. Identified hazards varied widely depending on the geographic make-up of, priorities of, and services provided by the city. Using these methods, the planning committee estimated vulnerable populations, infrastructure, and potential losses from hazards.

Updated content for each hazard profile for the city, including vulnerability, is provided in Section 4.5.

Web-Based Risk Assessment Mapping and Analysis

The web-based and interactive Risk Assessment Mapping Platform (RAMP), accessed via the project website at mitigatehazards.com/shastalakehmp/, allows interactive discovery of risk, vulnerability, and exposure data developed especially for the City of Shasta Lake. RAMP is a mapping platform built specifically for mitigation planning. It displays city facilities and buildings overlaid with natural hazards layers to bring interactivity and individual discovery to the GIS analysis performed for the HMP. Figure 3-3 shows the location of RAMP on the project website.

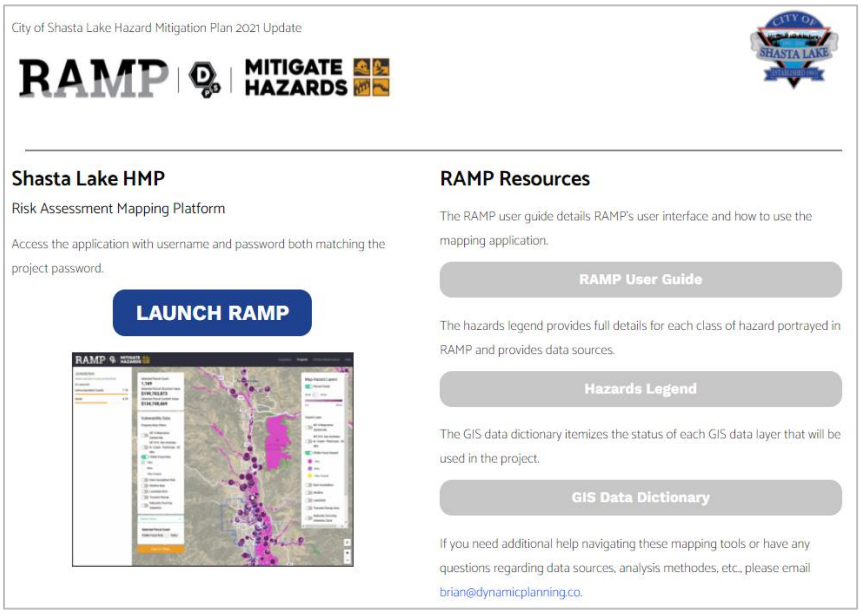


Figure 3-3: RAMP Access at mitigatehazards.com

The HMPC used RAMP to understand vulnerabilities to the city populations, critical facilities, and properties exposed to hazards with spatial footprints. Users interactively filter facilities and buildings by natural hazard zones and construction characteristics.

RAMP's robust data filtering and summation calculations allow the user to understand and visualize vulnerabilities at the facility level with detailed information on the number of structures exposed to various natural hazards. RAMP enables the City of Shasta Lake to pinpoint vulnerabilities and reinforces problem statements in the mitigation strategy. Figure 3-4 demonstrates the RAMP web-based interface.

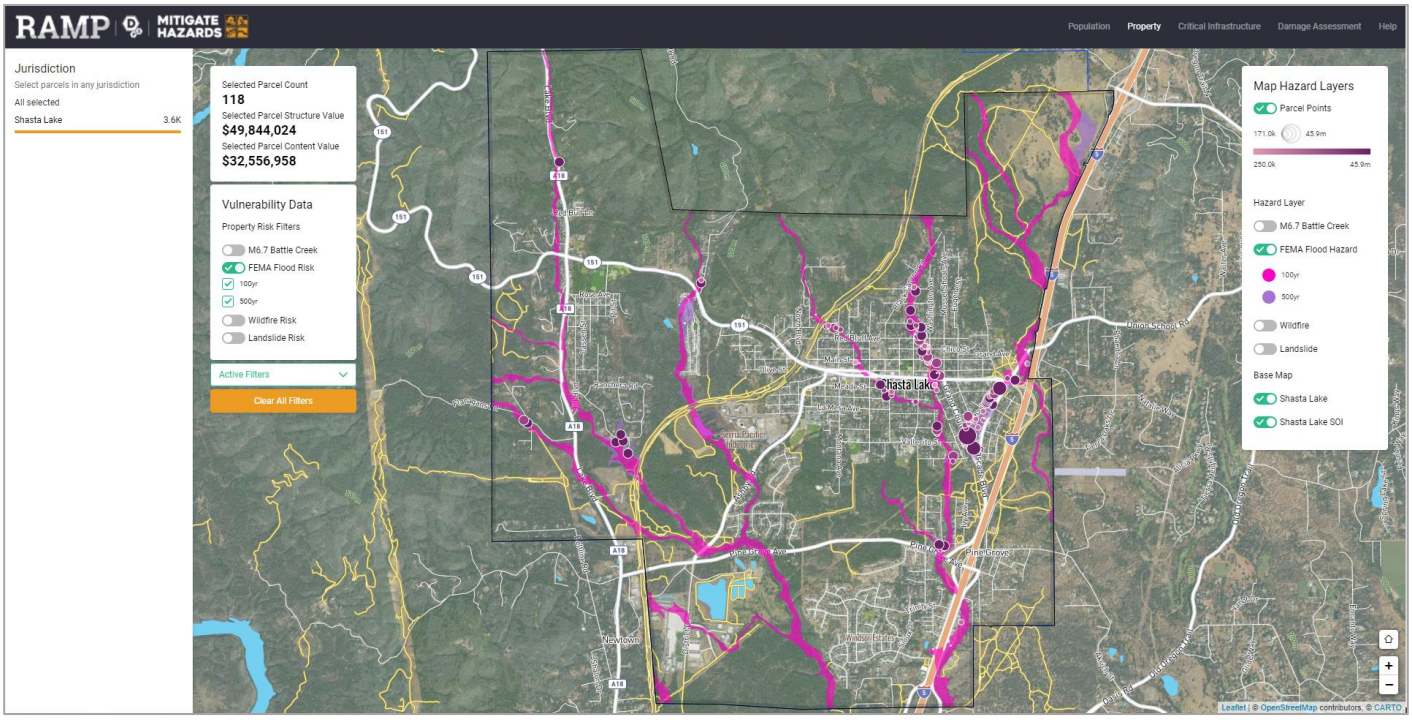


Figure 3-4: RAMP example showing properties exposed to FEMA 100-year flood risk

STEP 3: Develop a Mitigation Strategy

This plan provides a strategy and blueprint for reducing potential losses identified in the risk assessment based on existing authorities, policies, programs and resources, and the city's abilities to expand on and improve existing tools. HMP development included identifying goals, assessing existing capabilities, reviewing goals in the existing HMP, and identifying new mitigation actions. The HMP was prepared in accordance with requirements from DMA 2000, the California Office of Planning and Research (OPR), and FEMA's HMP guidance. The process is described below; the substance of the mitigation strategy is detailed in Section 5 for the city.

Identify Goals

The Planning Committee reviewed the goals of recent jurisdictional HMPs and the California Hazard Mitigation Plan and determined to craft HMP goals consistent with the California HMP and consistent with HMP and FEMA requirements. The goals were updated to meet the current hazard environments and to be consistent with the changing policies and goals of the city. The goals are presented in Section 5.4.

Develop Capabilities and Adaptive Capacity Assessment

A capabilities assessment is a comprehensive review of participating jurisdictions' capabilities and tools to implement the mitigation actions in the HMP. Capabilities assessments include considerations of a community's adaptive capacity for climate change, which is a community or region's existing ability to moderate climate change impacts. The Planning Committee identified technical, financial, and administrative capabilities to implement mitigation actions, as detailed in Section 5.3.

Identify Hazard Problem Statements

The Planning Committee developed mitigation actions to address problems that could originate from hazards identified in the risk assessment, in line with identified capabilities of the city. Mitigation actions were created first by developing problem statements for prioritized hazards. Best practice is for each hazard problem statement to be mitigated with a combination of short-term and long-range planning activities, and through both operational and physical projects. Hazard problem statements are located at the conclusion of each hazard profile in table format in Volume 1 and are also uploaded in an interactive web-based Mitigation Action Support Tool (MAST), described below. Hazard problem statements for the city are categorized as impact-related, victim-related, or threat-related, as seen in Figure 3-5.

Figure 3-5: Categories of issues addressed in problem statements

Identify Mitigation Actions

As part of the HMP planning process, the HMPC reviewed and analyzed the status of the mitigation actions identified in the city's HMP. Some were more than a decade old, and mitigation actions were determined to be outdated. The Planning Committee then worked together to identify and develop new mitigation actions with implementation elements. Additional detail on these mitigation actions is provided in Section 5.3.

Mitigation Action Support Tool (MAST)

Hazard problem statements and mitigation activities are presented and will be updated through a web interface application developed specifically for the city, creating a living document that can continue to be a valuable resource into the future. The Mitigation Action Support Tool (MAST) is accessible through mitigatehazards.com/shastalakehmp/.

MAST is a web-based interactive tool that enables multiple users to search, view, enter, and update mitigation actions, ideas or projects, and other information. MAST provides the city and plan reviewers (Cal OES and FEMA) access to valuable mitigation information that can be leveraged by future planning or other risk reduction efforts within the city. The city can update the status of it's mitigation projects throughout the planning lifecycle, and this web-based tool will improve the city's ability to apply for FEMA's Hazard Mitigation Assistance (HMA) grant programs, including initial grant application processes through Cal OES.

City Planning Processes Library

The City of Shasta Lake has completed the HMP planning process per FEMA guidelines. This process is detailed in this section.

- **Risk Assessment:** The risk assessment measures the potential impact to life, property, and the economy resulting from natural hazards. The intent of the assessment is to identify the vulnerabilities of a community to the greatest extent possible given available data. The risk assessment increases understanding of natural hazard impacts to the community and provides a foundation to develop and prioritize mitigation actions.
    - **Risk Assessment – View Maps / Download Maps**

- **Hazard Prioritization:** The HMP Planning Committee considered and screened a broad set of hazards presented in relevant local, regional, and statewide hazard planning documents. The crosswalk of documents reviewed and the results of screening the relevant hazards to be reviewed are outlined in Section 4.1.1. The HMP then considered past hazard to help prioritize hazards to be evaluated in this document, as outlined in Section 4.1.2.d.
    - **Hazard Prioritization – View Risk Matrix**

- **Areas of Concern:** The HMP Planning Committee identified the areas of concern and potential impacts of each of the identified hazards on the community. Problem statements were

developed for areas of concern, which describe the nature of the consequences or effects of a hazard occurrence on the community and its assets, ensuring the identified mitigation actions are tailored to the specific problems created by various hazard scenarios and are specific to the City.

- **Areas of Concern – View Problem Statements**

- **Capability Assessments**: A capabilities assessment consists of an analysis of the existing planning and regulatory capabilities of the city. Planning and regulatory tools typically used by local jurisdictions to implement hazard mitigation activities are building codes, zoning regulations, floodplain management policies, and other municipal planning documents.
  - **Capability Assessment – View Capability Assessment**

STEP 4: Adopt and Implement the Plan

Once the risk assessment and mitigation strategy were completed, information, data, and associated narratives were compiled into the HMP. Section 2 provides detailed information on new and updated elements of the HMP.

Plan Review and Revision

Once the draft HMP update was completed, a public and government review period was established for official review and revision. Public comments were solicited through social media and a public meeting, then accepted, reviewed, and incorporated into this update. Applicable comments from the public were received and addressed prior to authorization to submit to FEMA and Cal OES. The notice of the public comment period is included in Appendix B.

Plan Adoption and Submittal

This plan has been submitted and approved by FEMA and adopted by the city. Copies of the resolutions are provided in Executive Summary section of this document.

NOTE: Adoption proceedings will be completed after approval by Cal OES and FEMA.

Implement, Evaluate, and Revise the Plan

The true worth of any mitigation plan is its implementation and success under FEMA's grant programs. This HMP has been assembled to reduce the risk of natural hazards, and also to meet the requirements of the DMA 2000 and maintain eligibility under FEMA's Hazard Mitigation Assistance (HMA) grant programs.

FEMA administers three programs that provide funding for local agencies with approved mitigation plans:

- **Hazard Mitigation Grant Program (HMGP),** which assists in implementing long-term hazard mitigation planning and projects following a Presidential major disaster declaration.

- **Building Resilient Infrastructure and Communities (BRIC),** which provides funds for hazard mitigation planning and projects on an annual basis.
- **Flood Mitigation Assistance (FMA),** which provides funds for planning and projects to reduce or eliminate risk of flood damage to buildings that are insured under the National Flood Insurance Program (NFIP) on an annual basis.

For more information about FEMA HMA, visit fema.gov/hazard-mitigation-assistance.

Plan Maintenance

The city will update and monitor this plan in accordance with all FEMA requirements in order to maintain eligibility for FEMA HMA. Evaluation and revision procedures for this plan are detailed in Section 6.

Section 6 includes the measures the City of Shasta Lake will take to ensure the HMP's continuous long-term implementation, including HMP monitoring, reporting, evaluation, maintenance, and updates. Most of this implementation and maintenance will be done through MAST. Figure 3-6 demonstrates how MAST information will translate into Cal OES Notices of Interest (NOIs) and grant sub-application requests. Section 6 also contains specifics on integrating mitigation with day-to-day decision making.

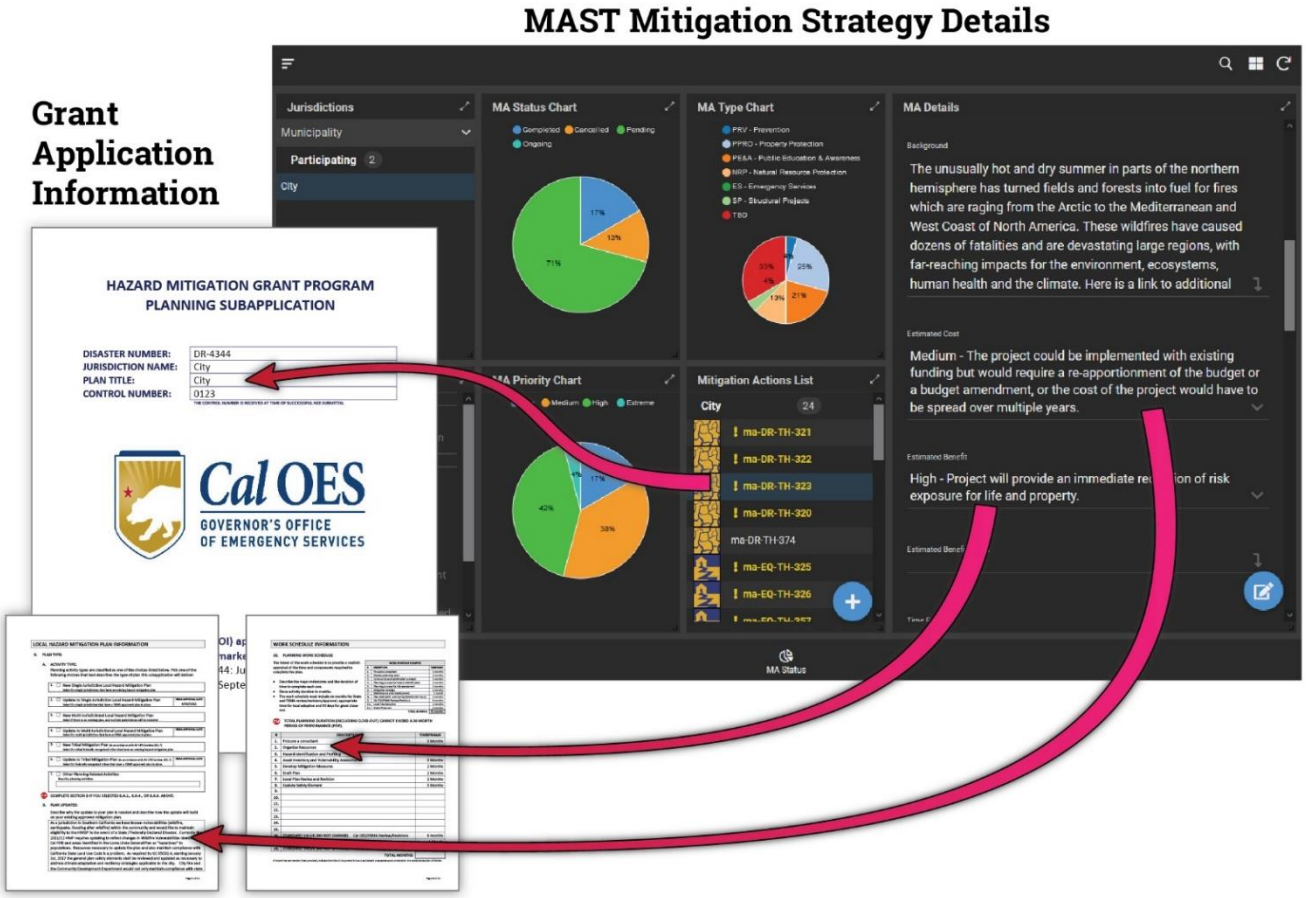


Figure 3-6: MAST elements and Cal OES Grant Applications

Section 4. Risk Assessment

The risk assessment measures the potential impact on life, property, and the economy resulting from natural hazards. The intent of the risk assessment is to identify the qualitative and quantitative vulnerabilities of a community to the greatest extent possible given available data. The risk assessment increases understanding of natural hazard impacts to the community and provides a foundation to develop and prioritize mitigation actions. In turn, mitigation actions reduce damage from natural disasters through increased preparedness and focus resources to areas of the greatest vulnerability.

This risk assessment section evaluates potential losses from a hazard event by assessing the vulnerability of buildings, infrastructure, and people. It identifies the characteristics and potential consequences of hazards, explores how much of the city could be affected by a hazard, and assesses the impact on city assets. The risk assessment approach consists of three components:

- Hazard Identification and Screening (Section 4.1)
- Hazard Prioritization (Section 4.2)
- Vulnerability Assessment and Hazard Profiles (Section 4.5)

Other sections provide background and context for the risk assessment. Section 4.3 provides a geographic and demographic overview of the City of Shasta Lake. Section 4.4 explains the methods utilized in the risk assessment.

4.1 Hazard Identification and Screening

Per FEMA guidance, the first step in developing the risk assessment is identifying the hazards. This step includes two parts. First, the Planning Committee considered and screened a broad set of hazards presented in relevant local, regional, and statewide hazard planning documents. The crosswalk of documents reviewed and the results of screening the relevant hazards are outlined in Section 4.1.1 below. Second, the HMPC considered past hazard events in the City of Shasta Lake to help prioritize hazards to be evaluated in this document, as outlined in Section 4.1.2.

4.1.1 Hazard Screening

The HMP Planning Committee first reviewed previously-prepared hazard mitigation plans and other relevant documents to determine the realm of natural hazards that have the potential to affect the city and the nearby region. Table 4-1 provides a crosswalk of hazards identified in the 2014 City of Shasta Lake HMP, 1999 City of Shasta Lake General Plan, and the 2018 California State Hazard Mitigation Plan. Through this thorough document review, there were 17 different hazards identified. The crosswalk was used to develop a preliminary hazards list, providing a framework for the HMP Planning Committee to evaluate which hazards were truly relevant to the city and which were not. For example, terrorism was considered to have no relevance to the city, earthquake, flood, volcano, landslide, and wildfire were indicated in every hazard document.

Table 4-1: Document Review Crosswalk

Hazards	2014 City of Shasta Lake HMP	1999 City of Shasta Lake General Plan	2018 California State HMP
Agricultural Pests			■
Climate Change	■		■
Dam Failure			■
Drought	■		■
Earthquake	■	■	■
Flood	■	■	■
Insect Hazards			
Landslide	■	■	■
Levee Failure			■
Manmade Hazards			■
Pandemic Disease			■
Sea Level Rise		■	■
Extreme weather			■
Soil Hazards		■	■
Terrorism & Tech Hazards			■
Tsunami			■
Volcano	■	■	■
Wildfire	■	■	■

The crosswalk provided the basis for further prioritizing hazards, displayed in Table 4-2. The prioritized hazards have detailed hazard profiles in Section 4.5, the vulnerability assessment.

Table 4-2: Hazard prioritization

Hazard Type	Explanation
Climate Change	**High priority city-wide, profiled hazard.**
Dam/ Levee failure	Dam failure is possible in the City of Shasta Lake but is best addressed in other plans, specifically Emergency Action Plans for high hazard dams affecting the City of Shasta Lake.
Drought	**High priority city-wide, profiled hazard.**
Earthquake/ Geologic Hazards	Earthquake/geologic hazards were not identified as priorities in this plan.
Flood	**High priority city-wide, profiled hazard.**
Hazardous Material	While hazardous materials can release and impact the city, there are better avenues to address this hazard outside this plan.
High Winds/ Straight Line Winds	**High priority city-wide, profiled as part of Extreme Weather.**
Insect Hazards	While hazardous insects exist in the City of Shasta Lake, this was not considered a priority and is not profiled in this plan.
Pandemic Disease*	While pandemic disease can impact the city, Shasta County Health and Human Services Agency is the lead agency on pandemic planning and mitigation.
Extreme Weather, including:	**High priority city-wide for high wind, heavy rain, and high heat.**
Extreme Heat	**Profiled as part of Extreme Weather.**
Hail	Hail events are rare and not considered a priority.
High Wind	**Profiled as part of Extreme Weather.**
Heavy Rain	**Profiled as part of Extreme Weather.**
Fog	Fog events are rare and are not considered a priority.
Lightning	Not a priority as an extreme weather event; discussed as source of wildfire.
Severe Thunderstorm	Severe thunderstorms were not identified as a priority in this plan.
Winter Storm / Extreme Cold/ Freeze Events	Winter storms are rare in the City of Shasta Lake and not identified as a priority for this plan.
Slope Failure	Slope Failure was not identified as a priority in this plan.
Soil Hazards	While limited soil hazards exist in the City of Shasta Lake (erosion and shifting soils), these are not prioritized in this plan. Erosion is discussed as relevant under the flood hazard.
Terrorism/Human Caused Threats	While terrorism is certainly a threat to the city, it is best addressed in other plans as this HMP does not address human-caused threats.
Tornado	Impacts to the city from tornados are extremely unlikely, if any.
Volcanic Activity	While volcanic activity is a relevant hazard, it is best addressed in venues outside of this plan.
Wildfire	**High priority city-wide, profiled hazard.**

4.1.2 Past Major Hazard Events

One important consideration in identifying and prioritizing hazards is past major hazard events, especially those that triggered federal or state disaster declarations. The HMP Planning Committee reviewed and considered past major hazard events in the City of Shasta Lake as part of the screening and identification process.

Most available information on major past hazard events comes from federal or state disaster declarations. These declarations may be granted when the severity and magnitude of an event surpasses the ability of the local government to respond and recover. Additional federal or state disaster funding (or both) is generally available in response to a disaster declaration. State funding assistance is provided when a local government's capacity to respond to the disaster is exceeded. Should the disaster be so severe that both the local and state governments' capacities are exceeded, a federal emergency or disaster declaration may be issued, allowing for the provision of federal assistance.

Shasta County has received 37 federal disaster declarations[1] since 1964, some of which were statewide. Extreme weather and flooding events are most likely to occur in the winter months, with 25 of the 54 federally-declared disasters occurring in January and February since 1953 in California. Wildfires have typically occurred in late summer and fall, with 188 wildfire declarations from July through October since 1953. Table 4-3 lists federal disaster declarations in Shasta County from 1964 to 2020. This list excludes the closest wildfire to the City of Shasta Lake in recent memory, the 2021 Fawn Fire.

Table 4-3: Disaster Declarations in Shasta County 1964- present

Year	Incident Description	Disaster Number
2020	COVID-19	3428
2020	COVID-19 PANDEMIC	4482
2019	SEVERE WINTER STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES	4431
2018	CARR FIRE	5259
2018	CREEK FIRE	5245
2018	WILDFIRE	3398
2018	WILDFIRES AND HIGH WINDS	4382
2017	SEVERE WINTER STORMS, FLOODING, AND MUDSLIDES	4308
2017	SEVERE WINTER STORMS, FLOODING, AND MUDSLIDES	4301
2014	BALD FIRE	5069
2014	EILER FIRE	5067
2013	CLOVER FIRE	5050

[1] California was declared as part of the Hurricane Katrina evacuation; however, no disaster occurred in California.

Year	Incident Description	Disaster Number
2012	PONDEROSA FIRE	5007
2008	WILDFIRES	3287
2007	CREEK FIRE	2702
2006	SEVERE STORMS, FLOODING, MUDSLIDES, AND LANDSLIDES	1628
2005	HURRICANE KATRINA EVACUATION	3248
2005	MANTON FIRE	2580
2004	CA-BEAR FIRE-08-11-2004	2544
2004	CA-FRENCH FIRE 08-14-2004	2547
2004	CA-LAKE FIRE 08-14-2004	2548
2003	CA-WHITMORE FIRE-10-28-2003	2508
2002	SQUIRREL FIRE	2461
1999	CA-WILDFIRES-08/25/1999	3140
1997	SEVERE STORMS, FLOODING, MUD AND LANDSLIDES	1155
1995	SEVERE WINTER STORMS, FLOODING LANDSLIDES, MUD FLOW	1046
1995	SEVERE WINTER STORMS, FLOODING, LANDSLIDES, MUD FLOWS	1044
1993	SEVERE WINTER STORM, MUD & LAND SLIDES, & FLOODING	979
1992	OLD GULCH & FOUNTAIN FIRES	958
1988	WILDFIRES	815
1986	SEVERE STORMS & FLOODING	758
1983	COASTAL STORMS, FLOODS, SLIDES & TORNADOES	677
1977	DROUGHT	3023
1974	SEVERE STORMS & FLOODING	412
1970	SEVERE STORMS & FLOODING	283
1969	SEVERE STORMS & FLOODING	253
1964	HEAVY RAINS & FLOODING	183

Source: FEMA Disaster Database via mitigatehazards.com/hazard-mapping/ , accessed 11/04/2021

Disaster declarations may also occur through the USDA, as agricultural areas in and around Shasta County can be particularly impacted. The USDA has declared 9 drought disaster declarations and 1 excessive rain declaration since 2012. (Section 4.5.4.3) A USDA disaster declaration certifies that the affected county has suffered at least a 30-percent loss in one or more crop or livestock areas and provides affected producers with access to low-interest loans and other programs to help mitigate the impact of the drought. Importantly, all counties neighboring those receiving disaster declarations are eligible for the same assistance.

Hazard events occurring outside city boundaries can also directly and indirectly impact the city. For example, dam failures and wildfires may occur outside the City of Shasta Lake but affect watersheds that drain into the city and result in flooding and longer-term watershed health impacts. Power supply also could be interrupted by hazard occurrences outside of the city. An example of this type of event is

the Fawn Fire which occurred in early October 2021 and directly impacted the City of Shasta Lake. The fire started in Shasta County, north of the city limits, and burned into the portion of the city east of I-5.

4.2 Hazard Prioritization

The Planning Committee's hazard prioritization process combines historical data, local knowledge, and consensus opinions to produce a matrix that illustrates whether each profiled hazard is an extreme or high priority. The criteria below were used to evaluate hazards and identify the highest risk hazard in the City of Shasta Lake. The results of the prioritization process for the City of Shasta Lake are shown in Figure 4-1.

Figure 4-1 provides the guidance that shaped the ranking for the hazard risk matrix, including probability ratings and impact ratings. This figure also includes the outcomes of the City of Shasta Lake's Risk Matrix exercise. Table 4-2 also summarizes reasons why various hazards were not included in the city's prioritization exercise.

Risk Assessment Matrix Definitions

PROBABILITY RATING

The likelihood of a hazard event occurring within a time period?

PROBABILITY

- **Highly Likely** - **Highly likely** - 100% annual probability. Or likely to occur every year in your lifetime.
- **Likely** - **Likely** - Between 10 and 100% annual probability. Or will occur several times in your lifetime.
- **Possible** - **Possible** - Between 1 and 10% annual probability. Or likely to occur some time in your lifetime.
- **Unlikely** - **Unlikely** - Less than 1% annual probability. Or unlikely but possible to occur in your lifetime.

IMPACT RATING

In terms of injuries, damage, or death, would you anticipate impacts to be minor, limited, critical, or catastrophic when a significant hazard event occurs? The impact could be in terms of one hazard event (flooding from a culvert failure) or a large-scale event (multiple rivers flooding) in the same jurisdictional boundary.

IMPACT

Minor	Limited	Critical	Catastrophic

Minor - Very few injuries, if any. Only minor property damage and minimal disruption on quality of life. Temporary shutdown of critical facilities.

Limited - Minor injuries only. Approx. 10% or less of property in disaster footprint damaged or destroyed. Complete shutdown of critical facilities for more than one day.

Critical - Multiple deaths/injuries possible. Between 25% and 50% of property in disaster footprint is damaged or destroyed. Complete shutdown of critical facilities for more than one week.

Catastrophic - High number of deaths/injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for 30 days or more.

To concentrate resources on highest priority hazards, the jurisdictional planning team will focus on "High" and "Extreme" risk hazards in this annex. These hazards have higher probability and greater impact as it relates to the jurisdiction's planning area.

Hazard definitions are included in Vol. 1 of this plan.

Hazard Information / Legend:

Climate Change impacts will be addressed at the end of each hazard section within the 2021 plan update and as a stand-alone section.

Extreme Weather in the City of Shasta Lake includes high heat, high wind, heavy rain, and winter storms.

If a hazard symbol is grey, the HMPC did not develop hazard vulnerability information due to lower perceived probability and impact.

City of Shasta Lake Risk Matrix

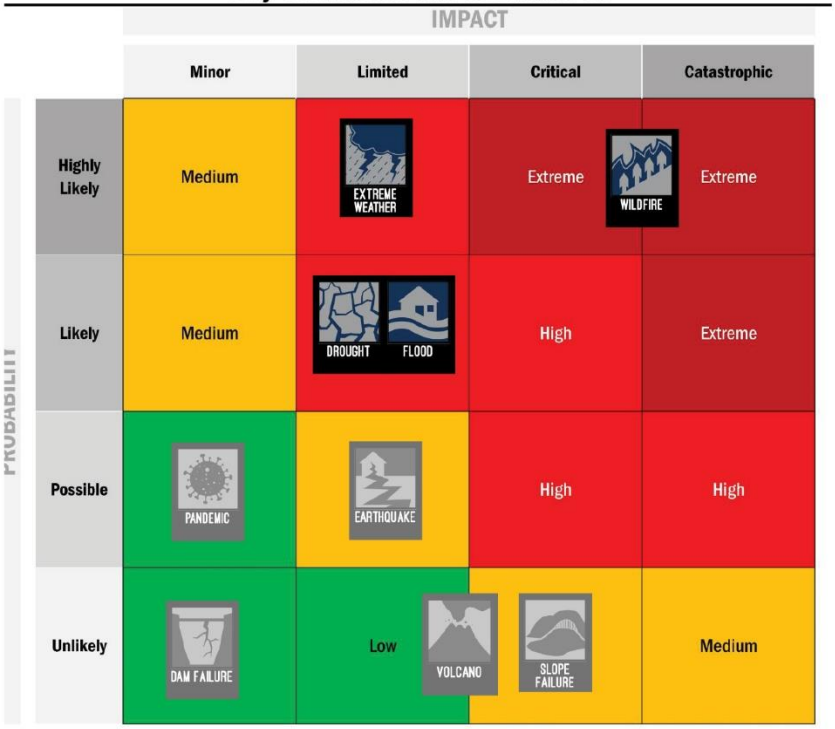


Figure 4-1: Prioritized Hazard Assessment Matrix for the City of Shasta Lake

4.3 City of Shasta Lake Geographic and Demographic Profile

The geographic and demographic profile for the City of Shasta Lake sets the stage for the vulnerability's assessment. Pairing the vulnerabilities assessment and regional profile can help guide jurisdictions' resources and mitigation strategy to key populations and geographic areas. The Planning Committee reviewed geographic and demographic data as part of the risk prioritization and assessment process.

4.3.1 Geography

The City of Shasta Lake has a total area of 10.9 square miles (28 km2), according to the United States Census Bureau. Approximately 99.93 percent of this areas is comprised by land and 0.07 percent is covered by water. The city is located just north of the City of Redding (the county seat of Shasta County). This is in in the western third of Shasta County. Mount Shasta, is a volcano in the north of Siskiyou County, and is a prominent feature across the city landscape. Shasta Lake is located North-West of the city in the Shasta-Trinity National Forest. Shasta Lake, just outside the city limits, was created by the construction and completion of Shasta Dam stretching across the Sacramento River. (City of Shasta Lake Hazard Mitigation Plan, 2014)

The City of Shasta Lake varies in terrain and elevation. It is surrounded by mountains to the north, east, and west, and open to California's Sacramento Valley to the south. The urban center of the city is relatively flat at an approximate elevation of 190 feet (FT). The topography along I-5, east and northeast of the city, transitions to slight rolling hills from a flat distribution. In the western area of the city, the general elevation begins to increase following Lake Boulevard in a northerly direction from the urban center. As Lake Boulevard increases in elevation as it nears Shasta Lake, the road continues through a valley that is more than 700 feet below the adjacent hills. Just north of the city center, there are areas where elevations reach as high as 3,000 feet along the edges of Shasta Lake. (*Id.*)

4.3.2 Transportation Routes

Interstate I-5 is a prominent transportation route that runs along the eastern portion of the city. There are three major exit ramps to the city from Interstate I-5; these include Pine Grove Avenue (Exit 684), Shasta Dam Boulevard (Exit 685), and Mountain Gate/Wonderland Boulevard (Exit 687) just north of the city. (*Id.*)

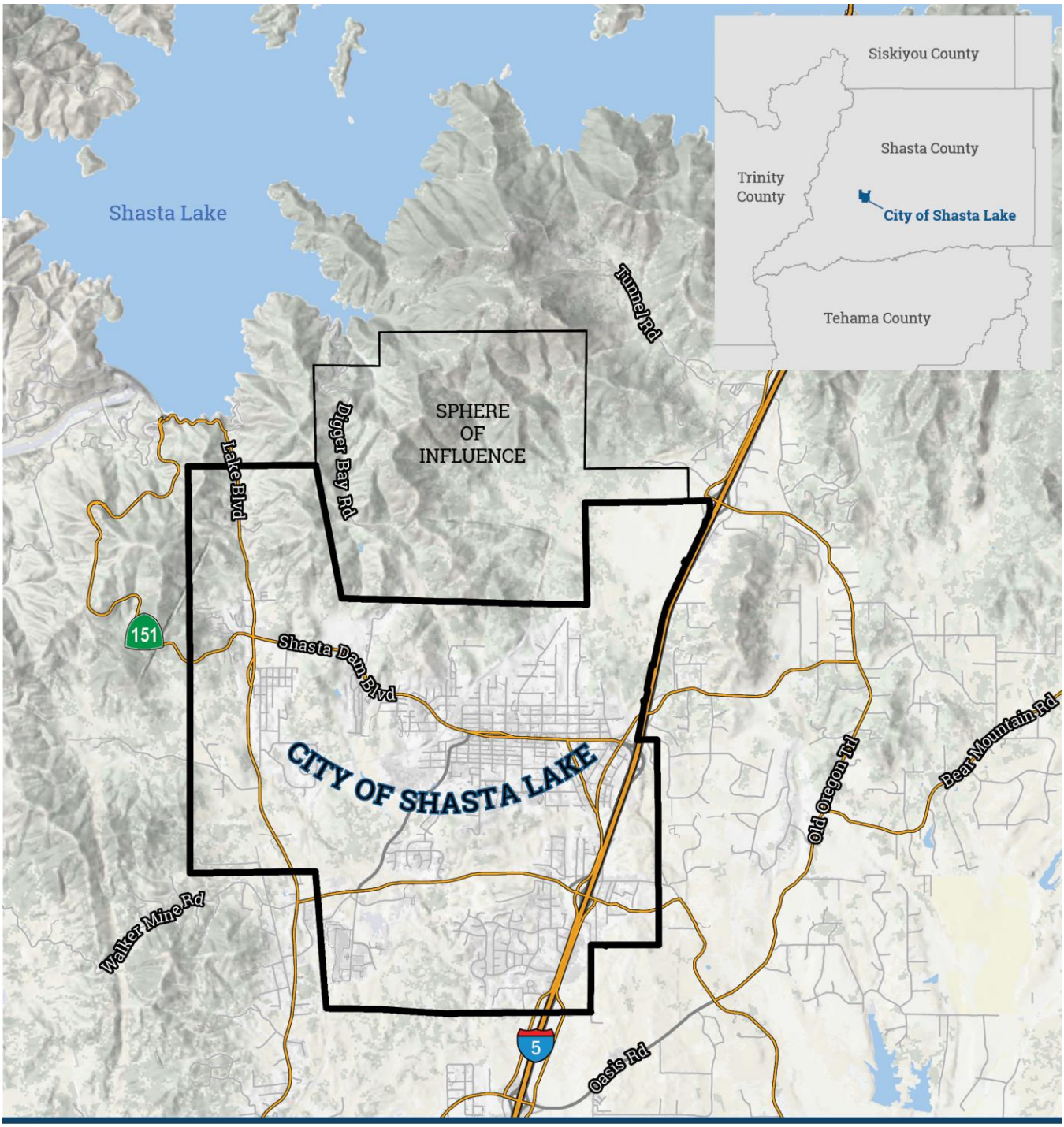


Figure 4-2. City of Shasta Lake – Geographic Overview

4.3.3 Climate

Climate influences the occurrences of natural hazards, influencing drought, flooding, landslides, extreme weather, and wildfires.

The City of Shasta Lake receives approximately 47 inches of rain per year while the U.S. average is 38. The average amount of snowfall is two inches. The number of days with any measurable precipitation is approximately 89 days a year, and on average there are 246 sunny days per year in Shasta Lake. The July average high temperature is around 95 degrees, and the January average low temperature is 39 degrees. The Shasta Lake comfort index, which is based on humidity during the hot months, is 58 out of 100, while the average comfort index for the U.S. is 44. (bestplaces.net, 2021)

While the general climate of the City of Shasta Lake may be mild, hazard events often center on the climate extremes such as high wind, heavy rain or flooding, or drought. Climate change is predicted to intensify these climate extremes (California's Fourth Climate Change Assessment, 2018)

4.3.4 Demographics and Vulnerable Populations

Population information causally relates to the impact of hazards in a community. The composition of the population, how it has changed, and how it may change in the future helps with future decision making.

This overview of regional demographics comes primarily from the United States Census Bureau's five-year estimate period from 2013-2018. The United States Census Bureau estimated the City of Shasta Lake population to be 179,085 for the 2013-2018 5-year estimate period. Figure 4-3 comparatively displays the population and number of households.

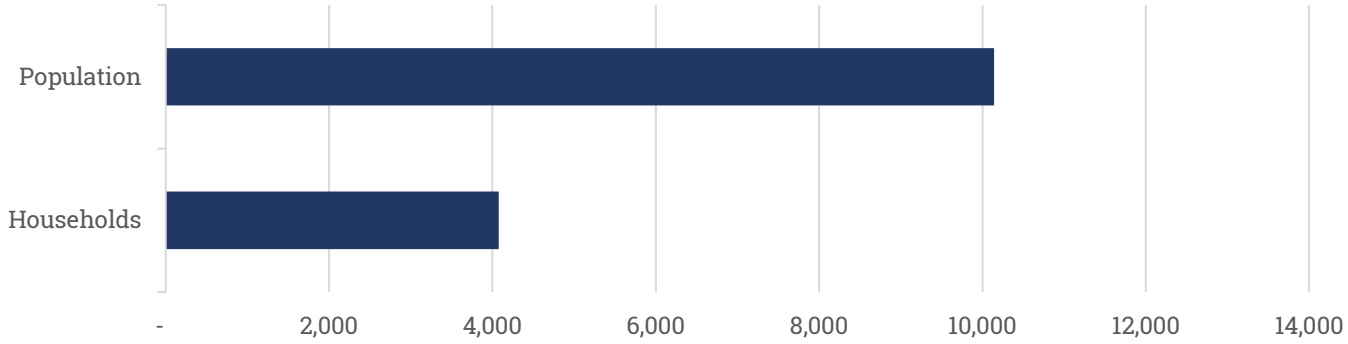


Figure 4-3: Total Households & Populations
Source: 2013-2018 American Community Survey 5-Year Estimates

Jurisdiction	Households	Population
Shasta County	**78,535**	**179,085**
City of Shasta Lake	4,079	10,142

Table 4-4: Total Households & Populations

Important note:
The demographics information contained herein has been post-processed based on the United States Census Bureau's five-year estimate period from 2013-2018 and will not necessarily match other demographics-based regional studies or plans. In order to examine geometries not available in census reports, including unincorporated County areas, a weighted GIS analysis combined and redistributed block groups. Inherently, the margin of error for this data can be high, especially in more rural areas.
This section provides a generalized approximation of specific demographics, reported by various planning study areas. It is not meant to provide any definitive information, but merely to suggest larger trends in the region.

4.3.4.1 Introduction to Vulnerable Populations

Importantly, demographics help identify which populations may be particularly vulnerable to hazard events. Some populations are at greater risk because of age, resources, physical abilities, or other factors. Vulnerability in the face of a hazard event is not a fixed characteristic; the same person may be at risk for some hazards but not at risk for others. For example, a low-income family without a car may be at risk for a wildfire or flood if a quick evacuation is necessary but well-prepared in the event of an earthquake. Some individuals are highly and permanently vulnerable to many hazards, such as the frail elderly, people living with chronic sensory, mobility, or cognitive impairments, and individuals dependent upon assistive devices or complex medical regimens to survive. (National Center for Disaster Preparedness, 2020) Vulnerable populations also may be living in hazard-prone areas, compounding their risk.

In the context of all-hazards preparedness and response planning, **at-risk individuals** (often used interchangeably with "**vulnerable populations**") are defined federally as "children, pregnant women, senior citizens, and other individuals who have access or functional needs in the event of a public health emergency." (42 U.S.C. § 2802(b)(4)(B) (2019)) Examples of these populations may include, but are not limited to, individuals with disabilities, individuals who live in institutional settings, individuals from diverse cultures, individuals who have limited English proficiency or are non-English speaking, individuals who are transportation-disadvantaged, individuals experiencing homelessness, individuals who have chronic medical disorders, and individuals who have pharmacological dependency.

Communities may be able to reduce the vulnerability of certain populations by increasing the adaptive capacity of affected communities. Examples include cost-sharing to reduce fuels, stabilize structures, or implement flood-reducing measures or educational programs offered in English and Spanish and targeted to specific populations. Specifically, planning for vulnerable populations in hazard mitigation can help prioritize resources where they will be the most effective. This section explores the various demographic and economic circumstances surrounding common vulnerable populations.

4.3.4.2 Income & Housing

Income or wealth is one of the most important factors in natural hazard vulnerability. Low-income residents are more likely to occupy housing which is inadequately maintained and otherwise poorly built to withstand extreme events. For example, mobile or modular homes are more susceptible to damage in earthquakes and floods than other types of residences. In urban areas, low-income residents often occupy older homes and apartment complexes with unreinforced masonry. This building type is particularly susceptible to damage during earthquakes. Renters are also more vulnerable to natural hazards, as they are less likely to take out property insurance, and the decision to make major structural improvements typically lies with the property owner. Additionally, disaster recovery services target homeowners; renters may not receive as much outreach. See Table 4-5 for a comparative display of renter-occupied versus owner-occupied buildings per jurisdiction.

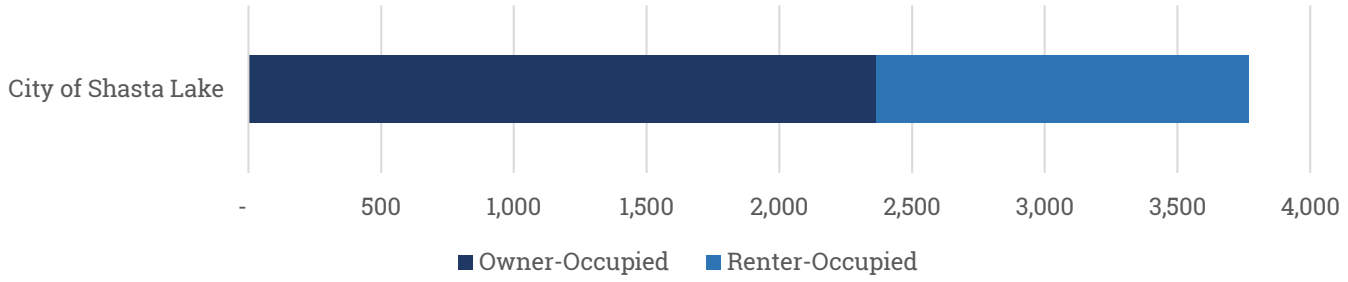


Figure 4-4: Owners and Renters

Source: 2013-2018 American Community Survey 5-Year Estimates

Jurisdiction	Households	Owner-Occupied	Renter-Occupied
City of Shasta Lake	4,079	2,366	1,401

Table 4-5: Renters vs Owners

Low-income households and communities face disproportionate financial burden from costs associated with disaster preparedness, response, and recovery. Disasters create unexpected expenses which may serve as "tipping points" for families and individuals living on the edge of poverty or homelessness. Recovery costs may be higher for those without resources to conduct hazard mitigation activities ahead of time. Families and individuals who lack access to transportation may be unable to evacuate ahead of an emergency. (Krause & Reeves, 2017)

Low-income residents and renters are also less likely to purchase insurance, meaning that those with the most to lose during an event are also the least prepared to deal with potential losses. Major hurricane events in recent history such as Harvey, Irma, and Katrina all demonstrate that low-income and/or historically marginalized communities face increased vulnerability to hazard events, and struggle to recover the most. (*Id.*)

Table 4-6 shows the median household income for the City of Shasta Lake. The "median" is the value that divides the distribution of household income values into two equal parts (using the "mean", or average, as a summary statistic would result in a value weighted towards the highest-income "outlier" households). The median household income in the City of Shasta Lake in 2018 (in 2018 dollars) was estimated to be $51,836, compared to $61,937 across the U.S. (United States Census Bureau, 2019) Nearly one-fifth, or 17% of the city's population was living in poverty, higher than the national rate of 11.8% during the same year.

Figure 4-5 illustrates income levels geographically in the city; the lowest income class is concentrated to the area south of Shasta Lake Boulevard and immediately west of I-5, with lower income classes also scattered throughout the city.

Table 4-6: Household Income and Poverty Levels
Source: 2013-2018 American Community Survey 5-Year Estimates

Jurisdiction	Population	Persons in Poverty	Households	Median Household Income
City of Shasta Lake	10,142	1,722	4,079	$ 51,836

4.3.4.3 Age

Children and the elderly may be more vulnerable during an extreme hazard event. Specific planning attention for the elderly is an important consideration, especially given the current aging of the American population. Indeed, 29% of City of Shasta Lake households include at least one senior individual, 28% of which experience poverty (Figure 4-6). Vulnerability among persons in the same age cohort varies significantly based on health, age, and economic security; nevertheless, senior residents as a group have a higher prevalence of physical and financial barriers to response and recovery, both during and after an emergency.

Seniors living alone may have more difficulty evacuating, especially for individuals with mobility challenges and those who lack internet access and/or internet fluency. Persons over 65 living alone compromise 10% of all households in Shasta Lake. Assisted-living facilities usually require extra notice and coordination to implement evacuation and are typically identified as "critical facilities" by emergency managers. This plan identifies 5 assisted living facilities in City Limits, which are considered as a part of the damage estimate for hazard-specific profiles in section 4-45.

In addition to physical limitations, an overall higher prevalence of chronic medical conditions among seniors also translates to exacerbated health risks for specific disasters, including smoke from wildfires and extreme temperatures in either direction. This underlying vulnerability of senior residents to natural hazards is compounded by financial hardship. In the City of Shasta Lake, 28% of households with at least one senior member experience poverty. (see Table 4-7)

Children as well as seniors often depend on family and caregivers to navigate daily life. As such, their wellbeing during and after a natural disaster is only as resilient as the networks of care upon which they rely. Additional outreach efforts and resources may be necessary to protect the most vulnerable residents of the community.

Based on 2013-2018 American Community Survey 5-year estimates, 29% of City of Shasta Lake households include elderly individuals. Table 4-7 displays age and household information including total households, total number of households with members, city-wide information on elderly households, including total households that are 65 and older, households with only one person who is 65 and older, and households with someone who is 65 and older living in poverty. Table 4-8 displays city-wide information on households with young children and single parents. The overall age distribution for the City of Shasta is illustrated in Figure 4-6 for the population under 18 and Figure 4-7 for population over 65. Figure 4-6 shows that the highest urban concentrations of people under the age of 18 occur in the southeast of the city.

Table 4-7: Elderly Households
Source: 2013-2018 American Community Survey 5-Year Estimates

Jurisdiction	Total Households	Total Households w/ 65+	(%)	Households w/ 65+ Living Alone	Households w/ 65+ Living in Poverty
City of Shasta Lake	4,079	1,193	29%	420	121

Table 4-8: Households with Young Children and Single Parents
Source: 2013-2018 American Community Survey 5-Year Estimates

Jurisdiction	Total Households	Households w/ Minors	(%)	Single Parent Households with Minors <18
City of Shasta Lake	4,079	1,235	30%	482

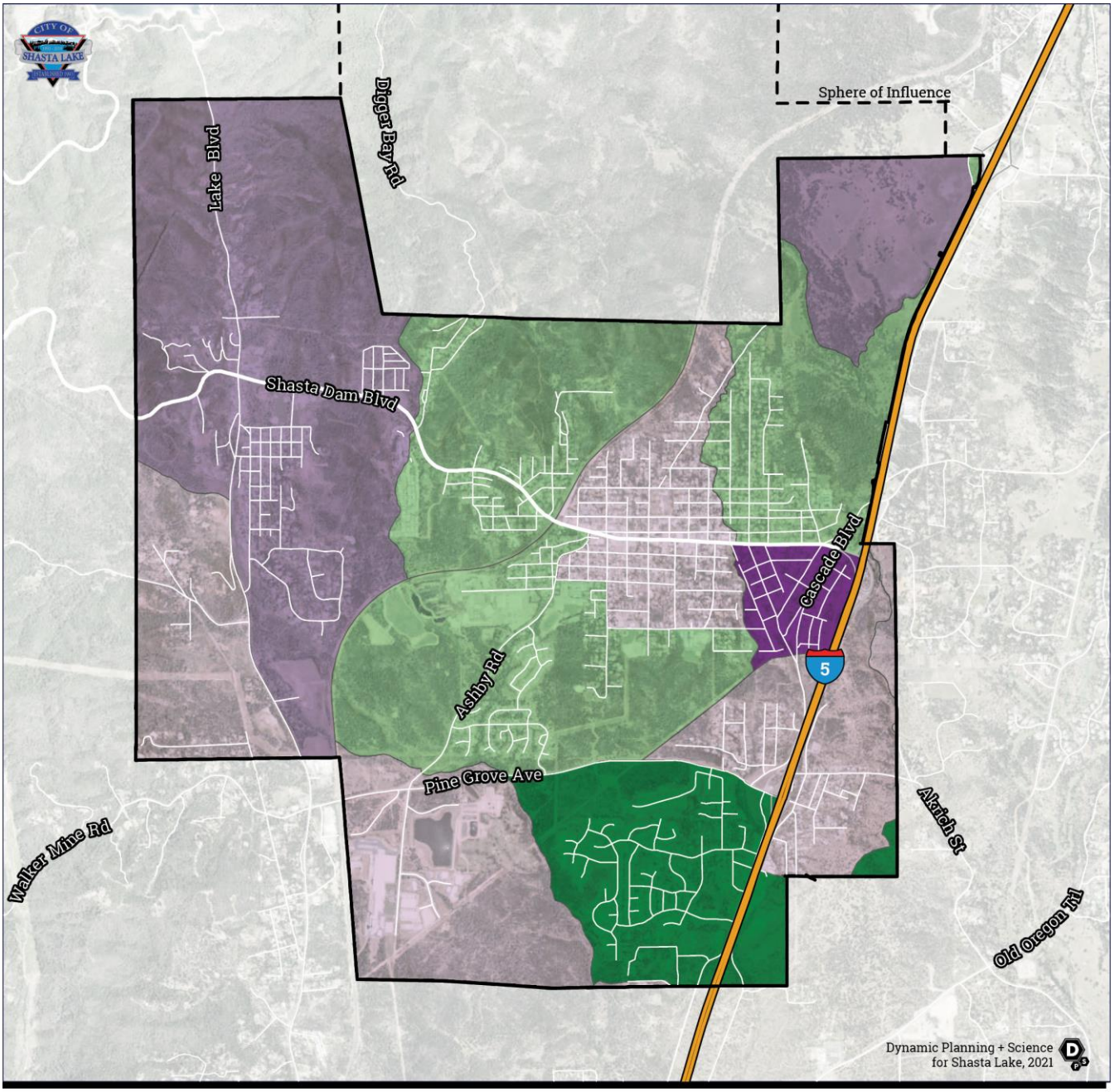


Figure 4-5: Median Household Income Distribution

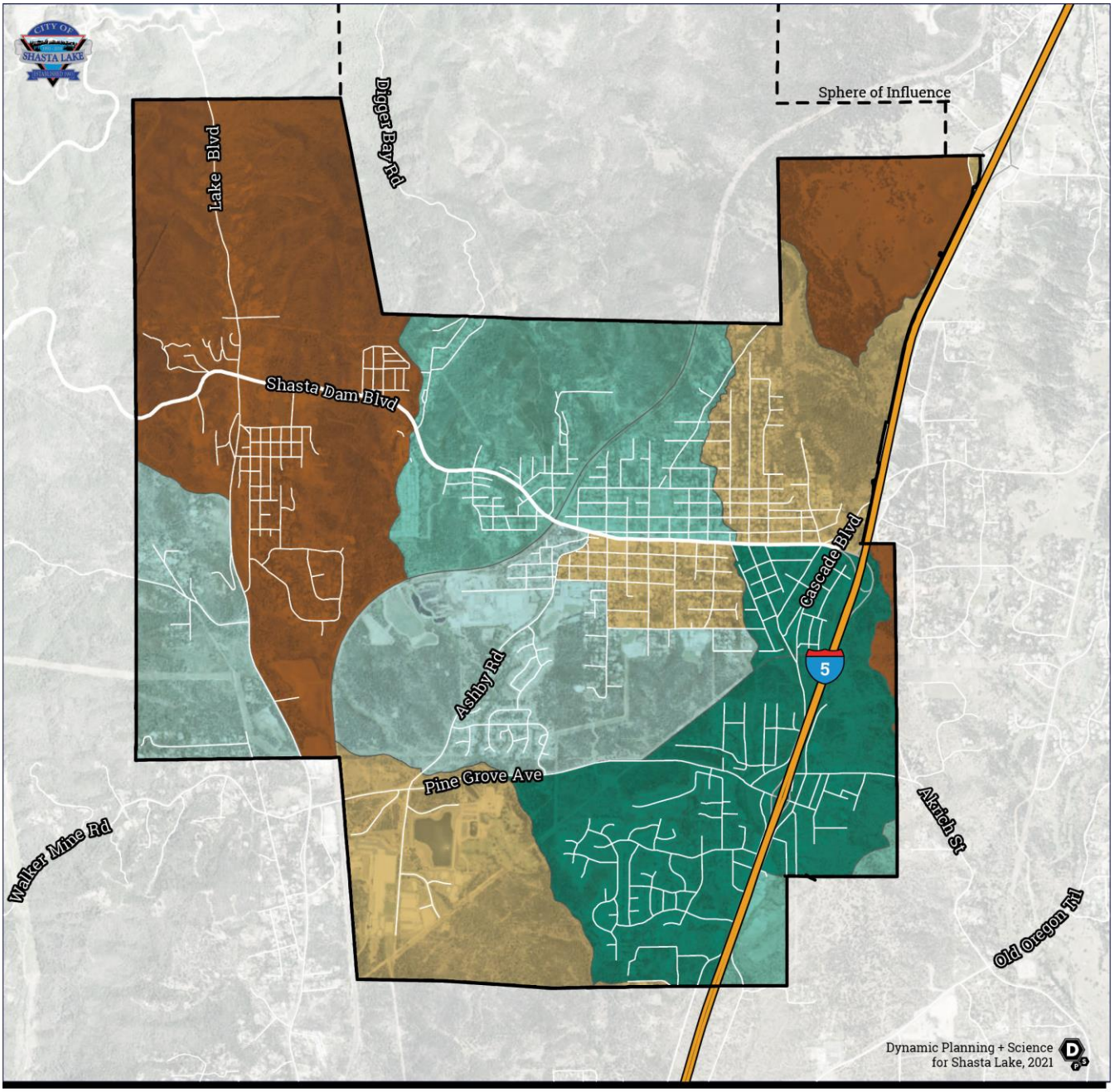


Figure 4-6: Population Under Age 18

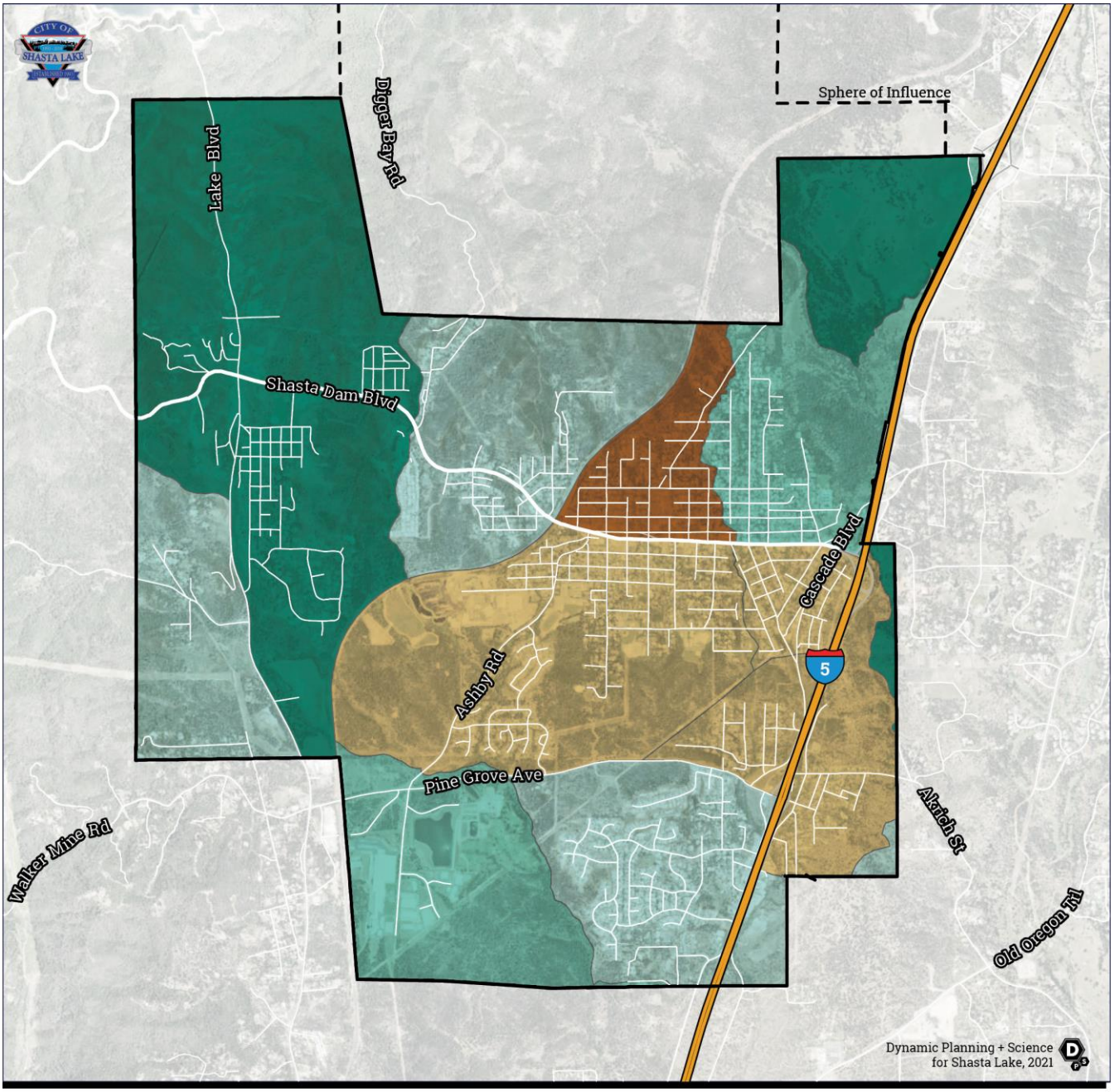


Figure 4-7: Population Over Age 65

4.3.4.4 Race, Ethnicity, and Language

Natural disasters compound racial disparities, and non-white individuals and communities receive less recovery aid from FEMA than their white counterparts, even where the amount of damage is the same. (Billings, Gallagher, & Ricketts, 2019) (Domingue & Emrich, 2019) At the time of this plan's publication, the ongoing COVID-19 pandemic is a glaring testament to racial and ethnic disparities in disaster outcomes, with non-white persons facing morbidity rates from COVID-19 infections anywhere from 70 to 350% higher than white, non-Hispanic persons. (Centers for Disease Control and Prevention, 2021) Majority-Black, Hispanic, and Native American census tracts additionally face a 50% greater vulnerability to wildfire compared to other census tracts. (Levin, Phil; Davies, Ian, 2019)

These disparities are evidence not of intentionally-biased policy design, but rather the complicated relationship between disaster recovery and overlapping social vulnerabilities including race, income, language, and health. Communities with more nonwhite residents may have lower tax revenue and property values, which means less investment in mitigation and rebuilding efforts before and after an emergency. Nonwhite residents are also more likely to be low income and renters, conditions which create barriers to navigating FEMA individual assistance programs. Indeed, Latino residents of Shasta County face higher levels of unemployment, poverty, homelessness and lower median income, educational attainment health insurance coverage, and access to services. (Shasta County Health and Human Services Agency, 2019) The population of Shasta Lake has a larger majority of white residents than the U.S. or the State of California as a whole, at 90%. Ten percent of its residents identify as Hispanic/Latino, 4% as Native American, 1% as Black/African American, 1% as Asian, and 7% as two or more races. (Figure 4-10) The Shasta County Latino population is expected grow to 20% by 2060. (*Id.*)

Individuals with no or limited English-speaking ability may have difficulty understanding evacuation information and navigating recovery programs. According to 2013-2018 American Community Survey estimates from the U.S. Census, approximately 7% of total households in the City of Shasta Lake are Spanish-speaking, with approximately one-fourth of those households speaking English "less than very well". (Figure 4-8) Farm workers may be particularly vulnerable during a hazard event, especially those with language and/or transportation barriers, or those living in temporary worker housing. (California Employment Development Department, 2019) (U.S. Dep't of Ag, 2017)

Local communities can take steps to increase equity in disaster preparedness and recovery outcomes, including timely translation of all preparedness materials and emergency notification and partnering with local community groups to target outreach more efficiently to at-risk populations.

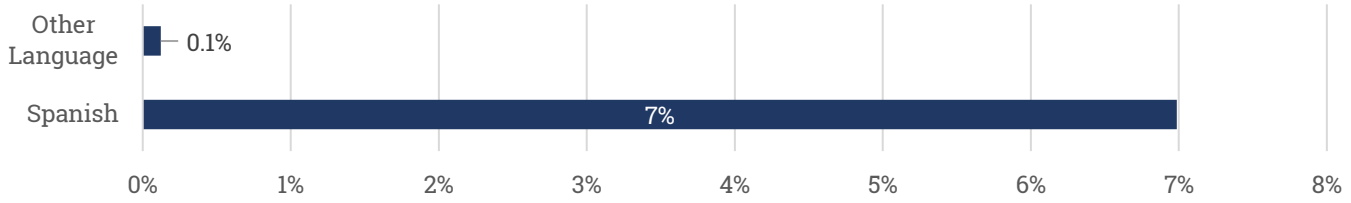


Figure 4-8: Household Language
Source: 2013-2018 American Community Survey 5-Year Estimates

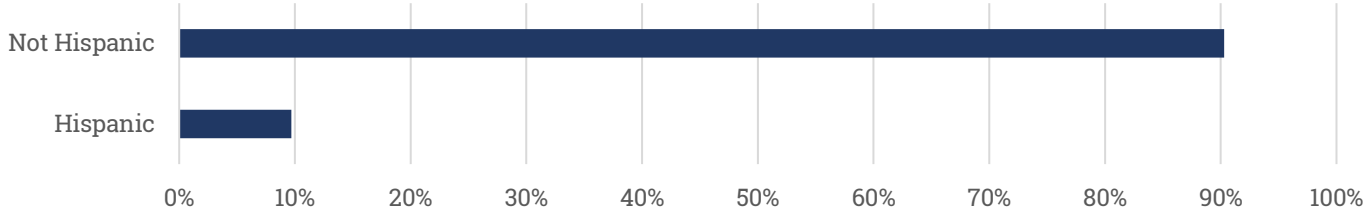


Figure 4-9: Hispanic Population
Source: 2014-2018 American Community Survey 5-Year Estimates
Note: Hispanic includes all individuals who identify with one or more nationalities or ethnic groups originating in Mexico, Puerto Rico, Cuba, Central and South America, and other Spanish cultures. In Addition:
People who are Hispanic may be of any race.
People in each race group may be either Hispanic or Not Hispanic.
Each person has two attributes, their race (or races) and whether or not they are Hispanic.

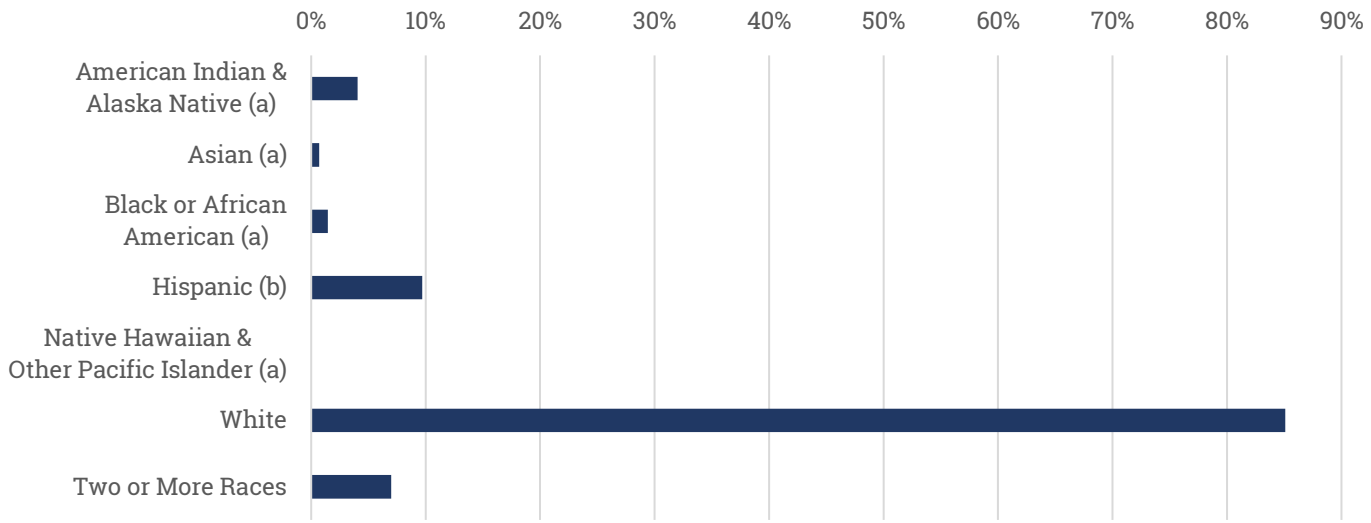


Figure 4-10: City of Shasta Lake Race Distribution in 2013-2018

Source: 2013-2018 American Community Survey 5-Year Estimates
Note: Hispanics may be of any race, so are included in applicable race categories. This has the effect of influencing total population percentage. (a) Includes persons reporting only one race. (b)Hispanics may be of any race, so also are included in applicable race categories

4.3.4.5 At-Risk Individuals with Access and Functional Needs

Access and functional needs may interfere with the ability to access or receive medical care before, during, or after a disaster or emergency. Irrespective of a specific diagnosis, status, or label, the term "access and functional needs" refers to a broad set of cross-cutting access and function-based needs, generally distinguished into **access-based** or **function-based** needs according to the following:

- **Access-based needs** require that resources are accessible to all individuals, such as social services, accommodations, information, transportation, and medications to maintain health.
- **Function-based needs** refer to restrictions or limitations an individual may have that requires assistance before, during, and after a disaster or public health emergency.

At-risk individuals may have additional needs that must be considered in planning for, responding to, and recovering from a disaster or emergency. A recommended approach for integrating the access and functional needs of these individuals is to consider elements based on the following "CMIST" framework:

- **C**ommunication – Individuals who may have limitations that interfere with the receipt of and response to information require information to be provided in an appropriate and accessible format. This can include individuals who are deaf or hard of hearing, individuals who speak American Sign Language, individuals who have limited or no English proficiency, individuals who are blind or have low vision, and individuals who have cognitive or physiological limitations.

- **M**aintaining Health – Individuals who may require Personal Assistance Services (or personal care assistance) in maintaining their activities of daily living such as eating, dressing, grooming, transferring, and toileting.

- **I**ndependence – Includes individuals who function independently if they have their assistive devices, such as consumable medical supplies (diapers, formula, bandages, ostomy supplies, etc.), durable medical equipment (wheelchairs, walkers, scooters, etc.), or service animals.

- **S**ervices and Support – Includes support for individuals with behavioral health needs, those who have psychiatric conditions (such as dementia, Alzheimer's disease, Schizophrenia, severe mental illness), pregnant women, nursing mothers, infants, and children.

- **T**ransportation – Includes individuals with transportation needs because of age, disability, temporary injury, poverty, addiction, legal restriction, or those who do not have access to a vehicle. This requires coordination to ensure access to mass transit and accessible vehicles such as paratransit. (U.S. Department of Health & Human Services, 2016)

While most individuals with access and functional needs do not have acute medical needs requiring the support of trained medical professionals, many will require assistance to maintain health and minimize preventable medical conditions. These individuals may require more time and assistance during an evacuation. It is estimated that approximately 19% of City residents live with some form of disability, including 117 minors, 1,077 adults between 18 and 64, and 739 seniors above 65, as shown in Table 4-10. (American Community Survey, 2018)

Of the city's total households, approximately 251 households have no vehicle available. (American Community Survey, 2018) Vulnerable populations without private transit may be at increased risk during emergencies due to lack of rapid access to medical services and or limited ability to rapidly evacuate an at-risk area. These numbers warrant special attention from planners and emergency managers. Additionally, where cell reception services are limited, individuals may need alternate means of transportation to ensure adequate access to communication services. In addition to preemptively improving cellular service reliability, disseminating maps which indicate the locations of superior cell reception may aid individuals seeking better information communication access in an emergency.

Table 4-9: Public Transportation Dependence & Disabilities

Jurisdiction	Population	Public Transportation Dependent Population	Households	Households with No Vehicle Available
City of Shasta Lake	10,142	47	4,079	251

Source: 2014-2018 American Community Survey 5-Year Estimates

Table 4-10: Disability Status of Non-Institutionalized Population in City of Shasta Lake in 2013-2018

				Persons with a Disability		
Jurisdiction	Population	Persons with a Disability	(%)	Under 18	18-64	65+
City of Shasta Lake	10,142	1,878	19%	117	1,022	739

Source: 2013-2018 American Community Survey (5 year estimates)
Age ranges are sums of multiple male/female and age range fields.

4.3.5 Economy

The City of Shasta Lake has made it a priority to create an environment where businesses thrive. The city's business advocacy includes providing regular communication out to city businesses, continuing to expand the city's relationship with Economic Development for Shasta County, and meeting with managers in order to improve the city's service provision to businesses. The city has also made it a priority to allocate funds in order to maximize the revenue from tourism for local businesses, and invest in tourism funds in a way that will continue to expand the local economy. (City of Shasta Lake, 2021)

The city has invested in three areas in particular. These three areas include the Shasta Gateway

Industrial Park, special economic electric rates for qualifying businesses, and an enterprise zone which provides significant tax credits for hiring and investment. The Shasta Gateway Industrial Park has grown to include the following businesses, which are significant economic contributors in the area: Knauf Insulation, Foam Experts Co, Premier Brand Meats, Mid Valley Providers, Lawrence and Associates, and Fresenius Medical Care/ARC Fresh. (*Id.*)

Figure 4-11 shows the average annual unemployment rates for Shasta County, California, and the United States from 2000 to 2018. As shown in the figure, economic hardships during the recession had a more noticeable impact in the county compared to statewide and countywide. This is likely attributed to a relative lack of economic diversification and economic development resources to respond to changes in underlying economic conditions. In 2018, average annual unemployment rates were 4.9 percent in Shasta County, 4.2 percent in California, and 3.9 percent in the United States.

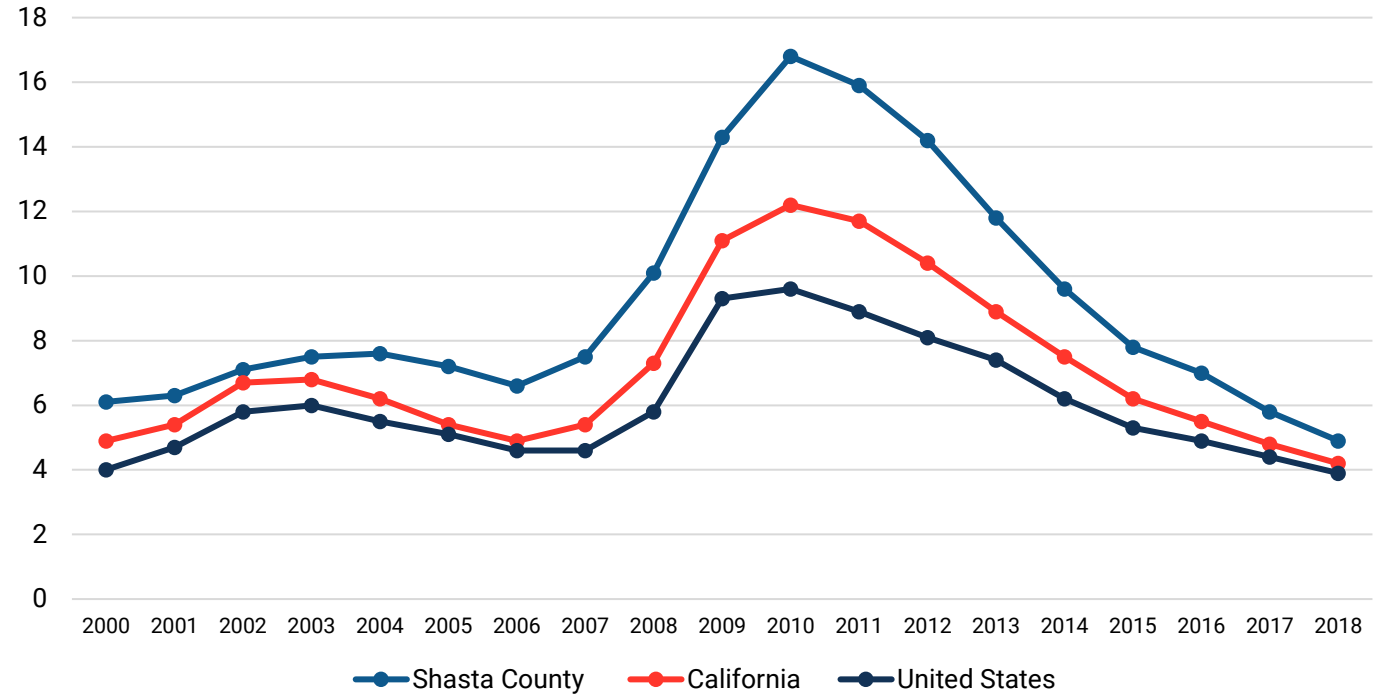


Figure 4-11: Historic Unemployment Rates
Source: U.S. Bureau of Labor Statistics

In recent years, the City of Shasta Lake has concentrated on diversifying the number and type of industries within the city. Large economic sectors are educational services, retail trade, and professional, scientific, and management and administrative and waste services. The arts, entertainment, and recreation, accommodation, and food services, construction, and public administration are also large employers. According to the United States Census Bureau, for the 2019 5-

year estimates, there were 4,078 jobs in all sectors in Shasta Lake. Table 4-11 shows the number of jobs by major sector in the city in 2019.

Table 4-11: Industry by Occupation for the Civilian Employed Population 16 Years and Over

Occupation	Total	Percent of total employment (in %)
Educational services, and health care and social assistance	1,112	27
Retail trade	626	15
Professional, scientific, management, administrative and waste service	413	10
Arts, entertainment, and recreation, accommodation, and food services	347	9
Construction	276	7
Public Administration	230	6
Transportation and warehousing, and utilities	196	5
Manufacturing	194	5
Finance and insurance, and real estate and rental leasing	166	4
Agriculture, forestry, fishing and hunting, and mining	150	4
Information	136	3
Other services, except public administration	119	3
Wholesale trade	113	3
Total: Industry by Occupation for the Civilian Employed Population 16 Years and Over		**4,078**

Source: United States Census Bureau, American Community Survey, 2019 5-Year Estimates, https://data.census.gov/cedsci/table?q=industry&g=1600000US0671225_312M500US398200659920&tid=ACSST5Y2019.S2405

4.3.6 Past and Future Trends in Development

Shasta Lake is a general law city that crafts its own development regulations and is subject to State law. Future development is subject to compliance with state and local planning, zoning, subdivision, and architecture laws. More recent development has occurred with reduced hazard risk because of the existing overlay of federal, state, and local regulation.

The city's General Plan establishes long-range development policies. The General Plan is designed to help the City address issues related to land use, circulation (traffic), housing, open space, conservation, noise, and safety. The Land Use portion of the plan helps guide the city in determining the location of future development(s). The city is currently updating its General Plan in its entirety and is integrating mitigation into the General Plan—in particular in the Safety Element.

In addition, the City has other plans that guide development in specific areas, including specific plans, policy plans, and master plans. These plans help to shape future development and dictate the City's Sphere of Influence (SOI). One of the central functions in these planning documents is to decrease risk of impact from natural hazards. The city has approved large-scale development plans in the northeast

corner of the city which require hazard mitigation, in particular wildfire mitigation and evacuation route planning.

Past development has occurred in hazard areas in the city to some degree, increasing hazard risks. However, the city employs development standards and performance measures to reduce risk, oftentimes incorporated into specific plans, policy plans, and master plans. These development standards are continuously improving and will strengthen into the future. This HMP has been revised to reflect this substantial change in past development and continues to focus on avenues to better mitigate impacts from problematic past development.

Shasta Lake has gone to great lengths to ensure future development within hazard areas is minimized and mitigated to the greatest extent possible. The city's Capabilities Assessment, Section 5.3, explains those proactive steps in greater detail. Buildings are increasingly more resilient to hazards through California's building codes, some of the strongest in the country. Nationally, building codes have continually improved disaster resilience, and since 1990 those great improvements have added approximately 1% to construction costs. (National Institute of Building Sciences, 2019)

The city has also completed and continues to implement mitigation projects that decrease its vulnerability to hazards, as described in Section 2.4. The anticipated growth in the city will not cause significant change in vulnerability to the City for identified priority hazards.

4.4 Vulnerability Assessment Methods

This section provides an overview of the methods used in the vulnerability assessments in Section 4.5. Vulnerabilities to Specific Hazard. Each hazard included Section 4.5. are assessed in a two-step process. First, population, critical facilities, and parcels are inventoried to develop a "lay of the land." Second, the inventories are used to calculate estimated exposure and damage from hazards at various levels of severity. A more detailed explanation of the methodology is included in Appendix A.

The vulnerability assessment uses geospatial data along with local knowledge of past events. Geospatial data is essential in determining population and assets exposed to hazards identified in this plan. Geospatial analysis can be conducted if a natural hazard has a spatial footprint that can be analyzed against the locations of people and assets. In the City of Shasta Lake, wildfire and flooding have identifiable geographic extents and corresponding spatial information about each hazard.

4.4.1 Population and Asset Inventory

To describe vulnerability for each hazard, it is important to first understand the total population and total assets at risk. Population and asset inventories provide a baseline to measure the vulnerability to people and assets for natural hazard events. Asset inventories can also be used to estimate damages and losses expected during a "worst-case scenario" event for each hazard. Figure 4-12 provides a summary of how and what data sources are used to provide exposure and damage estimation results. More detail on the risk assessment analysis is provided in Appendix A. The following sections describe the total population, critical facilities, and parcel inventory inputs.

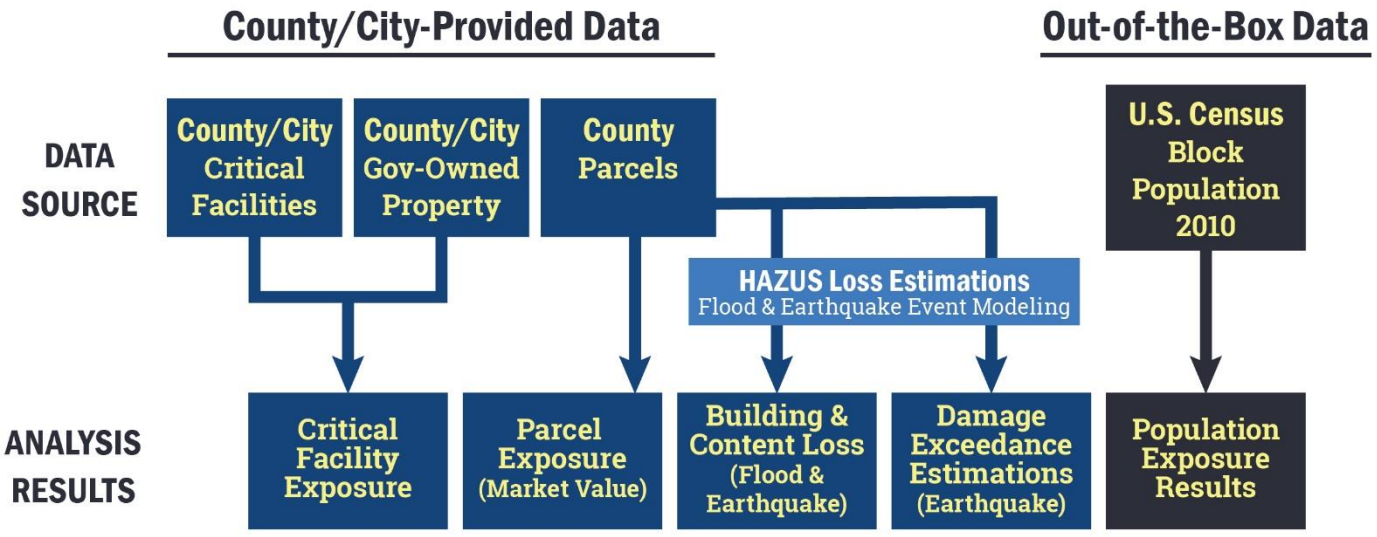


Figure 4-12: Data Source and Method

4.4.1.1 Population

An initial step in producing the hazard-specific vulnerability assessments is to determine the population near each natural hazard. Each natural hazard scenario affects the city residents differently depending on the location of the hazard and the population density of where the hazard event could occur. For hazards that potentially affect the whole city such as earthquake or drought, the vulnerability assessment assumes 10,142 persons or 100% of the city's population is exposed.[2] Vulnerability assessments presented in Section 4.5 summarize the population exposure for each natural hazard if available.

4.4.1.2 Critical Facilities Inventory

Critical facilities are of particular concern when planning to mitigate hazards. A critical facility is a structure or other improvement that, because of its function, size, service area, or uniqueness, has the potential to cause disruption of vital socioeconomic activities if it is destroyed, damaged, or functionally impaired.

Critical facilities inventory data was developed from a combination of datasets, including from county, city, special purpose district, state, federal, and private industry. A critical infrastructure spatial database was developed to translate critical facilities information into georeferenced[3] points and lifelines.

- **Critical facility points** include facilities such as police stations, fire stations, hospitals, elder care facilities, daycare facilities, schools, transportation infrastructure, utilities, and government buildings.
- **Lifelines** include facilities related to electric power, liquid fuel, natural gas, and transportation routes. A current representation of the critical facility points and lifelines are provided in Figure 4-13. Some critical facility information may have been omitted from this document due to national security purposes. For additional information on included critical facilities, see Appendix A.

Critical facilities and transportation and lifeline data come from a collection of sources, listed in Appendix A. All data sources have a level of accuracy acceptable for planning purposes. Due to the sensitivity of this information, a detailed list of facilities are not provided. More detailed critical facilities lists are on file with each jurisdiction. The risk assessment for each hazard qualitatively discusses critical facilities with regard to each hazard's severity footprint.

[2] Population estimates were derived from 2014-2018 Census American Community Survey 5-Year (ACS) information.
[3] To georeference something means to define its existence in physical space. That is, establishing its location in terms of map projections or coordinate systems. The term is used both when establishing the relation between raster or vector images and coordinates, and when determining the spatial location of other geographical features.

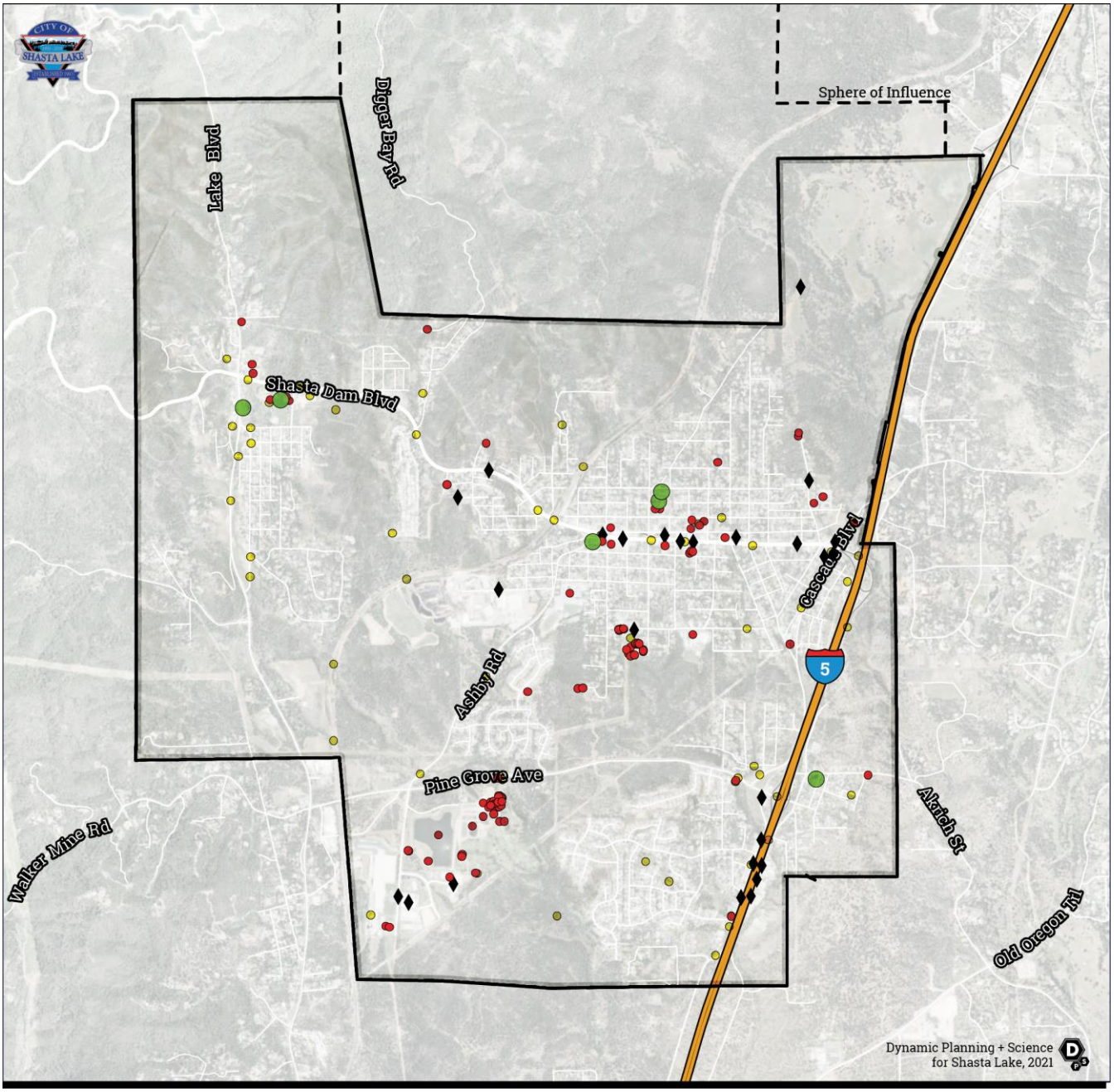


Figure 4-13: Critical Facilities

4.4.1.3 Parcel Value Inventory

The Shasta County Assessor's data is essential to developing parcel values exposed to each hazard and includes the current fair market value of at-risk assets. The City of Shasta Lake's Parcel Value Inventory is summarized in Table 4-12. This table only includes parcels that are located in the City of Shasta Lake. The Parcel Value Inventory includes the market value,[4] content replacement value, and total assessed value ("total value"). Each hazard profile outlines predicted impacts to this inventory for each hazard's geographic extent. These elements are called out in the table because, in the event of a disaster, the value of the infrastructure or improvements to the land is usually the focus of concern. Generally, the land is not a total loss, and structures can be rebuilt or contents replaced.

Total market value as presented in this plan reflect Shasta County Assessor data for the City of Shasta Lake. Where building areas were available, a standard replacement value of $250 per square foot was used. If no area was available for a given property, the value reflects the assessed improvement value.

Total content value was calculated based on the assessor's use codes, translated to occupancy-based multipliers. Each occupancy class prescribes a specific content cost multiplier used to calculate the content cost values shown in the summary and in the hazard profiles in Section 4.5. Occupancy-based content cost multipliers used in this plan reflect those found in the FEMA Hazus-MH 4.2 technical manuals.

Table 4-12: City of Shasta Lake Parcel Counts and Value

	Total Improved Parcels	Total Market Value ($)	Total Content Value ($)	Total Value ($)
Shasta Lake	3,636	$1,320,294,215	$822,128,105	$2,142,422,319

Total market value as provided by County Assessor's Office and based on $250/sqft where available. Content value calculated using content multipliers per Hazus occupancy classes per county land use designation. Total value is the sum of total market value and total content value. Improved Parcels Only.

[4] Market Value includes a long-term asset which indicates the cost of the constructed improvements to land, such as buildings, driveways, walkways, lighting, and parking lots.

4.4.2 Hazard Exposure and Damage Estimation

The population and inventory information are used to generate specific exposure and damage estimations based on the severity of specific hazard events. The hazards in the City of Shasta Lake which have known geographic extents and corresponding spatial information, and thus have exposure and damage estimations, are wildfire and flood.

Population and Asset Exposure

The total counts of parcels, people, facilities, and assets within the planning area in which a hazard event may occur is known as the hazard "exposure." A natural hazards overlay was developed to reflect the combination of many known natural hazard spatial footprints. The spatial overlay method enables summarization of building values, parcel counts, population exposure, and critical facility exposure within a hazard's geographic extents. Figure 4-14 illustrates hypothetical flooding exposure. Exposure numbers were generated using Shasta County Assessor data, address point, and parcel data for replacement and content cost estimates.

At-risk populations, critical infrastructure, improved parcels, and loss results for each hazard category are provided in bar chart summary tables in Section 4.5 to evaluate the percentage of assets exposed to different types of hazards. The side-by-side comparison allows the City of Shasta Lake to evaluate the impacts of potential hazards to prioritize hazard mitigation energy and resources.

Figure 4-14: Hazard Exposure Explanation Graphic

Damage Estimation

For flood and wildfire, detailed damage estimations were conducted through FEMA's Hazus software. Hazus is a nationally applicable, standardized methodology that contains models for estimating potential losses from earthquakes, floods, and hurricanes. Hazus uses Geographic Information Systems (GIS) technology to estimate the physical, economic, and social impacts of disasters. The estimated damage and losses provided by the Hazus Software is based upon chosen severity of events and provides the ability to understand possible widescale damage to buildings and facilities.

In the hypothetical geography shown in Figure 4-15, even though both structures are exposed to flooding, it is expected that the structure with a first-floor height below the depth of flooding will receive significantly more damage than the structure with a first-floor height above the expected water depth. For a more detailed explanation of risk assessment methods, see Appendix A.

Figure 4-15: Hazus Damage Estimation Example

4.5 Vulnerability to Specific Hazards

This section introduces prevalent hazards within the City of Shasta Lake and analyzes how each may affect populations, property, and critical facilities within the city's jurisdiction. Importantly, the hazard mitigation strategy presented in Section 5 is informed by, and responds to, the particular vulnerabilities outlined in this section. The mitigation strategy provides prescriptions or actions to achieve the greatest reduction of vulnerability based on this section, which results in saved lives, reduced injuries, reduced property damage, and protection for the environment in the event of a natural hazard. Methods for calculating exposure and loss estimates are described in Section 4.4 and Appendix A.

This section provides quantifiable exposures to people and property and damage and loss estimates for the City of Shasta Lake for the below-prioritized hazards.

Wildfire
SECTION 4.5.1

Extreme Weather
SECTION 4.5.3

Climate Change
SECTION 4.5.5

Flood
SECTION 4.5.2

Drought
SECTION 4.5.4

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4.5.1 Wildfire Hazard Profile

A wildfire is any uncontrolled fire occurring on undeveloped land that requires fire suppression. Wildfires can be ignited by lightning or by human activity such as smoking, campfires, equipment use, and arson. The 2018 California State Hazard Mitigation Plan defines wildfires as:

> *Any free-burning vegetative fire that initiates from an unplanned ignition, whether natural (e.g., lightning) or human-caused (e.g., powerlines, mechanical equipment, escaped prescribed fires), where the management objective is full suppression.* (California Office of Emergency Services, 2018, p. 507)

Wildfires are costly, putting lives and property at risk and compromising rivers and watersheds, open space, timber, range, recreational opportunities, wildlife habitats, endangered species, historic and cultural assets, scenic assets, and local economies. Vulnerability to flooding increases due to the destruction of forest and ground cover within watersheds. The potential for significant damage to life and property increases in areas where development is adjacent to densely vegetated areas, known as wildland-urban interface (WUI) areas. (FEMA, 2020)

While some fires are allowed to burn naturally in order to maintain or restore the health of forest lands, out of control wildfires need to be prevented through cooperative, community, and land management planning. (United States Forest Service, n.d.)

4.5.1.1 Local Conditions Relating to Wildfire

The Shasta Lake area lies at an elevation of 1,000 to 2,000 feet and includes conifer, oak, and chaparral woodland fuels as well as a high combination of brush fuels. The area is was used for copper mining and smelter operations which left the region devoid of vegetation. As a result, much of the area consists of brush fields that are at least 50 years old. The brush is laden with sufficient dead fuel and fine fuel to sustain large and damaging fires. (Shasta County CWPP, 2016)

This area, which includes parts of Shasta Lake, creates a high threat to life and property from wildfire. Specifically, subdivisions that were developed before 1982 are more at risk. They often have narrow, one-lane roads with limited or no community water systems. They also often only have a single access road. Some of these subdivisions were developed to include fire emergency access roads, however, many of these roads have not been adequately maintained and are overgrown to the extent that they are impassable. (*Id.*)

The City of Shasta Lake has dry summers where little rain falls from early June through late October. Most precipitation falls between October and March, as much as 4.75 inches per month; however, this seasonality of rainfall has been changing in recent years. Depending on the location, elevation, and weather patterns, the declared fire season in The City of Shasta Lake typically lasts from early June to mid or late October. The fire season is a time of increased risk of conflagration to residential and other

development within the city and neighboring areas. Conflagration is an extensive fire that destroys a great deal of land or property. The hilly and mountainous terrain on the north and west side of the city strongly influences both wildland fire behavior and fire suppression capabilities. Wind is also a significant factor in the spread of fire, as fires spread faster, and burning embers are carried with the wind to adjacent exposed areas. In densely-populated areas, flying ember production is the principal driver of wildfire. A related concern in built-out areas is the relative density of vegetative fuels that can serve as sites for new spot fires within the urban core and spread to adjacent structures.

4.5.1.1.1 Wildland-Urban Interface, Urban Conflagration, and Human-Caused Wildfire

Humans alter both fire ignition risk and behavior in the wildland-urban interface (WUI). As residential development in California has encroached on wildlands, wildfire risks have increased. The City is comprised of hilly, mountainous terrain, with homes and communities enmeshed in heavily vegetated and sloped areas. Unique wildfire hazards specific to these areas include the proximity of homes and structures to vegetative fuels, increased ignition frequency, and delayed response time of firefighting resources due to accessibility limitations

The spread of larger wildland fires into the built environment also poses a great risk of **urban conflagration** – the type of structure-to-structure spread in high density development areas that is implicated in massive losses from the Carr Fire in the outskirts of Redding in 2017 and the Camp Fire in Butte County in 2018. (Syphard, et al., 2019)

Arson has been attributed with a concerning number of wildfire ignitions, especially in recent years. The 2021 Fawn Fire was an arson-ignition and took 10 days to contain. Other larger fires have been attributed to arson as well.

4.5.1.1.2 Lightning

While humans cause the vast majority of wildfires, lightning-triggered wildfires burn about 60% of all acreage. (Climate Central, 2013) Climate change is predicted to increase the occurrence of lightning as much as 12 percent per every degree Celsius (about 2°F) rise in global temperatures, which could be as much as a 50 percent increase in lightning by the end of the century. (Thompson, 2014) This prediction is a blanket average increase across the continental United States; increases could be higher or lower depending on the distribution of increases over seasons or geographically. (*Id.*)

4.5.1.1.3 De-Energization and PSPS Events

Some recent wildfire events have been linked to electric transmission equipment, including instances of faulty equipment, trees falling into powerlines in high wind events, or even animals contacting equipment. These problems have lead electric utilities to institute to public safety power shutoffs (PSPS), also referred to as preemptive de-energization. (California Public Utilities Commission, 2020) Pacific Gas and Energy (PG&E) reached a 13.5 billion dollar settlement and pled guilty to 84 counts of

manslaughter as its transmission facilities sparked wine country blazes in 2017 and the fire that nearly destroyed the town of Paradise in 2018. (Blume, 2019) In an attempt to avoid these catastrophic wildfire events, electric utility companies, under the guidance of state law, have started massive, and preemptive power shutoffs in high wind events to avoid sparking fires. This leaves communities and essential facilities without power, a particular challenge in preparing for and responding to hazard events and assisting vulnerable populations. (California Public Utilities Commission, 2020, p. 5) The increased frequency of PSPS events renewed focus addressing the loss of power in hazard mitigation in the City of Shasta Lake as well as around the state, even as PSPS events grow more focused, creating less mass power losses in municipalities.

4.5.1.1.4 Extreme Fire Behavior

Extreme fire behavior is defined as "fire spread other than steady surface spread, especially when it involves rapid increases." (Werth, et al., 2016) While local conditions, such as fuel, weather, and topography, determine initial fire spread and intensity, large wildfires can also generate their own weather patterns, triggering feedback loops of destruction. Recent "megafires" generate enough heat to produce updrafts measured in excess of 130 mph, sending giant plumes of smoke and moisture into the lower stratosphere where it condenses to form a pyrocumulonimbus cloud. (Rodriguez, Lareau, Kingsmill, & Clements, 2020) Under certain conditions, these wildfire-generated supercell storms can produce lightning, tornado-strength winds, and even actual tornadoes in some cases. This phenomenon of pyrotornadogenesis was documented in the 2018 Carr Fire and can be directly related to four deaths. (Lareau, Nauslar, & Abatzoglou, 2018) Extreme fire behavior associated with pyrocumulonimbus activity is also implicated in the wake of the destructive 2020 wildfire season in California. (Morris, 2021) As climate change drives an increase in the frequency and severity of wildfires, extreme fire behavior, including pyrocumulonimbus activity, is observed with greater frequency in proximity to population centers, posing risks to life and property. (Peterson, et al., 2021)

Extreme heat during extreme fire events increases erosion and water quality problems. After intense heating, a thin layer of soil at or below the soil surface may repel water completely (i.e., become hydrophobic). (Brooks, 2021) Reduced water infiltration in soils increases runoff and erosion and carries sediment that can clog stream channels and reduce water quality even to a point where rivers and streams temporarily cannot be used for drinking water supplies.

4.5.1.1.5 Collaborative Forest Management

The land surrounding Shasta Lake is owned by multiple land management agencies, primarily the US Forest Service and US Bureau of Land Management. It can be challenging for these agencies to coordinate wildfire mitigation. Communication challenges, infrastructure deficiencies, and a host of other social, political, environmental, inter -and intra -organizational factors can all serve to confound the effective collaboration between multiple agencies. Figure 4-16 below depicts the local land management agencies as well as very high fire hazard severity zones.

4.5.1.1.6 Greenbelts as Wildfire Protection Buffers

Greenbelts are broadly defined as open space, parks, preserves, or agricultural lands where development is limited or prohibited altogether. Greenbelts can be recreational in nature, including play fields, golf courses, and bicycle or pedestrian paths, or they can be working lands, such as orchards and farms. These greenbelt areas play a critical role in reducing losses during wildfire events due to several core characteristics, including:

- Separating wildlands from and buffering developed areas;
- Serving as strategic locations for wildfire defense;
- Reducing fuel sources through land management and stewardship; and
- Conserving biodiversity and supporting overall ecological health. (Greenbelt Alliance, 2021)

To be effective buffers against wildfire, greenbelts must be consistently managed. Land stewardship that aims to protect biodiversity alongside reducing wildfire risk can result in healthier fire-prone and fire-dependent ecosystems and contribute to overall resilience. Ongoing adaptive management for these lands may include prescribed or cultural burns, targeted removal of dead vegetation, and creation of strategic fuel breaks. Greenbelt size parameters should be site-specific, but the most cost-efficient and effective range is an area of 300 feet to a quarter-mile wide adjacent to developed areas and communities. (*Id.*)

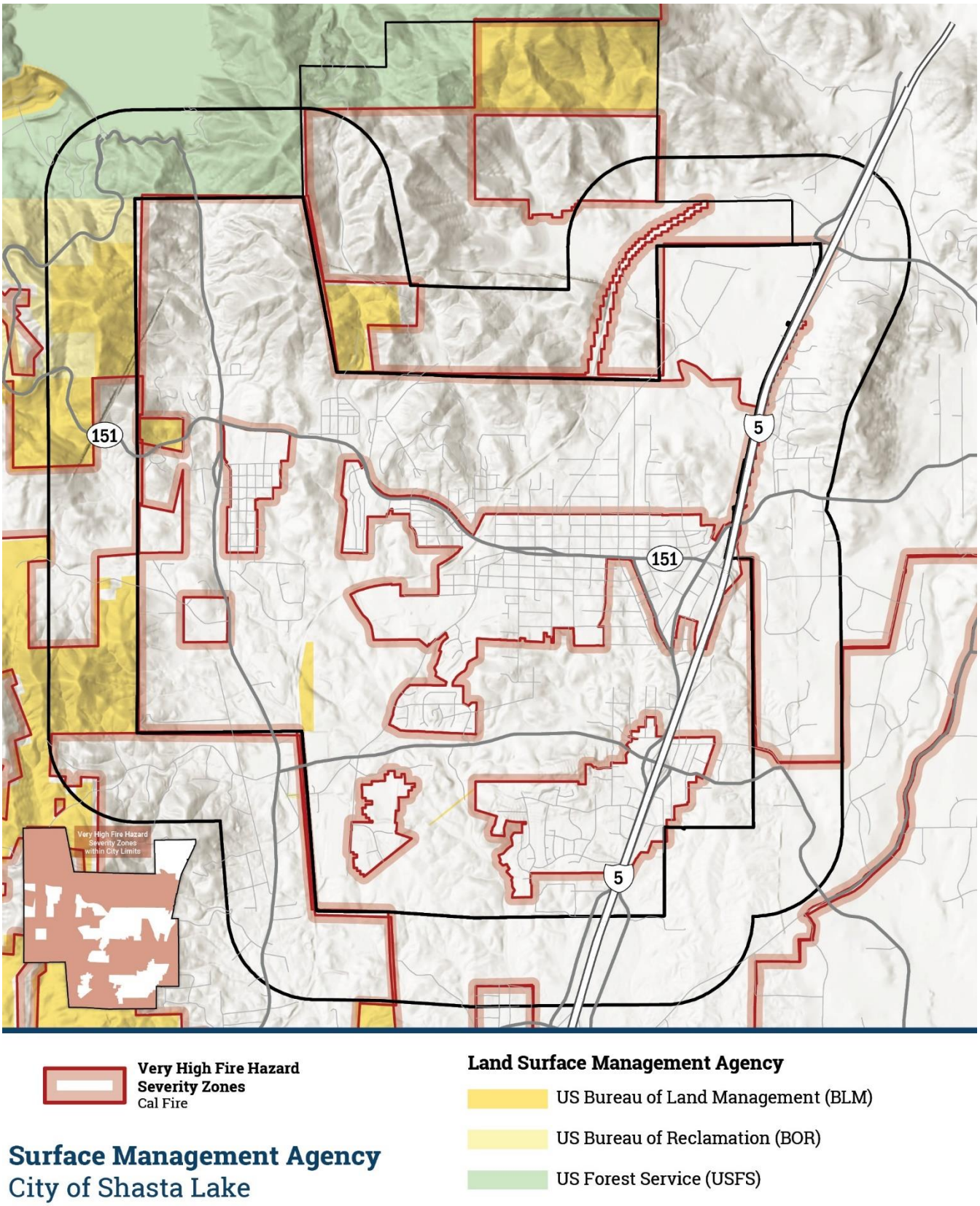


Figure 4-16: Surface Management Agencies Adjacent to City of Shasta Lake

4.5.1.2 Plans, Policies, and Regulatory Environment

Wildfire Protection Responsibility in California

Local, state, tribal, and federal organizations all have some level of legal and financial responsibility for wildfire protection. In many instances, two fire organizations have dual primary responsibility on the same parcel of land, one for wildfire protection and the other for structural fire protection. To address wildfire jurisdiction responsibilities, the California State Legislature outlined various wildfire responsibilities in 1981, described below, in Cal. Pub. Res. Code § 4291.5 and Cal. Health & Safety Code § 13108.5.

- **Federal Responsibility Areas (FRAs):** FRAs are fire-prone wildland areas that are owned or managed by a federal agency such as the U.S. Forest Service, National Park Service, Bureau of Land Management, U.S. Fish and Wildlife Service, or U.S. Department of Defense. Primary financial and rule-making jurisdiction 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 the responsibility of the relevant local government agency, not the federal land management agency. (California Department of Forestry and Fire Protection, 2013-2018) FRAs are not included in the wildfire severity zone classifications developed by the California Department of Forestry and Fire Protection (CAL FIRE); FRAs are shown as a separate designation for all wildfire mapping in this Hazard Profile for this reason. Figure 4-16 illustrates federal land management agency land ownership bordering the city.
- **State Responsibility Areas (SRAs):** SRAs are lands in California where the CAL FIRE has legal and financial responsibility for wildfire protection. CAL FIRE administers fire hazard classifications and building standard regulations in these areas. SRAs are classified into types of land based on cover, beneficial use of water from watersheds, probable damage from erosion, and fire risks and hazards. (California Legislative Information, pp. § 4102, § 4130) CAL FIRE adopts SRA boundaries and updates them every 5 years. Where SRAs contain structures or development, the relevant local government agencies have fire protection responsibility for those improvements. (Office of the State Fire Marshal, 2021)
- **Local Responsibility Areas (LRAs):** LRAs include land in cities, cultivated agriculture lands, unincorporated non-flammable areas, and lands that do not meet the criteria for SRA or FRA. LRA fire protection is typically provided by city or county fire departments, fire protection districts, or by CAL FIRE under contract to local governments. LRAs may still include areas of flammable vegetation and in the WUI. (*Id.*)

In 2012, as part of local general plan requirements, California began requiring local governments in SRAs and Very High Fire Hazard Severity Zones (VHFHSZ) to update their general plan safety elements to recognize specific wildfire risks in such areas and adopt special findings when approving subdivisions in such areas. Local governments are also required to use wildfire safety guidelines and

California Environmental Quality Act (CEQA) initial study wildfire hazards checklist updates issued by the Governor's Office of Planning and Research (OPR) when those become available. (Cal. Gov. Code § 65040.20 and § 65302.5)

For further information on the details and implications of these safety element requirements, see Progress Summaries 3.F and 8.A of the 2018 California State Hazard Mitigation Plan.

Healthy Forests Restoration Act (2003)

The federal Healthy Forests Restoration Act (HFRA) appropriates funding to address five main sub-categories of the National Fire Plan (NFP): preparedness, suppression, reduction of hazardous fuels, burned-area rehabilitation, and state and local assistance to firefighters.

California Fire Code (2019)

The City of Shasta Lake has adopted most recent edition of the California Fire Code, currently 2019, to safeguard the public health, safety, and general welfare from the hazards of fire, explosion, or dangerous conditions in new and existing buildings, structures, and premises, and to provide safety and assistance to firefighters and emergency responders during emergency operations. See Shasta Lake Municipal Code at §15.01.090). The Fire Code mandates specific requirements for new building construction placing strong emphasis on proper address signage, apparatus access, water requirements, and defensible space. The plan includes recommendations such as locating shaded fuel breaks along key roadways, and increasing the publicity for the updated fire and community evacuation plan.

California Building Code (2019)

The City of Shasta Lake has adopted the most current edition of the California Building Code, currently 2019), which includes materials and construction methods for exterior wildfire exposure and standards of quality for fire-resistant buildings

California Code, Public Resources Code § 4290

These regulations became effective in September of 1991. They require the future design and construction of structures, subdivisions and developments in SRA to provide, for basic emergency access and perimeter, wildfire protection measures. These measures provide for emergency access; signing and building numbering; private water supply reserves for emergency fire use; and vegetation modification.

California Code, Public Resources Code § 4291

These regulations require property owners in mountainous areas, forest-covered lands, or any land that is covered with flammable material to create at minimum a 100-foot defensible space (or to the property line) around their homes and other structures.

Shasta County Communities Wildfire Protection Plan (2016)

The Shasta County Communities Wildfire Protection Plan (CWPP) is a consolidation of existing strategic fuel management and community wildfire protection plans throughout Shasta County. The Plan addresses landowner objectives, fuel treatment types, the road system, potential funding sources, fuel break locations, and values at risk. This CWPP is being updated as of 2021, an effort led by the newly-reformed Shasta County Fire Safe Council.

City of Shasta Lake Wildfire Mitigation Plan

The City of Shasta Lake approved its wildfire mitigation plan in November of 2019. The Plan describes the number of activities that the Electric Department is taking to mitigate the threat of power-line ignited wildfires, including its various programs, policies, and procedures.

City of Shasta Lake General Plan

The 1999 City of Shasta Lake General Plan includes a number of policies in the Public Health and Safety Group that are designed to mitigate for the potential impacts of wildfire. Specifically, the policies seek to protect development from wildland fires by requiring development to incorporate design measures, as well as the incorporation of defensible space design techniques, in order to be more responsive to risk from fire hazards.

Fire Protection Features in the City of Shasta Lake Municipal Code

The City of Shasta Lake Municipal Code aids in reducing fire risks by requiring defensible space standards to be maintained These include requirements for pre-development review of major projects, as well as elements of landscape documentation package. (§12.36.062, §15.10.050)

4.5.1.3 Past Events

There are four major factors that contribute to historic wildfire events:

1. Extreme vegetation diversity;
2. Diverse fire weather and fire behavior;
3. Dynamic fire history; and
4. Complex land use patterns.

From 2000-2021, there have been four wildfires that approached city limits and two that crossed into city boundaries. These and other nearby fires events are displayed in Figure 4-18.

4.5.1.3.1 Recent Large Wildfire Events

Carr Fire (2018)

The Carr Fire was active in Shasta and Trinity Counties for 37 days and it burned a total of 229,651 acres. The fire was caused from a vehicle with a flat tire. The exposed rim of the flat tire scraped the road and created the spark that resulted in the fire. The fire began in July of 2018 and was contained by the end of August in 2018. (CAL FIRE, 2021)

The Carr Fire damaged 61 structures in Shasta and Trinity Counties, including residential, commercial, and otherwise. It destroyed a total of 1,614 structures, and it caused three fatalities, including fire personnel and civilian fatalities. It also destroyed several powerlines, including 2 miles of the City's transmission lines. Figure 4-17 shows aerial damage to a Redding neighborhood before and after the wildfire.

The CAL FIRE Shasta-Trinity Unit, US Forest Service, and NPS Whiskeytown National Recreation Area were the Administrative Units associated with the fire. The fire required the partnership of seven agencies, 456 personnel, and five fire crews to contain the fire. It also required 11 fire engines, 48 dozers, and 31 water tenders to mitigate. (*Id.*) The perimeter of Carr Fire closest to Shasta Lake is displayed in Figure 4-18

Figure 4-17: Carr Fire Before and After Aerial, Lake Redding Estates
Source: City of Redding

See Figure 4-18 for locations of historic fires since 2000 greater than 100 acres.

Fawn Fire (2021)

The Fawn Fire burned 8,578 acres northeast of the City of Shasta Lake. It was started by arson on September 22, 2021, was active for 10 days, and was fully contained on October 02, 2021. The fire damaged 26 structures, destroyed 185 structures, and resulted in three injuries. (Cal Fire, 2021)

The Shasta County Fire Department, Redding Fire Department, Shasta Lake Fire Protection District, and a number of other public agencies cooperated to contain the fire and assist with evacuation procedures. Many resources were directed towards containment of the fire, including three helicopters, 130 fire engines, 7 dozers, 15 water tenders, 1,191 personnel, and 28 fire crews. (*Id.*) The Fawn Fire perimeter nearest to Shasta Lake is shown in Figure 4-18.

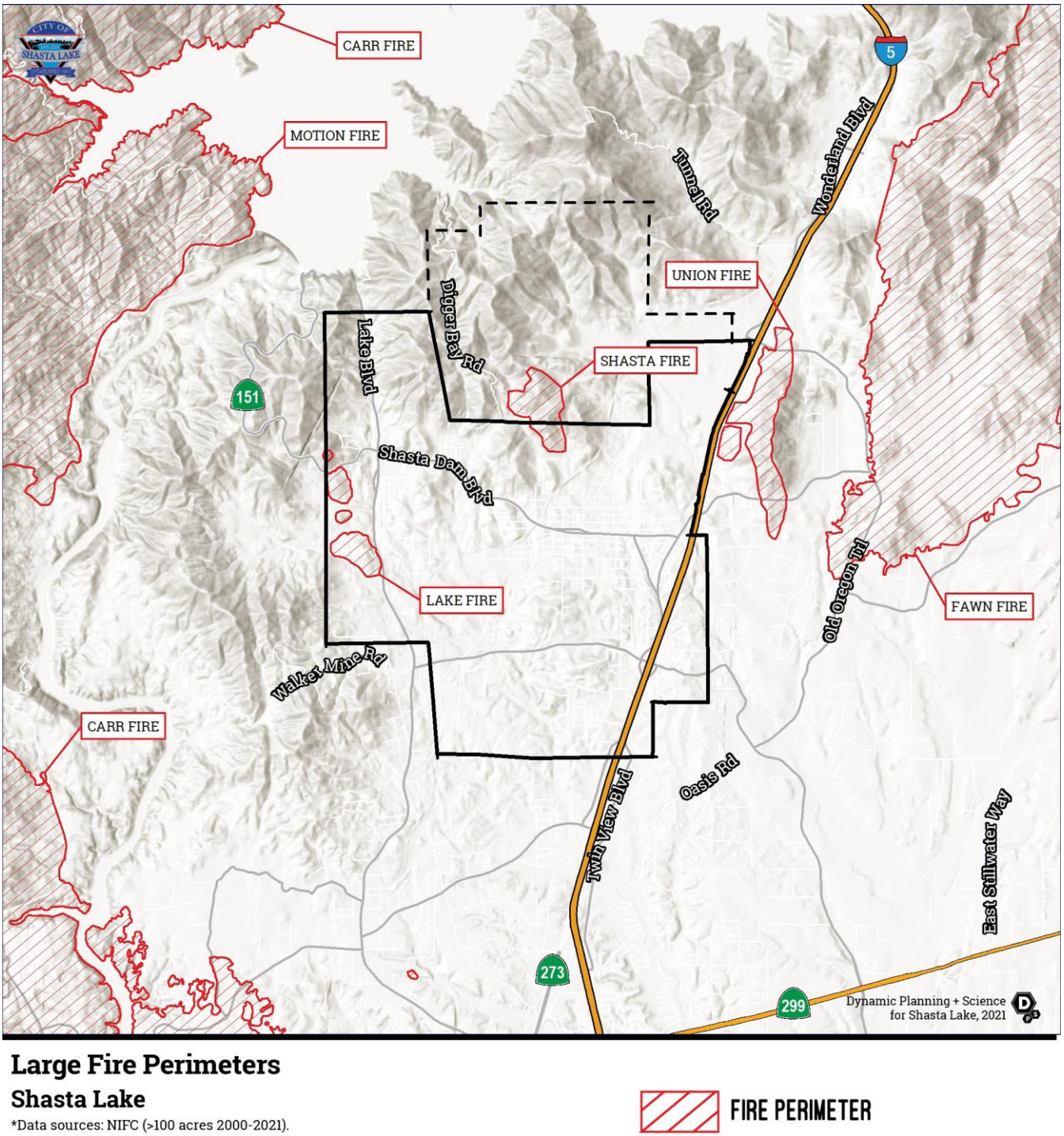


Figure 4-18: Historic Fire Occurrence Map (Fires Greater than 100 acres, 2000- 2021)

4.5.1.4 Fire Hazard Severity Zones (FHSZs)

The mountainous areas west and north of the city contain major wildland fire hazard risks for residential structures and other development, characterized by steep slopes, poor fire suppression delivery access, inadequate water supply, and highly flammable vegetation.

To help better refine areas of wildfire concern, CAL FIRE establishes and maps **Fire Hazard Severity Zones (FHSZ),** or areas of significant fire hazards based on factors such as fuel, weather, terrain, and the number of days of moderate, high, and extreme fire hazard. These zones define the application of various mitigation strategies to reduce the risk associated with wildfires.

The FHSV model inputs frequency of fire weather, ignition patterns, expected rate-of spread, and past fire history. It also accounts for flying ember production based on the area of influence where embers are likely to land and cause ignitions. The FHSZ model also is built from existing data and hazard constructs and thus does not necessarily take into consideration significant land use and structural resiliency. The geography, weather patterns, and vegetation in the planning area provide ideal conditions for recurring wildfires.

Notably, the FHSZs do not include federally-owned land, termed Federal Responsibility Areas or FRAs. Wildfire mapping in this HMP depicts FRAs along with FHSZs to point out areas that would likely be in FHSZs but for federal land ownership and wildfire responsibility.

See Figure 4-19 and Figure 4-20 for wildfire return intervals and fire severity zones. These maps are the basis for this wildfire risk assessment.

4.5.1.5 Frequency and Probability of Future Occurrences

Generally, the City of Shasta Lake faces a wildland fire threat annually. Fire conditions arise from a combination of hot weather, an accumulation of vegetation, and low moisture content in the air. These conditions, when combined with high winds and years of drought, increase the potential for a wildfire to occur. Urban Wildfires often occur in those areas where development has expanded into the rural areas. A fire along this urban/rural interface can result in major losses of property and structures. Generally, there are three major factors that sustain wildfires and allow for predictions of a given area's potential to burn: fuel, topography, and weather.

Fuel is the material that feeds a fire and is a key factor in wildfire behavior. Fuel is generally classified by type and by volume. Fuel sources are diverse and include everything from dead tree needles and leaves, twigs, and branches to dead standing trees, live trees, brush, and cured grasses. Also, to be considered as a fuel source, are man-made structures and other associated combustibles. The type of prevalent fuel directly influences the behavior of wildfire. Light fuels such as grasses burn quickly and serve as a catalyst for fire spread. The volume of available fuel is described in terms of fuel loading. Certain areas in and surrounding the City of Shasta Lake are extremely vulnerable to fires as a result

of dense grassy vegetation combined with a growing number of structures being built near and within rural lands.

An area's topography affects its susceptibility to wildfire spread. Fire intensities and rates of spread increase as slope increases due to the tendency of heat from a fire to rise via convection. Where fire quickly spreads up a canyon, gully, or other similarly constrained topographic feature, this is referred to as the "chimney effect." The natural arrangement of vegetation throughout a hillside can also contribute to increased fire activity on slopes. Weather components such as temperature, relative humidity, wind, and lightning also affect the potential for wildfire. High temperatures and low relative humidity dry out the fuels that feed the wildfire creating a situation where fuel will more readily ignite and burn more intensely. Wind is the most treacherous weather factor. The greater a wind, the faster a fire will spread, and the more intense it will be. Winds can be significant at times in the City of Shasta Lake. In addition to high winds, wind shifts can occur suddenly due to temperature changes or the interaction of wind with topographical features such as slopes or steep hillsides. Related to weather is the issue of recent drought conditions contributing to concerns about wildfire vulnerability. During periods of drought, the threat of wildfire increases. (NOAA, 2018)

The majority of past wildfire events in the City of Shasta Lake were in summer months (typically June through October). Frequency of wildfire events may increase because of increasingly drier conditions caused by climate change. Fire risk will also continue to grow as more people build in WUI areas, which increases fuel loads and the risk of human-caused fires. (FEMA, 2020)

As seen in Figure 4-18, fire occurrences are the most common in mountainous areas in the western region near the City of Shasta Lake. However, in 2021 the Fawn Fire erupted northeast of the City boundary, east of I-5, entering the City boundary on the east side of I-5. The probability of a wildfire occurring in the City of Shasta Lake is highly likely (100% annual chance).

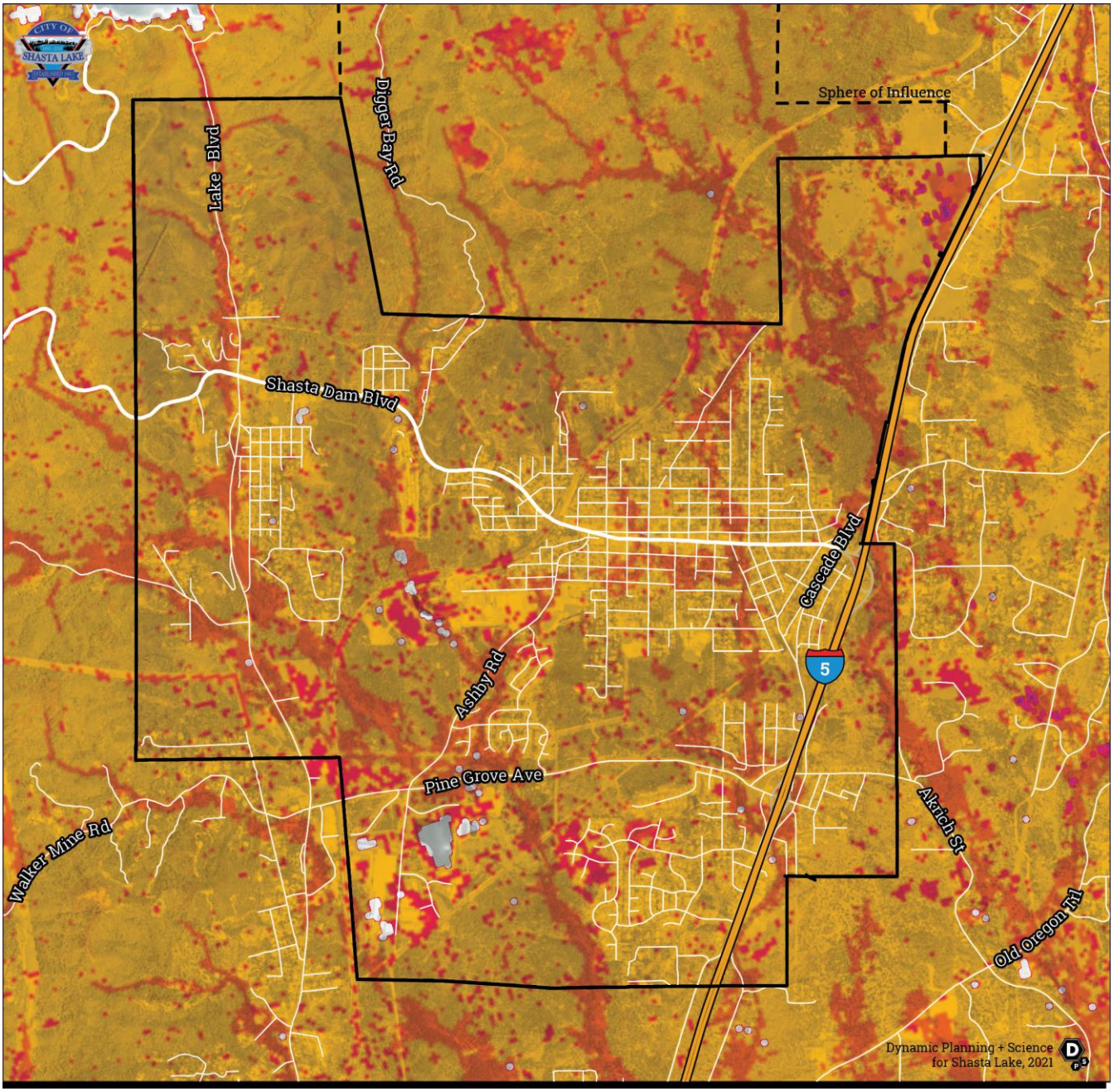


Figure 4-19: Mean Wildfire Return Intervals

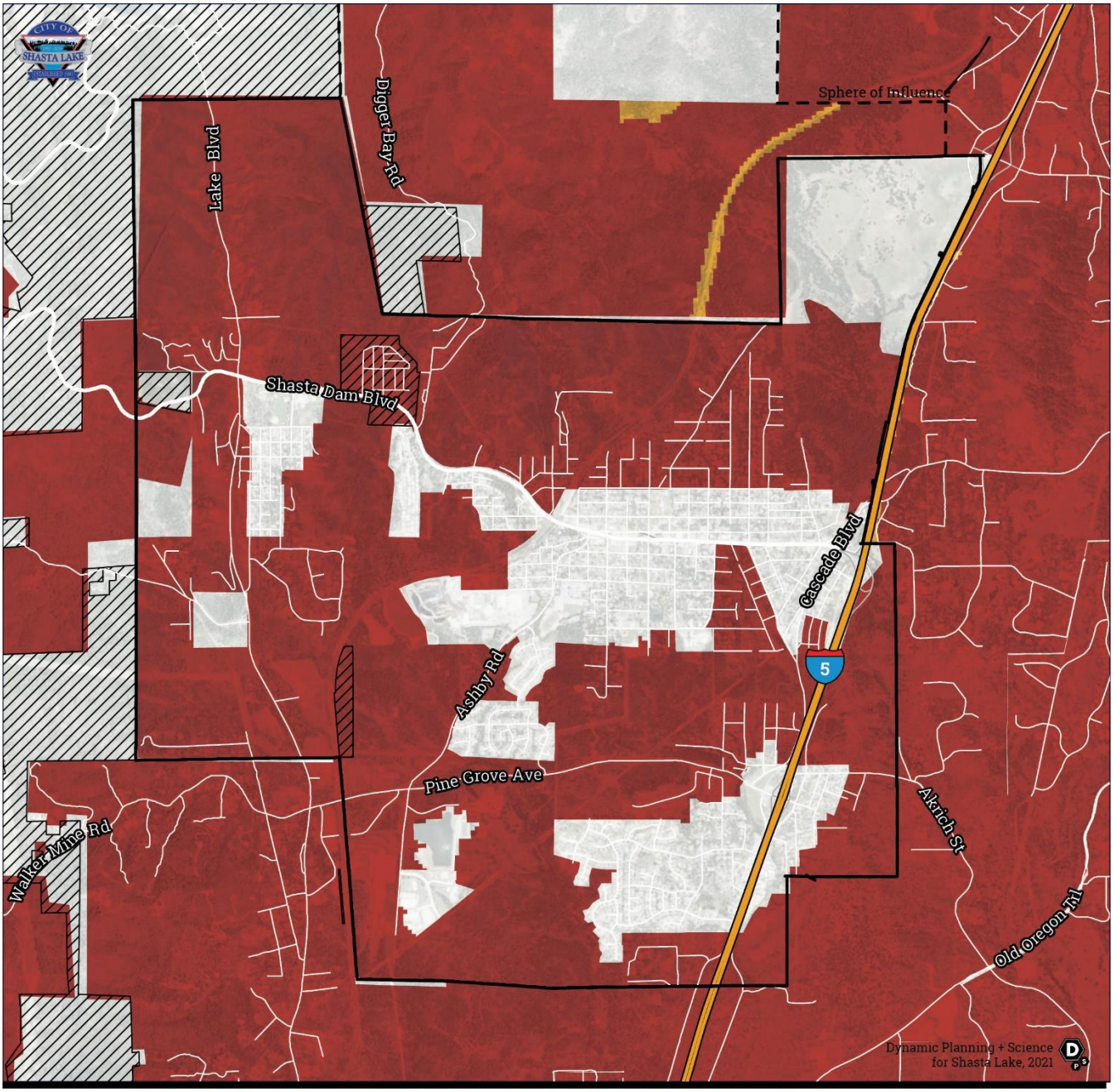


Figure 4-20: Wildfire Risk Exposure

4.5.1.6 Severity and Extent

The severity of the wildland fire hazard is determined by the relationship between three factors: fuel classification, topographic slope, and critical fire weather frequency. The City of Shasta Lake has a significant amount of wildfire fuels and susceptible topographic slope. Critical fire weather conditions occur in periods of low relative humidity, high heat, and high winds.

Smoke and air pollution from wildfires can be a health hazard, especially for sensitive populations including children, the elderly and those with respiratory and cardiovascular diseases. Wildfire may also threaten the health and safety of those fighting the fires. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke. In addition, wildfire can lead to ancillary impacts such as landslides in steep ravine areas and flooding due to the impacts of silt in local watersheds.

4.5.1.7 Warning Time

Regardless of the circumstances around the start of a wildfire, response time can be rapid and warning time short. Wildfires are often caused by humans, intentionally or accidentally. There is no way to predict when one might occur. The Fourth of July can be a time of heightened concern and outreach around wildfires since fireworks can cause fires and usage is high. Dry seasons and droughts greatly increase fire likelihood and lightning from dry thunderstorms may trigger wildfires. Extreme weather can be predicted, so special attention can be paid during weather events that may include lightning or wind events. Reliable National Weather Service lightning warnings are available on average 24 to 48 hours prior to a significant electrical storm.

There is also continued focus on more rapid detection and alert systems for wildfires. ALERTWildfire is a partnership of three universities: The University of Nevada, Reno (UNR), University of California San Diego (UCSD), and the University of Oregon (UO). The effort provides access to state-of-the-art Pan-Tilt-Zoom (PTZ) fire cameras discover, locate, and confirm fire ignition and ongoing fire behavior. The camera system has been used as a resource in many recent large wildfires in California, including the 2020 LNU Lightning Complex fires. Cameras continue to be placed throughout California, with the goal of placing 1,000 cameras in California by 2022. Cameras may be installed by federal agencies, utilities such as PG&E, state emergency services such as CAL FIRE, local governments, and NGOs. (ALERTWildfire, 2021)

If a fire does break out and spread rapidly, residents may need to evacuate within days or hours. A fire's peak burning period generally is between 1 p.m. and 6 p.m. Once a fire has started, fire alerting is reasonably rapid in most cases. The rapid spread of cellular and two-way radio communications in recent years has contributed to a significant improvement in warning time. (CAL FIRE, 2020) The City partners with Shasta County to register any residents of others interested through CODE RED alert system.

4.5.1.8 Secondary Hazards

Wildfires can generate a range of secondary effects, which in some cases may cause more widespread and prolonged damage than the fire itself. Fires can cause direct economic losses in the reduction of harvestable timber and indirect economic losses in reduced tourism and commerce. Wildfires cause the contamination of reservoirs, destroy transmission lines, and contribute to flooding. They strip slopes of vegetation, exposing them to greater amounts of runoff, weakening soils, and causing slope failures. Major landslides can occur several years after a wildfire. Most wildfires burn hot and for long durations that can bake soils, especially those high in clay content, thus creating hydrophobic soils that repel water. When it rains in burned areas, more soil washes off the hills and into roads, ditches, and streams and increases flooding. (United States Department of Agriculture, n.d.)

4.5.1.9 Climate Change Impacts

Fire in western ecosystems is determined by climate variability, local topography, and human intervention. Climate change has the potential to affect multiple elements of the wildfire system: fire behavior, ignitions, fire management, and vegetation fuels. Hot, dry spells create the highest fire risk. Drought and increased temperatures intensify wildfire danger by warming and drying out vegetation (even while climate change is also predicted to increase other severe weather, such as heavy rain and winter storm events). Climate change also may increase winds that spread fires. Faster fires are harder to contain, and thus are more likely to expand into residential neighborhoods. (Center for Climate and Energy Solutions, n.d.)

A changing climate is expected to subject forests to increased stress due to drought, disease, invasive species, and insect pests. These stressors are likely to make forests more vulnerable to catastrophic fires. While periodic fires are natural processes and fulfill an important ecological function, catastrophic fire events that cannot be contained or managed can cause serious threats to homes and infrastructure, especially for properties located at the wildland-urban interface.

Climate change is predicted to increase instances of "megafires" and extreme fire behavior, discussed in additional detail in Section 4.5.1.1.4. Moreover, rain events are predicted to become more severe in our changing climate. This could worsen post-rain flood events. (*Id.*) With or without rain, climate change also may bring an increased occurrence of lightning, responsible for a significant number of wildfires and acreage burned from wildfires, as discussed above in Section 4.5.1.1.1.

It is predicted that the City of Shasta Lake will see higher daily temperatures, more heatwaves, increased wildfires, and a diminished snowpack within this century, as a result of climate change. the City of Shasta Lake is projected to experience an increase in wildfire risk by the year 2064. A moderate emission scenario projects an increase of 3.9 degrees Fahrenheit while a high emission scenario projects an increase of 4.7 degrees Fahrenheit by the year 2064. (Cal-Adapt, 2021)

4.5.1.10 Wildfire Vulnerability Analysis

This section describes vulnerabilities to wildfire in terms of population, property, and infrastructure. Wildfire population, parcel value, critical facilities and lifeline exposure numbers were generated by overlaying the inventory outlined in Section 4.3 with CalFire Wildfire Hazard Severity Zones. Figure 4-22 shows a Snapshot Map of wildfire vulnerability in the City of Shasta Lake. Details for all data found in the Snapshot Map can be found in this section. All data sources have a level of accuracy acceptable for planning purposes.

4.5.1.10.1 Population

Smoke and air pollution from wildfires can be a severe health hazard, especially for sensitive populations including children, the elderly, and those with respiratory and cardiovascular diseases. Smoke generated by wildfire contain visible and invisible emissions that contain particulate matter such as soot, tar, water vapor, and minerals; gases such as carbon monoxide, carbon dioxide, and nitrogen oxides; and toxins such as formaldehyde, benzene. Emissions from wildfires depend on the type of fuel, the moisture content of the fuel, the efficiency or temperature of combustion, and the weather. Public health impacts associated with wildfire include difficulty in breathing, odor, and reduction in visibility. First responders likewise are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke.

Wildfire is of greatest concern to populations residing in the moderate, high, and very high fire hazard severity zones. U.S. Census Bureau block data was used to estimate populations within the CAL FIRE identified hazard zones. See Figure 4-22, Figure 4-21, and Table 4-13 for detail on populations residing in wildfire risk areas.

Table 4-13 Populations Exposed to Wildfire Risk

	Total Population
Shasta Lake	10,142

Wildfire Severity Zone	Population Count	% of Total
Very High	5,825	*57.44%*

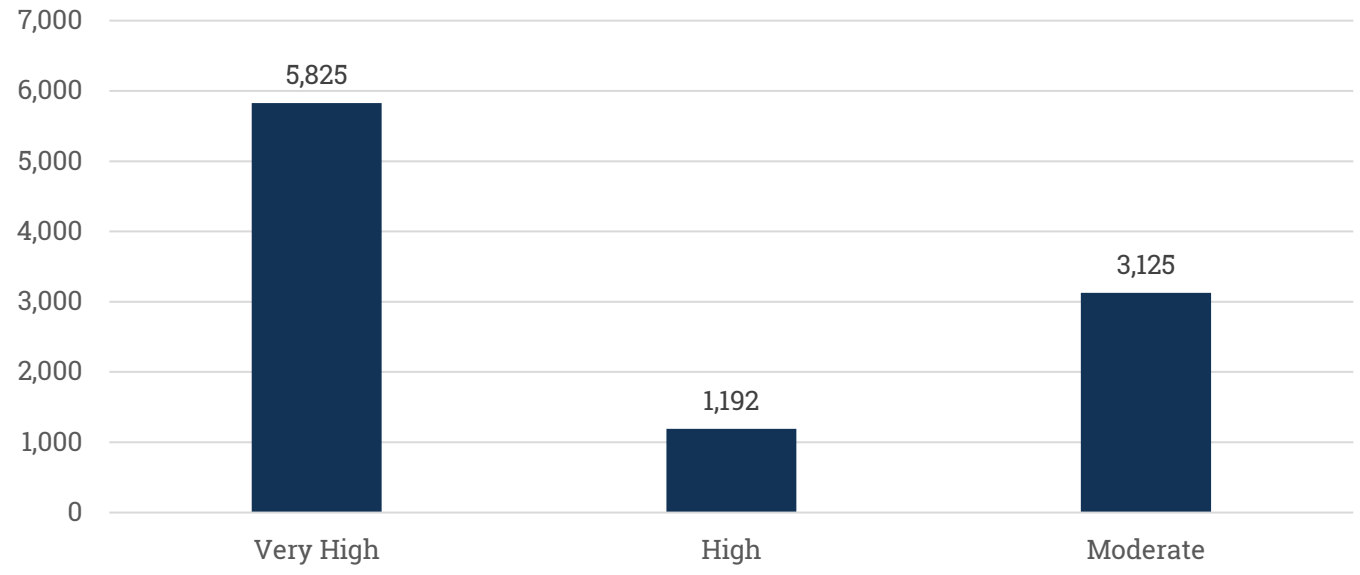


Figure 4-21: Population Exposed to Wildfire Risk

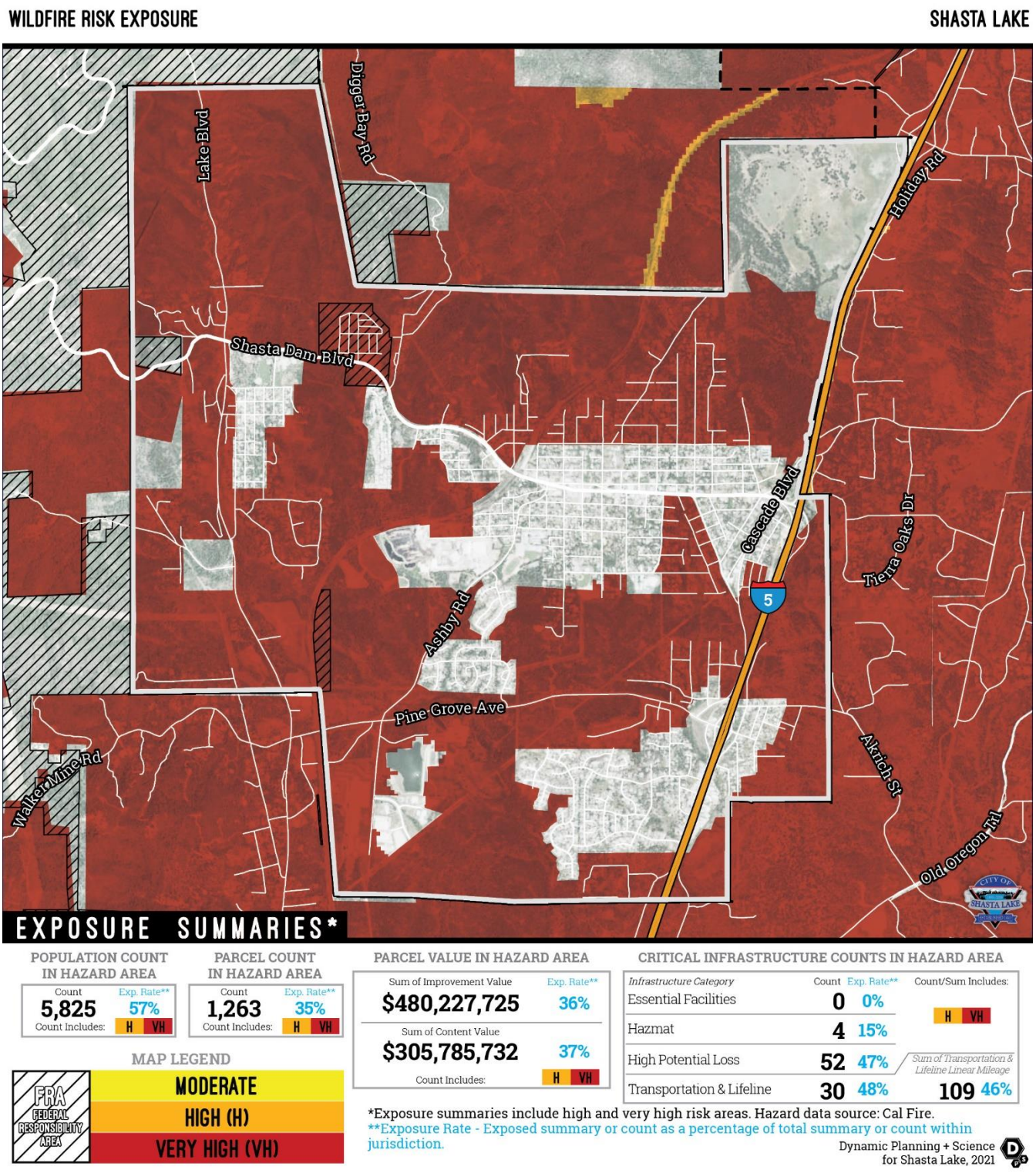


Figure 4-22: Exposure Wildfire Vulnerability and Snapshot Map

4.5.1.10.2 Property

This section calculates the considerable assets at risk of wildfire in those severity zones. See Table 4-14, which uses County parcel information to calculate exposure to wildfire severity zones. In some cases, a parcel will be within multiple fire threat zones, and for this exercise every parcel with a square footage value greater than zero was developed in some way. Only improved parcels were analyzed.

Table 4-14: Improved Parcel and Content within Wildfire Severity Zones

	Total Improved Parcels	Total Market Value ($)	Total Content Value ($)	Total Value ($)
Shasta Lake	3,636	$1,320,294,215	$822,128,105	$2,142,422,319

Fire Hazard Severity Zone	Parcel Count	% of Total	Market Value Exposure ($)	Content Value Exposure ($)	Total Exposure ($)	% of Total
Very High	1,263	*34.7%*	$480,227,725	$305,785,732	$786,013,458	*36.7%*

Critical Facilities and Infrastructure

Critical facilities of wood frame construction are especially vulnerable during wildfire events; power lines are also at risk from wildfire because some poles are made of wood and are susceptible to burning.

In many cases, roads and railroads would not be susceptible to damage except in the worst scenarios, but a wildfire event could create response issues, if affected. Fires can create conditions that block or prevent access and can isolate residents and emergency service providers. Wildfire typically does not have a major direct impact on bridges, but it can create conditions in which bridges are obstructed. Many bridges in areas of high to moderate fire risk are important because they provide the only ingress and egress to large areas and, in some cases, to isolated neighborhoods. Additionally, wildfires may cause the loss of function of cellular phone sites, or cell towers, which can limit emergency services such as tracking and evacuation.

Critical facilities data was overlain with fire hazard severity zone data to determine the type and number of facilities within each risk classification. Table 4-15 lists the critical facilities in wildfire hazard severity zones for the city, and Table 4-16 similarly lists critical infrastructure.

Table 4-15: Critical Facility Exposure to Wildfire Severity Zones

Critical Infrastructure - Wildfire Severity Zone	
Infrastructure Type	Very High
Essential Facility	-
EOC	-
Fire Station	-
Law Enforcement	-
High Potential Loss	52
Adult Residential Facility	1
Animal Control	1
Child Care Center	1
City Hall	-
Community Center	-
Dam	-
FM Transmission Tower	-
Healthcare Facility	-
*Real Property Asset	48
School	1
Transportation and Lifeline	30
Bridge	10
Bus Facility	2
NG Station	2
Park	5
Railroad Bridge	4
Substation	1
Wastewater Facility	1
Wastewater Lift Station	5
Hazmat	4
Hazardous Waste Tracking System Active Facility	4
Grand Total	**86**

**Real Property Assets are digitized insurance rolls for demonstrating value and ownership and may have overlapping points with other categories such as fire stations and law enforcement.*

Table 4-16: Lifelines in Wildfire Severity Zones

Lifelines (miles) - Wildfire Severity Zone	
Infrastructure Type (Linear)	Very High
NG Pipeline	3.75
Potable Water Line	39.38
Railroad	2.41
Street	37.17
Cul-de-sac	0.47
Driveway	0.00
Interstate	1.57
Local road	33.68
Ramp	0.27
State/county highway	1.18
Wastewater Line	26.15
Grand Total	**108.87**

4.5.1.11 Changes in Development and Future Trends

Fuel reduction projects are ongoing on federal, state, and private lands in the City of Shasta Lake. Such projects include vegetation management, broadcast burning, pre-commercial thinning, and the removal of dead, dying, and diseased trees. Historically, the City of Shasta Lake has not had much presence of citizen groups around wildfire prevention such as Fire Safe Councils. This is slowly changing, with the recent establishment of the Shasta County Fire Safe Council (SCFSC). SCFSC provides resources for coordination, communication, and support to decrease catastrophic wildfire throughout Shasta County. These efforts could result in additional wildfire planning within the City of Shasta Lake, furthering many mitigation actions identified by the City.

4.5.1.12 Wildfire Problem Statements

As part of the mitigation action identification process, the Planning Committee first examined geographic locations of different wildfire hazard severity zones, utilizing CAL FIRE wildfire hazard severity zone data. The Planning Committee then identified issues and weaknesses, also called "problem statements," for city facilities. Identification was based on the risk assessment and vulnerability analysis utilizing the RAMP mapping tool and wildfire data. Wildfire problem statements for the city are listed in Table 4-17.

Identifying these common issues and weaknesses assists the Planning Committee in understanding the realm of resources needed for mitigation. The goal is to have at least one mitigation action for every problem statement. See Table 5-6 for a full list of mitigation actions and the corresponding problem

statements that they address. Each problem statement is coded with a problem number for cross-referencing between Table 4-17 and Table 5-6.

Table 4-17 Wildfire Problem Statements

Problem No.	Hazard Type	Area of Concern	Mitigation Alternatives	Primary Agency	Problem Description	Related MA
ps-WF-SL-16	Wildfire	Threat	PRV - Prevention	**City of Shasta Lake**	Lack of established fuel breaks in many problem areas of City (e.g. herbicide, annual trimming)	ma-WF-SL-12, ma-WF-SL-14, ma-WF-SL-15
ps-WF-SL-17	Wildfire	Threat	PRV - Prevention	**City of Shasta Lake**	Fire fuel present on vacant properties poses a wildfire risk.	ma-WF-SL-9, ma-WF-SL-12, ma-WF-SL-13, ma-WF-SL-17
ps-WF-SL-18	Wildfire	Threat	PPRO - Property Protection	**City of Shasta Lake**	Many properties have excess of fuels (including trash) and dead tree canopies above house roof lines	ma-WF-SL-9, ma-WF-SL-12, ma-WF-SL-13, ma-WF-SL-17
ps-WF-SL-19	Wildfire	Threat	ES - Emergency Services	**City of Shasta Lake**	Some properties still have a lack of street addressing visible for emergency services.	ma-AH-SL-18
ps-WF-SL-20	Wildfire	Threat	SP - Structural Projects	**City of Shasta Lake**	many neighborhoods in the City lack secondary access for emergency evacuation.	ma-WF-SL-16
ps-WF-SL-21	Wildfire	Threat	SP - Structural Projects	**City of Shasta Lake**	Poor water supply/pressure in some areas west of Lake Blvd.	ma-WF-SL-10
ps-WF-SL-22	Wildfire	Threat	PRV - Prevention	**City of Shasta Lake**	Continuous/heavy fuel build-ups near on the northern and western portions of the city; areas of Duval Street, Manor Drive, Linda Vista Drive and Black Canyon Road.	ma-WF-SL-14, ma-WF-SL-15
ps-WF-SL-23	Wildfire	Victim	PE&A - Public Education & Awareness , SP - Structural Projects	**City of Shasta Lake**	Many residents lack education about property maintenance and reducing wildfire risk.	ma-WF-SL-10, ma-WF-SL-11, ma-WF-SL-12, ma-WF-SL-13
ps-WF-SL-24	Wildfire	Threat	SP - Structural Projects	**City of Shasta Lake**	Some roads in the City lack infrastructure and turnarounds to support emergency vehicles	ma-WF-SL-16
ps-WF-SL-31	Wildfire	Threat	PRV - Prevention , PPRO - Property Protection	**City of Shasta Lake**	City and partners struggle to fund ongoing maintenance of wildfire mitigation projects.	ma-WF-SL-14

4.5.2 Flood Hazard Profile

Flooding is one of the three primary hazards in California, along with earthquake and wildfire, and represents the second most destructive source of hazard, vulnerability, and risk statewide. (Cal OES, 2018) Flooding is a priority hazard for the City of Shasta as well.

Connections between a river and its floodplain are most apparent during and after major flood events. A **floodplain** is the area adjacent to a river, creek, or lake that becomes inundated during a flood. Floodplains may be broad, as when a river crosses an extensive flat landscape, or narrow, as when a river is confined in a canyon. These areas form a complex physical and biological system that supports a variety of natural resources and provides natural flood and erosion control. When a river is separated from its floodplain with levees and other flood control facilities, its natural, built-in benefits can be lost, altered, or significantly reduced. (FEMA, 2020)

There are three types of flood events that might occur within the City of Shasta Lake area: riverine, flash, and urban stormwater. Regardless of the type, the cause is primarily the result of extreme weather and excessive rainfall, either in the flood area or upstream reach. (The National Severe Storms Laboratory, 2020)

Riverine flooding, the most common type of flood event, occurs when a watercourse exceeds its bank-full capacity. Riverine flooding occurs as a result of prolonged rainfall that is combined with saturated soils from previous rain events, or combined with snowmelt, and is characterized by high peak flows of moderate duration and by a large volume of runoff. Riverine flooding occurs in river systems whose tributaries drain large geographic areas and can include many watersheds and sub-watersheds. The duration of riverine floods varies from a few hours to many days. Factors that directly affect the amount of flood runoff include precipitation amount, intensity and distribution, soil moisture content, channel capacity, seasonal variation in vegetation, snow depth, and water-resistance of the surface due to urbanization. (*Id.*)

In Shasta Lake, riverine flooding can occur anytime during the period from November through May. Flooding is more severe when antecedent rainfall has resulted in saturated ground conditions and often results in flooding to a number of streams. Specifically, the City's topography provides sufficient slope to expediently disperser storm water runoff downstream, however, heavy rain events can cause critical capacities for some of the small streams from time to time.

The term "flash flood" describes localized floods of great volume and short duration, generally in less than four hours. In contrast to riverine flooding, this type of flood usually results from a heavy rainfall in a relatively small drainage area. Precipitation of this sort usually occurs in the spring and summer.

Urbanization may increase peak flow runoff as well as the total volume of stormwater runoff from a site. The increase is dependent upon the type of soil and its topography in relation to the proposed development. Comparison of the peak flow and volume impacts to the watershed should be analyzed whenever development is proposed to assure that any increases are accommodated. (USGS, 2016)

Flooding may be a secondary impact from an earthquake, and may cause failure of dams, canal banks, or where landslides block drainage channels, streams, and/or rivers. *See* Section 4.5.5 for the Earthquake Hazard Profile.

FEMA Floodplain Definitions

100-YR Floodplain
The boundaries of the 100-YR floodplain coincide with an annual risk of 1% and are a FEMA study product consisting of both floodway and flood fringe.

500-YR Floodplain
The boundaries of the floodplain coincide with an annual risk of 0.2% and are a FEMA study product. The 500-YR floodplain includes the 100-YR.

Floodway
This includes the channel of the tributary and the land adjacent to it. This zone needs to remain free from obstruction so the 100-YR flood can be conveyed downstream.

Flood Fringe
This is the remaining portion of the 100-YR floodplain, excluding the floodway. This zone can be obstructed or developed if criteria are met.

Special Flood Hazard Area (SFHA)
An area having special flood, mudflow, or flood-related erosion hazards and shown on a Flood Insurance Rate Map (FIRM). The SFHA is the area where the National Flood Insurance Program's (NFIP) floodplain management regulations must be enforced.

Floodplain Ecosystems

Floodplains can support ecosystems that are rich in quantity and diversity of plant and animal species. A floodplain can contain 100 or even 1,000 times as many species as a river. Wetting of the floodplain soil releases an immediate surge of nutrients left over from the last flood and resulting from the rapid decomposition of organic matter that had accumulated. Microscopic organisms thrive, and larger species enter a rapid breeding cycle. Opportunistic feeders, particularly birds, move in to take advantage. The production of nutrients peaks and falls away quickly; however, the surge of new growth endures for some time. This makes floodplains particularly valuable for agriculture. Species growing in floodplains are markedly different from those that grow outside floodplains. For instance, trees in floodplains and riparian areas tend to be very tolerant of root disturbance and very quick-growing compared to non-riparian trees.

Floodplains that are undisturbed or have been restored to a natural state provide many benefits to both human and natural systems. In their natural vegetative state, undisturbed floodplains provide the following benefits:

- Slow the rate at which incoming surface runoff reaches the main body of water, slowing down the impact of flood events.

- Maintain water quality by allowing surface runoff to drop sediment into the natural soil, preventing it from depositing in streams and rivers.
- Recharge groundwater. The slowing of runoff allows additional time for the runoff to recharge existing groundwater aquifers.
- Provide habitat for large and diverse populations of plants and animals.

Floodplains are often compromised by human development. Because they border water bodies, floodplains have historically been popular sites to establish settlements. Human activities tend to concentrate on floodplains because water is readily available, the land is fertile and suitable for farming, transportation by water is easily accessible, and the land is flatter and easier to develop.

Human activity in floodplains frequently interferes with the natural function of floodplains. It can affect the distribution and timing of drainage, thereby increasing flood problems. Human development can create local flooding problems by altering or confining drainage channels. This increases flood potential in two ways: it reduces the stream's capacity to contain flows, and it increases flow rates or velocities downstream during all stages of a flood event. Human activities can interface effectively with a floodplain as long as steps are taken to mitigate the activities' adverse impacts on floodplain functions.

4.5.2.1 Plans, Policies, and Regulatory Environment

National Flood Insurance Program (NFIP)

The NFIP makes federally-backed flood insurance available to homeowners, renters, and business owners in participating communities. The City of Shasta Lake participates in NFIP. Table 4-18 lists NFIP and CRS statistics for the city.

For most participating communities, FEMA has prepared a detailed Flood Insurance Study (FIS). The study presents water surface elevations for floods of various magnitudes, including the 1-percent annual chance flood (the 100-YR flood) and the 0.2-percent annual chance flood (the 500-YR flood).

Base-flood elevations and the boundaries of the 100- and 500-YR floodplains are shown on Flood Insurance Rate Maps (FIRMs), which are the principal tool for identifying the extent and location of the flood hazard. FIRMs also designate and display the floodway, which is the channel of the river or stream and adjacent land that must remain free from obstruction so that the 100-YR flood can be conveyed downstream. FIRMs are the most detailed and consistent data source available, and for many communities, they represent the minimum area of oversight under their floodplain management program. The most recent FIRM identified for the city was completed in 2011.

Participants in the NFIP must, at a minimum, regulate development in floodplain areas in accordance with NFIP criteria. Before issuing a permit to build in a floodplain, participating jurisdictions must ensure that three criteria are met:

- New buildings and those undergoing substantial improvements must, at a minimum, be elevated to protect against damage by the 100-YR flood;

- New floodplain development must not aggravate existing flood problems or increase damage to other properties; and
- New floodplain development must exercise a reasonable and prudent effort to reduce its adverse impacts on threatened salmonid species.

Structures permitted or built in the County before December 31, 1974, are called "pre-FIRM" structures, and structures built afterward are called "post-FIRM." Post-FIRM properties are eligible for reduced flood insurance rates. Such structures are less vulnerable to flooding since they were constructed after regulations and codes were adopted to decrease vulnerability. Pre-FIRM properties are more vulnerable to flooding because they do not meet code or are located in hazardous areas. The insurance rate is different for the two types of structures.

Compliance is monitored by FEMA regional staff and by the California Department of Water Resources under a contract with FEMA. Maintaining compliance under the NFIP is an important component of flood risk reduction. All participating jurisdictions that participate in the NFIP have identified initiatives to maintain their compliance and good standing.

Community Rating System (CRS)

The CRS is a voluntary program within the NFIP that encourages floodplain management activities that exceed the minimum NFIP requirements. The City of Shasta Lake is not a member of CRS currently. Table 4-18 lists NFIP and CRS statistics for the city.

For CRS member jurisdictions, flood insurance premiums are discounted to reflect the reduced flood risk resulting from community actions that meet the three goals of the CRS: 1) reduce flood losses, 2) facilitate accurate insurance rating, and 3) promote awareness of flood insurance. Rates are discounted in increments of 5 percent according to the community's classification. For example, a Class 1 community would receive a 45 percent premium discount, and a Class 9 community would receive a 5 percent discount. Class 10 communities are those that do not participate in the CRS; they receive no discount. The CRS classes for local communities are based on 18 creditable activities related to public information, mapping and regulations, flood damage reduction, and flood preparedness.

Table 4-18: Flood Insurance Statistics for the City of Shasta Lake

NFIP and CRS Status & Information	
City of Shasta Lake	
NFIP Status	10/22/97
CRS Class	N/A
Policies in Force	7
Policies in SFHA	3
Policies in non-SFHA	4
Total Claims Paid	$456,226
Paid Losses	13
Repetitive Loss Properties	0 (awaiting FEMA confirmation)
Severe Repetitive Loss Properties	0 (awaiting FEMA confirmation)
Repetitive Loss Payment by NFIP on Building	N/A
Repetitive Loss Payment by NFIP on Contents	N/A

Source: FEMA CIS 2021, OpenFEMA Data, FIMA RUL City of Shasta Lake

Note: Policies and claims provided directly from FEMA Region IX CIS Report (8/2021). Repetitive loss tabulations by jurisdiction derived via GIS-based intersect of data available at OpenFEMA Data (https://www.fema.gov/about/openfema/data-sets). Countywide data reported for entire county area including municipalities.The Privacy Act of 1974 (5 U.S.C. 522a) restricts the release of certain types of data to the public. Flood insurance policy and claims data are included in the list of restricted information. FEMA can only release such data to state and local governments, and only if the data are used for floodplain management, mitigation, or research purposes. Therefore, this plan does not identify the repetitive loss properties or include claims data for any individual property.

Cobey-Alquist Floodplain Management Act

The Cobey-Alquist Floodplain Management Act of 1965 provided state-level guidance and review of floodplain management, including the review of floodplain management plans, establishment of floodplain management regulations, and the use of designated floodways. The California Department of Water Resources (DWR) adopts regulations, maintains a statewide flood management data collection and planning program, manages a statewide grant program, and helps coordinate emergency flood response operations.

Central Valley Flood Protection Board and Sacramento-San Joaquin Drainage District

The Central Valley Flood Protection Board (CVFPB), formerly known as the California State Reclamation Board, is the regulating authority over flood risk management in the Central Valley and the Sacramento-San Joaquin Drainage District. In addition, CVFPB is charged with the review and adoption the Central Valley Flood Protection Plan (CVFPP). The CVFPB's governing body consists of seven Governor-appointed and Senate-confirmed members. The board works in close partnership with the Department of Water Resources (DWR), the US Army Corp of Engineers (USACE), and stakeholders to implement the CVFPP. The CVFPB also works closely with the California Department of Fish and Wildlife, US Fish and Wildlife, and the National Marine Fisheries Service to evaluate the environmental impacts of flood control.

The area of the board's jurisdiction includes the entire Central Valley, including all tributaries and distributaries of the Sacramento and San Joaquin Rivers and Tulare and Buena Vista basins. Shasta Lake encompasses the headwaters of the upper Sacramento watershed under CVFPB jurisdiction but does not have any levees or other flood maintenance structures under CVFPB jurisdiction within city limits.

Urban Water Management Plans (UWMP)

Jurisdictions either supplying over 3,000 acre-feet of water annually or serving more than 3,000 urban connections are required to submit an UWMP and update these plans every five years. The City of Shasta Lake has a 2020 UWMP. Most relevant to flood mitigation, UWMPs explore stormwater capacity and assist in planning and funding future stormwater needs. UWMPs contain important information on long-term water supply planning and managing demands in times of drought, so UWMPs are important for drought hazard planning and discussed in Section 4.5.4.2. (CDWR, 2021)

City of Shasta Lake General Plan

The 1999 City of Shasta Lake General Plan includes a number of policies in its Public Health and Safety Group that provide for City-wide flood protection. These policies prioritize the protection of public health and safety through floodplain management that regulates the types of land uses which may locate in the floodplain, prescribes construction designs for floodplain development, and requires mitigation measures for development that would impact the floodplain by increasing runoff quantities.

Flood Damage Prevention in the City of Shasta Lake Municipal Code, § 15.04.

The City of Shasta Lake Municipal Code contains provisions designed to reduce flood loss and to protect loss of property and life. New development in the floodplain must meet strict standards and be approved by the floodplain administrator. This includes special attention to the management of altered natural floodplains, stream channels, and natural protective barriers, which help accommodate or channel floodwaters; the management of filling, grading, dredging, and other development which may increase flood damage; and the prevention and regulation of the construction of flood barriers which will unnaturally divert floodwaters, or which might increase flood hazards in alternate areas. The Code prohibits encroachments, which include fill, new construction, substantial improvement, and other new development unless certified by a registered professional engineer and approved by the City.

4.5.2.2 Major Flood Events

Table 4-19 shows the flood events that took place in the County of Shasta since the year 2000. Floods in February 2017 and December 2014 were particularly costly, with $250,000 in reported damages. (NOAA, 2020)

Table 4-19: Shasta County Flood Events Since 2000

Date	Flood Type	Property Damage Value ($)
7/4/2000	Flood	N/A
10/3/2008	Flash Flood	$10,000
10/18/2009	Flash Flood	$30,000
12/2/2012	Flood	N/A
9/25/2014	Flood	N/A
10/25/2014	Flash Flood	N/A
12/11/2014	Flood	$50,000
2/20/2017	Flood	$200,000
4/6/2018	Flood	N/A
4/6/2018	Flood	N/A
2/25-26/2019	Flood	$10,000
3/27/2019	Flash Flood	$27,000
4/2/2019	Flood	N/A
4/5/2019	Flash Flood	$50,000
4/8/2019	Flood	N/A
12/7/2019	Flood	N/A
5/18/2020	Flood	N/A
11/18/2020	Flood	N/A

Source: NOAA Storm Events Database – N/A – No Damage was reported in database,

4.5.2.3 Location

The City of Shasta Lake, due to its varied geography and climate, has a significant number of potential flood sources. Figure 4-23 depicts FEMA flood zones within the City of Shasta Lake. More detailed views of FEMA flood zones are available for participating jurisdictions through the Risk Assessment Mapping Platform (RAMP) on mitigatehazards.com/shastalakehmp/ramp/.

The drainage pattern for the City of Shasta Lake general flows from north to south. There are three major streams that begin north of the city, flow through the city and travel south into Redding on their way to the Sacramento River. The westernmost stream is Churn Creek, which drains 6,000 acres when it leaves the city. The second stream is Salt Creek, which drains 2,424 acres as it leaves the city. Salt Creek collects runoff from the central core of Shasta Lake and converges with Churn Creek at the City of Redding. Finally, Moody Creek the easternmost stream drains approximately 2,580 acres, a small area at the eastern-most portions of the city.

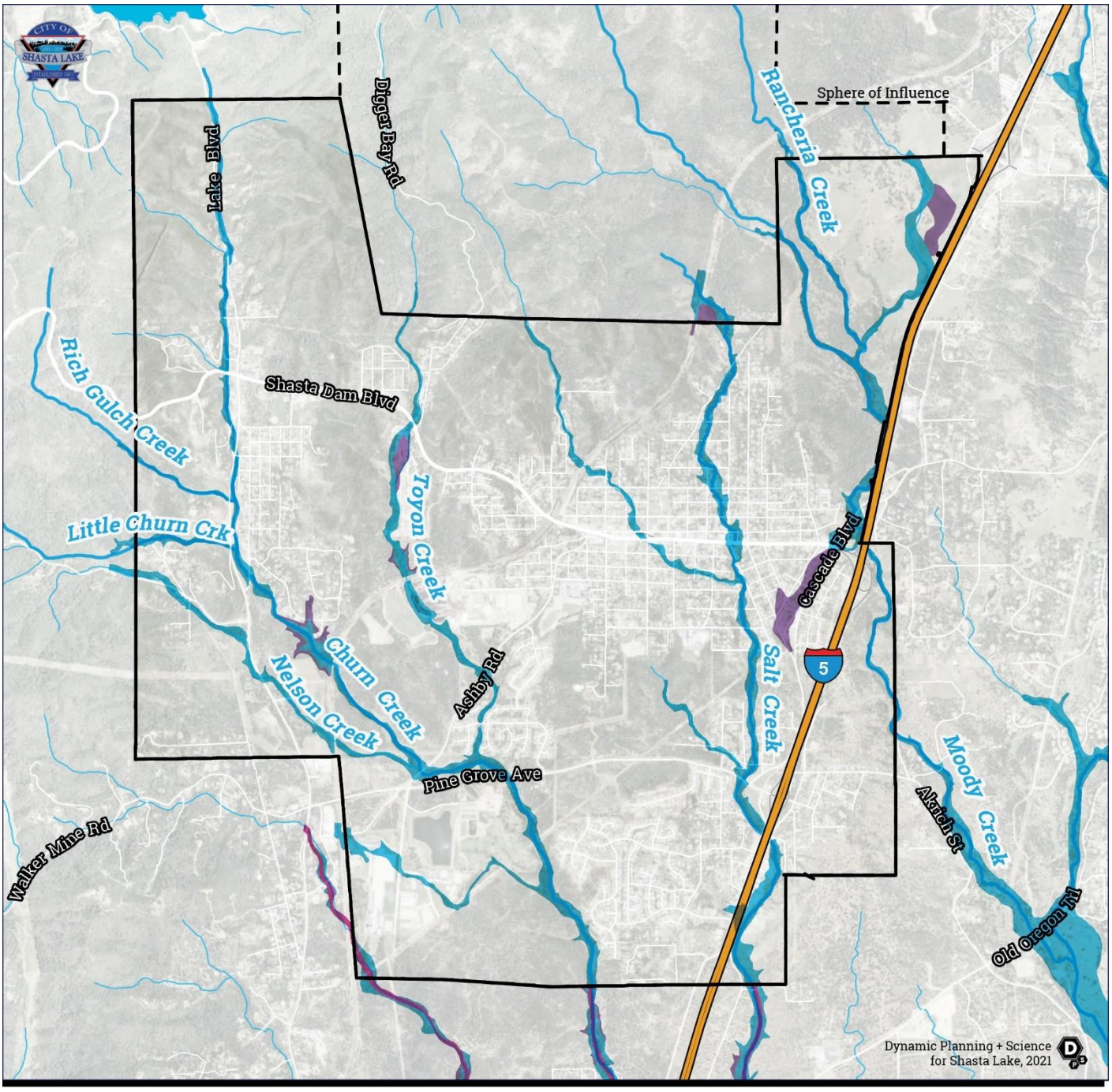
The extent of flooding associated with a 1-percent annual probability of occurrence (the base flood or 100-YR flood) is used as the regulatory boundary by many agencies and helps identify the location and extent of flooding in areas across the City of Shasta Lake. This area, the special flood hazard area (SFHA), is a

convenient tool for assessing vulnerability and risk in flood-prone communities. Figure 4-23 shows the FEMA 100-YR and 500-YR floodplain zones, calculated based on a flood that has a 1-percent (100-YR) and 2-percent (500-YR) chance of occurring in any given year. Vulnerabilities to flood within these flood zones are included in Section 4.5.2.10.

4.5.2.4 Measuring Frequency and Severity

The frequency and severity of flooding are measured using a discharge probability, a statistical tool that defines the probability that a certain river discharge or flow level will be equaled or exceeded within a given year. Flood studies use historical records to determine the probability of occurrence for the different discharge levels. The flood frequency equals 100 divided by the discharge probability. For example, the 100-YR discharge has a 1-percent chance of being equaled or exceeded in any given year. The "annual flood" is the greatest flood event expected to occur in a typical year. These measurements reflect statistical averages only; it is possible for two or more floods with a 100-YR or higher recurrence interval to occur in a short time period. The same flood can have different recurrence intervals at different points on a river.

The extent of flooding associated with a 1-percent annual probability of occurrence (the base flood or 100-YR flood) is used as the regulatory boundary by many agencies. Also referred to as the special flood hazard area (SFHA), this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities. Many communities have maps that show the extent and likely depth of flooding for the base flood. Corresponding water-surface elevations describe the elevation of water that will result from a given discharge level, which is one of the most important factors used in estimating flood damage.



FEMA Flood Risk Exposure

Shasta Lake

*Data sources: FEMA.

100-YR | FLOODWAY

500-YR

Figure 4-23: City of Shasta Lake Flood Exposure

4.5.2.5 Frequency and Probability of Future Occurrences

The City of Shasta Lake will experience flooding in the future, with the probability of flooding in the City of Shasta Lake between 10 and 100% annually. For background on measuring frequency, see above Section 4.5.2.4. The majority of the floods in the City of Shasta Lake have occurred from winter-through-spring rainfall, but several have been the result of heavy rain events during July, August, and September. The North Pacific high is known to cause increased intensity in weather patterns. As it moves southwards, it encourages storm formation across the state, producing widespread rain at low elevations and snow at high elevations. It is responsible for occasional heavy rains that are known to cause serious flooding. The semi-permanent high-pressure area of the north Pacific Ocean is also responsible for storms, causing heavy rains and widespread flooding during winter months. (Western Regional Climate Center, 2020)

Flooding in California is often associated with the El Nino weather phenomenon. El Nino is a term originally used to describe the appearance of warm (surface) water from time to time in the eastern equatorial Pacific region along the coasts of Peru and Ecuador. This ocean warming can strongly affect weather patterns all over the world. El Nino events are often associated with above-normal precipitation in the southwestern United States. El Niños often occur during the Christmas season. La Niña is the opposite or "cold phase" of the El Niño cycle. Current understanding suggests that El Niño has a return period of four to five years. When an El Niño event occurs, it often lasts from 12 to 18 months. (NOAA, 2020)

4.5.2.6 Severity and Extent

The main factors affecting flood damage are water depth and velocity. Deeper and faster flood flows can cause more damage. Shallow flooding with high velocities can cause as much damage as deep flooding with slow velocity. This is especially true when a channel migrates over a broad floodplain, redirecting high velocity flows and transporting debris and sediment. Figure 4-25 shows FEMA predictions for the extent of a 100-YR and 500-YR flood in the City of Shasta Lake.

Flood severity is often evaluated by examining peak discharges; FEMA Flood Insurance Mapping Studies (FIS) use peak flows to map the City of Shasta Lake Floodplains. Table 4-20 provides some highlights of peak flows in the 2011 FEMA FIS.

Table 4-20: Summary of Discharges of Major Waterways in the City of Shasta Lake

	Drainage sq. Miles	Peak Discharge (cubic feet/second)			
Flooding Source/Location		10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Churn Creek					
At Shasta Dam Boulevard	1.28	690	1,100	1,300	1,500
Upstream of Rich Gulch Creek	1.84	940	1,500	1,700	2,100
Downstream of Rich Gulch Creek	2.51	1,200	2,000	2,300	2,800
Upstream of Little Churn Creek	2.54	1,300	2,100	2,300	2,900

Flooding Source/Location	Drainage sq. Miles	Peak Discharge (cubic feet/second)			
		10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Downstream of Little Churn Creek	3.87	1,800	3,000	3,300	4,100
At County Road A18	3.89	1,800	3,000	3,300	4,100
Upstream of Nelson Creek	4.32	1,900	3,200	3,600	4,400
Downstream of Nelson Creek	5.44	2,300	3,900	4,300	5,500
Upstream of Churn Creek North Branch	5.53	2,400	3,900	4,400	5,500
Downstream of Churn Creek North Branch	8.10	3,500	5,700	6,400	8,000
Upstream of Churn Creek North Branch	5.50	3,600	5,900	6,600	8,300
Downstream of Churn Creek South Branch	9.34	3,900	6,300	7,100	9,000
3,200 feet upstream of Oasis Road	9.55	3,900	6,400	7,200	9,100
1,900 feet upstream of Oasis Road	9.68	3,900	6,500	7,300	9,200
At Confluence with Churn Creek North Branch	7.60	2,640	3,790	4,190	5,380
Upstream of Confluence with Newton Creek	8.90	2,830	4,070	4,520	5,900
At Rancho Road	33.90	6,900	10,400	11,900	16,000
Churn Creek at North Branch					
At Shasta Dam Boulevard	1.08	560	930	1,000	1,300
At Southern Pacific Railroad	1.50	710	1,200	1,300	1,600
Upstream of Confluence with Churn Creek	2.57	1,100	1,800	2,000	2,500
Churn Creek South Branch					
Upstream of Confluence with Churn Creek	0.54	238	416	488	628
Moody Creek					
1,500 feet downstream of Southern Pacific Railroad	0.80	420	660	740	900
Upstream of Rancheria Creek	1.57	800	1,300	1,400	1,700
Downstream of Rancheria Creek	3.69	1,800	2,900	3,200	4,000
At Interstate 5	4.43	2,100	3,400	3,800	4,700
3,500 feet downstream of Interstate 5	4.71	2,200	3,500	4,000	4,900
5,500 feet downstream of Interstate 5	4.91	2,300	3,600	4,100	5,000
2,500 feet downstream of Oasis Road	5.21	2,400	3,800	4,200	5,300
Salt Creek					
Upstream of Salt Creek North Branch	1.11	610	990	1,100	1,400
Downstream of Salt Creek North Branch	2.03	920	1,500	1,700	2,100
Upstream of Salt Creek South Branch	2.40	1,100	1,700	2,000	2,500
Downstream of Salt Creek South Branch	2.80	1,300	2,000	2,300	2,900
Upstream of Interstate 5	2.92	1,300	2,100	2,400	3,000

Flooding Source/Location	Drainage sq. Miles	Peak Discharge (cubic feet/second)			
		10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Downstream of Interstate 5	3.37	1,500	2,400	2,800	3,500
Upstream of Mendocino Street	3.47	1,500	2,400	2,800	3,600
Downstream of Mendocino Street	3.75	1,700	2,600	3,000	3,900
400 feet downstream of Crooked Oak Lane	3.89	1,700	2,700	3,100	4,000
1,000 feet upstream of Oasis Road	4.14	1,800	2,800	3,300	4,200
At Confluence with Churn Creek	5.00	1,590	2,270	2,470	3,200
Salt Creek North Branch					
At Southern Pacific Railroad	0.67	290	470	540	680
Upstream of confluence with Salt Creek	0.92	390	630	730	920
Salt Creek South Branch					
Upstream of confluence with Salt Creek	0.38	180	300	350	450

Source: Selection taken from Table 6 Summary of Discharges from FEMA FIS Text, 2011
Note: see original text for additional information, including footnotes.

4.5.2.7 Warning Time

The type and rate of flooding experienced in the City of Shasta Lake varies. In general, warning times for floods can be between 24 and 48 hours to prepare communities to reduce flood damages; however, this time can be reduced dramatically by thunderstorm activity and during extreme weather events. Seasonal notification for flooding can enhance awareness for citizens at risk, and, when communicated effectively, advance notification can reach target audiences on a large scale.

4.5.2.7.1 DWR Awareness Zones Notification

The Flood Risk Notification Program (FRN Program) is part of DWR's FloodSAFE California Initiative. The program's key goal is to increase flood risk awareness by effectively communicating that risk to individual property owners, the public, and local, state, and federal agencies. This includes encouraging people to understand the levee system that protects them; be prepared and aware of their flood risk; and take appropriate actions before, during, and after flooding to protect themselves, minimize damage to their property or personal possessions, and facilitate recovery.

To achieve this goal, the FRN Program:

- sends out an annual notice to property owners whose property is at risk of flooding,
- maintains accurate Levee Flood Protection Zone (LFPZ) maps and an associated parcel information database,
- provides people with useful ways to assess risk and reduce flood loss,

- establishes outreach and educational projects with public involvement,
- expands its interactive Flood Risk Notification website, and
- collaborates with federal agencies, local agencies, and communities.

The notice informs recipients of their property's potential flood risks and potential sources of flooding and offers flood emergency planning and preparedness tips. It encourages recipients to take preventative actions such as purchasing flood insurance, elevating or "floodproofing" their buildings, and preventing blockage of channels, drains, and ditches.

4.5.2.8 Secondary Hazards

The most problematic secondary hazard for flooding is bank erosion and landslides, which in some cases can be more harmful than actual flooding. Hazardous materials spills are a secondary hazard of flooding if storage tanks rupture and spill into streams or storm sewers. Wildland fires within a watershed can exacerbate flood hazards by virtue of increased rate and volume of runoff and attendant erosion and sediment discharge. (USGS, 2020)

Public Health

Following any natural disaster that leaves excess moisture or standing water in its wake, such as a flood, the risk of mold growth in homes or other buildings greatly increases. Controlling moisture within a structure is the most critical factor for preventing mold growth. Any exposed buildings should be cleaned up and dried out quickly, within about 24 to 48 hours if possible, and any remaining wet porous items should be removed. People with asthma, allergies, respiratory conditions, or immune suppression are at the greatest risk for health effects from contact with mold. (CDC, 2020)

4.5.2.9 Climate Change Impacts

The effects of climate change are varied and include warmer and more varied weather patterns, melting ice caps, and poor air quality, for example. As a result, climate change will likely worsen a number of natural hazards, including flooding. Climate change will shift rainfall patterns, making heavy rains more frequent in many areas. An increase in heavy rain events will lead to more flooding, including flash floods that happen suddenly as a result of heavy rain and localized flooding, which involves the pooling of water in low-lying areas. Heavy rain events can inundate and overwhelm stormwater drainage systems resulting in localized flooding where pooling of water can cause significant damage to buildings. Overwhelmed stormwater drainage facilities also create hazardous conditions on roadways where water pools in low lying areas creating dangerous driving conditions. (EPA, 2020)

4.5.2.10 Flood Vulnerability Analysis

Both an exposure analysis and Hazus loss estimation analysis were conducted to develop the flood vulnerability analysis for the City of Shasta Lake. Flood exposure numbers were generated using the inventories outlined in 4.5.2.10.1 City inventories were overlaid with FEMA delineated flood plains to determine exposure. These risk assessment exposure analysis values do not include Hazus -generated results.

Hazus flood vulnerability data was generated using a Level 2 Hazus 4.2 analysis. Hazus is a FEMA software product that uses a GIS to analyze 100-YR depth grids derived from FEMA 100-YR "A" zones with Base Flood Elevations (BFE) to estimate loss. Parcel data defined in 4.5.2.10.1 was imported into Hazus as User Defined Facilities (UDF) and serves as the basis for replacement and content cost estimations as well as associated loss. Where flood vulnerability is mentioned absent of Hazus, exposure analysis figures are used. Figure 4-25 displays a snapshot of flood exposure and damage estimation in the City of Shasta Lake.

4.5.2.10.1 Flood Exposure

The tables and graphs in this section detail the populations, properties, and infrastructure exposed to flooding in the City of Shasta Lake. Flood exposure is categorized by exposure to different flood hazard zones, including the floodway, flood fringe, 100-YR floodplain, and 500-YR floodplain. The tables and graphs also include a category of the 100-year total, which is a combined total of floodway, flood fringe, and 100-YR floodplain categories. The 500-YR sans 100-YR category includes only the 500-YR floodplain, and the 500-YR total includes all of the categories combined. Refer to section 4.5.2 for floodplain definitions to better understand these flood hazard areas.

Population

Population counts of those living in the floodplain were generated by analyzing County assessor and parcel data that intersect with the 100-YR and 500-YR floodplains identified on FIRMs. Using GIS, U.S. Census Bureau information was used to intersect the floodplain, and an estimate of population was calculated by weighting the population within each census block and track with the percentage of the flood risk area. Using this approach, Table 4-21 and Figure 4-24 display the results of this analysis showing how much of the population of the City of Shasta Lake is exposed to flood hazard zones..

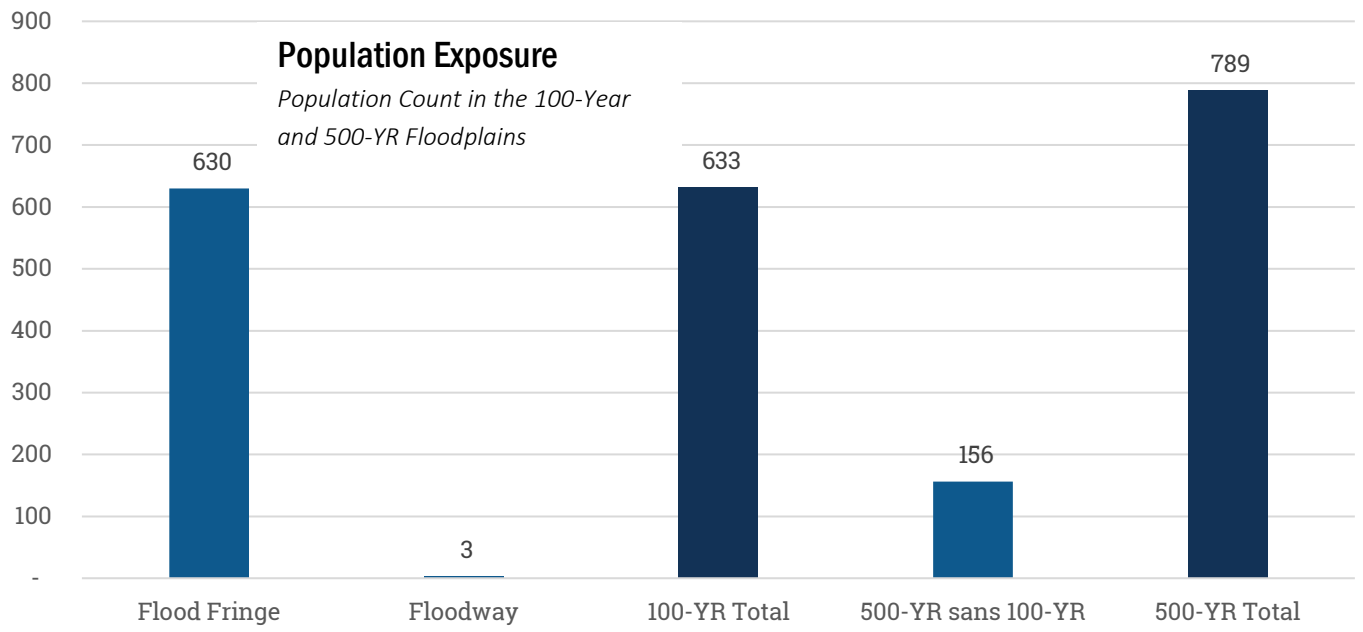


Figure 4-24: Population Exposure to Flood

Table 4-21: Summary Population Exposure to Flood

	Total Population
Shasta Lake	10,142

Flood Hazard Zone	Population Count	% of Total
Flood Fringe	630	*6.21%*
Floodway	3	*0.03%*
100-YR Total	633	*6.24%*
500-YR sans 100-YR	156	*1.54%*
500-YR Total	789	*7.78%*

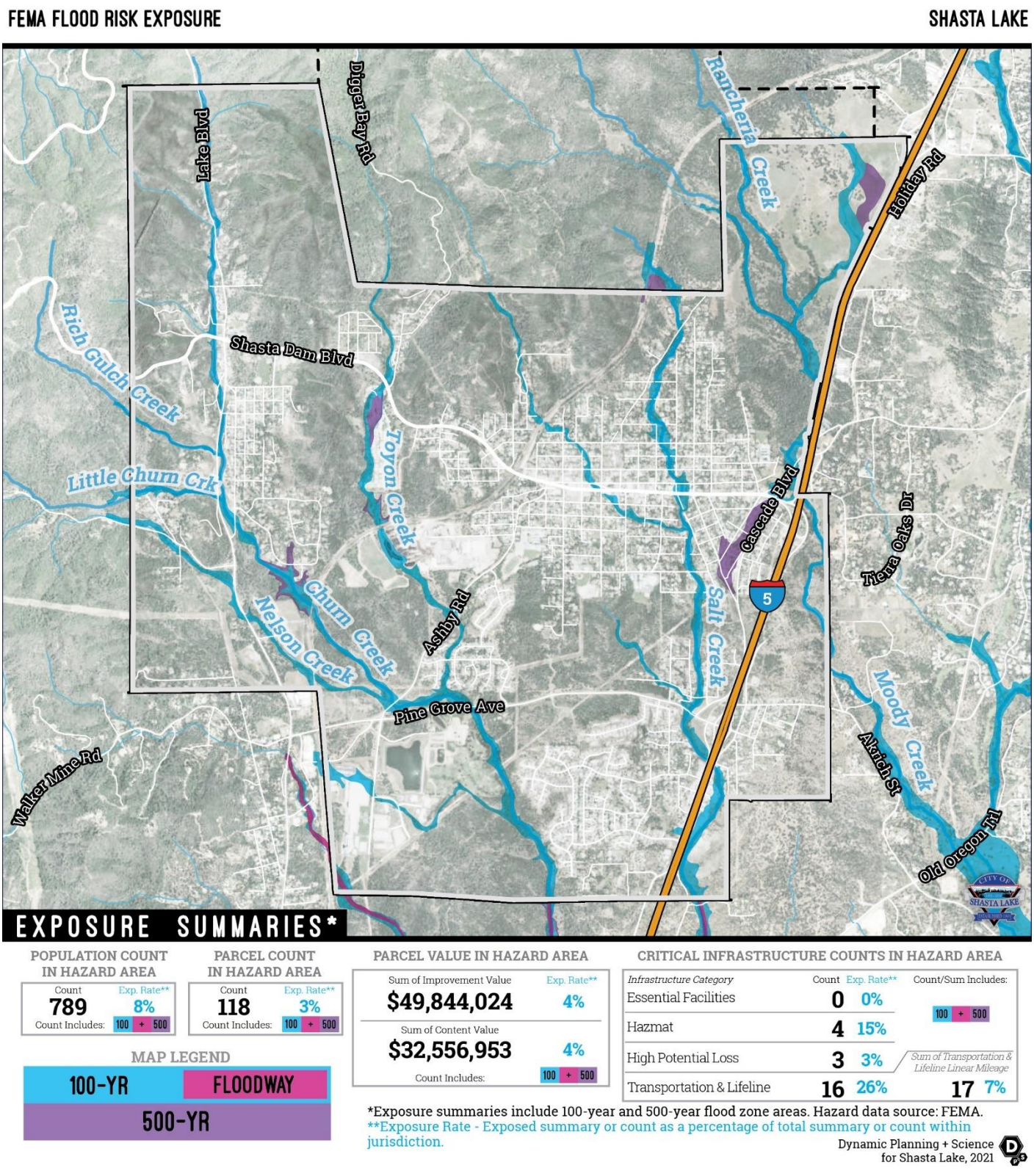


Figure 4-25: FEMA Flood Risk Exposure and Snapshot Map

Structures and Parcel Value

Table 4-22 summarizes parcels in the City of Shasta Lake that are exposed to flood hazard areas. The beginning of Section 4.5.2 includes definitions of the various flood hazard areas.

Table 4-22: Parcels Exposed to NFIP Flood Zones

	Total Improved Parcels	Total Market Value ($)	Total Content Value ($)	Total Value ($)
Shasta Lake	3,636	$1,320,294,215	$822,128,105	$2,142,422,319

Flood Hazard Zone	Parcel Count	% of Total	Market Value Exposure ($)	Content Value Exposure ($)	Total Exposure ($)	% of Total
Flood Fringe	78	*2.1%*	$22,432,111	$12,854,604	$35,286,715	*1.6%*
Floodway	0	*0.0%*	$0	$0	$0	*0.0%*
100-YR Total	78	2.1%	$22,432,111	$12,854,604	$35,286,715	1.6%
500-YR sans 100-YR	40	*1.1%*	$27,411,913	$19,702,349	$47,114,262	*2.2%*
500-YR Total	118	3.2%	$49,844,024	$32,556,953	$82,400,977	3.8%

Note: The table above does not display loss estimation results; the table exhibits total value at risk based upon the hazard overlay and Shasta County Assessor data.

Critical Facilities and Infrastructure

Table 4-23 summarizes the critical facilities and infrastructure located in the flood fringe, floodway, and 100-YR and 500-YR floodplains of the City of Shasta Lake. Table 425 summarizes the critical facilities and infrastructure located in areas protected by levees.

Table 4-23: Critical Facility Points in the Floodplain

Infrastructure Type	Flood Fringe	Floodway	100-YR Total	500-YR sans 100-YR	500-YR Total
Essential Facility	-	-	-	-	-
EOC	-	-	-	-	-
Fire Station	-	-	-	-	-
Law Enforcement	-	-	-	-	-
High Potential Loss	1	-	1	2	3
Adult Residential Facility	-	-	-	2	2
Animal Control	-	-	-	-	-
Child Care Center	-	-	-	-	-
City Hall	-	-	-	-	-
Community Center	-	-	-	-	-
Dam	-	-	-	-	-
FM Transmission Tower	-	-	-	-	-
Healthcare Facility	-	-	-	-	-
*Real Property Asset	1	-	1	-	1

Infrastructure Type	Flood Fringe	Floodway	100-YR Total	500-YR sans 100-YR	500-YR Total
School	-	-	-	-	-
Transportation and Lifeline	15	-	15	1	16
Bridge	12	-	12	-	12
Bus Facility	-	-	-	1	1
NG Station	-	-	-	-	-
Park	-	-	-	-	-
Railroad Bridge	1	-	1	-	1
Substation	-	-	-	-	-
Wastewater Facility	-	-	-	-	-
Wastewater Lift Station	2	-	2	-	2
Hazmat	2	-	2	2	4
Hazardous Waste Tracking System Active Facility	2	-	2	2	4
Grand Total	**18**	**-**	**18**	**5**	**23**

**Real Property Assets are digitized insurance rolls for demonstrating value and ownership and may have overlapping points with other categories such as fire stations and law enforcement.*

Linear Utilities

Roads or railroads that are blocked or damaged can isolate residents and can prevent access throughout the county, including for emergency service providers needing to get to vulnerable populations or to make repairs. Bridges washed out or blocked by floods or debris also can cause isolation. Water and sewer systems can be flooded or backed up, causing health problems. Underground utilities can be damaged.

Table 4-24: Lifelines in the Floodplain

Lifelines (miles) - Flood Risk Exposure					
Infrastructure Type (linear)	Flood Fringe	Floodway	100-YR Total	500-YR sans 100-YR	500-YR Total
NG Pipeline	0.3	-	0.3	-	0.3
Potable Water Line	3.8	-	3.8	0.9	4.7
Railroad	0.1	-	0.1	0.0	0.1
Street	3.5	-	3.5	0.9	4.4
Cul-de-sac	0.0	-	0.0	0.0	0.1
Driveway	0.1	-	0.1	0.3	0.4
Interstate	0.2	-	0.2	-	0.2
Local road	3.0	-	3.0	0.7	3.6
Ramp	0.1	-	0.1	-	0.1
State/county highway	0.1	-	0.1	-	0.1
Wastewater Line	6.4	-	6.4	1.1	7.5
Grand Total	**14.0**	**-**	**14.0**	**3.0**	**17.0**

Roads

Flooding can seriously affect roads within the City of Shasta Lake. Floodwaters can inhibit or prevent evacuation during emergencies. It can also pose a hindrance to the provision of emergency supplies, and it can isolate people during extreme weather emergencies.

Water and Sewer Infrastructure

Water and sewer systems can be affected by flooding. Floodwaters can back up drainage systems, causing localized flooding. Culverts can be blocked by debris from flood events, also causing localized urban flooding. Floodwaters can get into drinking water supplies, causing contamination. Sewer systems can be backed up, causing wastewater to spill into homes, neighborhoods, rivers, and streams.

4.5.2.10.2 Flood Damage Estimation

Hazus, FEMA's hazard damage estimation software described in detail in Section 4.4 and Appendix A, calculates losses to structures from flooding by analyzing the depth of flooding and type of structure. Using historical flood insurance claim data, Hazus estimates the percentage of damage to structures and their contents by applying established damage functions to an inventory. For this analysis, all non-vacant parcels with current market values were used instead of the default inventory data provided with Hazus. Table 4-25 and Figure 4-26 shows the 100-YR flood loss estimation (based on depth) in NFIP flood zones by occupancy type. Figure 4-27 and Table 4-26 shows the 500-YR flood loss estimation (based on depth) in NFIP flood zones by occupancy type.

The County's insurance data was obtained and formatted for use in Hazus for a detailed damage estimation of City-owned facilities. This combined government dataset has additional information, including the number of floors, building value, content value, and construction type that greatly enhances Hazus results. Table 4-25 displays damage estimation for City facilities located in the 100-YR flood zone.

Damage Estimation for 100-YR Floodplain

Table 4-25 and Figure 4-26 display damage estimation summaries for the 100-YR floodplain in the City of Shasta Lake by improved parcel and government property loss.

Table 4-25: 100-YR Flood Damage Estimation by Occupancy Type

Building Type	Building Damage ($)	Building Damage (% of total loss)	Content Damage ($)	Content Damage (% of total loss)	Total Damage ($)	Proportion of Loss (%)
Agriculture	$0	0.0%	$0	0.0%	$0	0%
Commercial	$80,237	1.1%	$287,672	4.0%	$367,909	5%
Education	$0	0.0%	$0	0.0%	$0	0%
Emergency	$0	0.0%	$0	0.0%	$0	0%
Government	$26,198	0.4%	$36,235	0.5%	$62,433	1%
Industrial	$8,568	0.1%	$17,770	0.2%	$26,337	0%
Religion	$0	0.0%	$0	0.0%	$0	0%
Residential	$5,177,784	72.3%	$1,523,114	21.3%	$6,700,898	94%
Total	**$5,292,787**	**74%**	**$1,864,791**	**26%**	**$7,157,577**	

Note: Total Inventory Values
1 - Building Replacement Costs = $1,323,260,139
2 - Content Replacement Costs = $784,659,353
3 - Total Value = $2,107,919,492

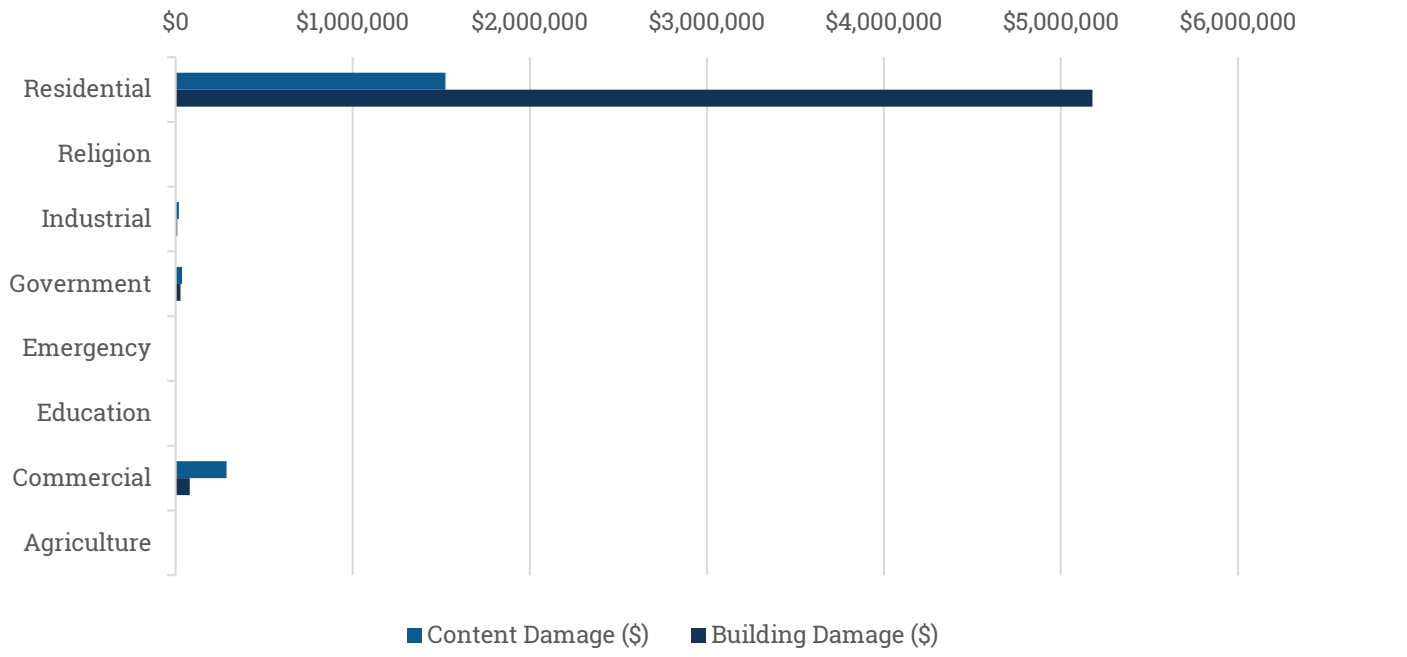


Figure 4-26: 100-YR Flood Damage Estimation by Occupancy

Damage Estimation for 500-YR Floodplain

Table 4-26 displays the damage estimation for the 500-YR floodplain in the City of Shasta Lake by improved parcel. Industrial facilities make up 1% of the estimated proportion of losses within the 500-YR floodplain.

Table 4-26: Damage Estimation Summary for 500-YR. Floodplain

Building Type	Building Damage ($)	Building Damage (% of total loss)	Content Damage ($)	Content Damage (% of total loss)	Total Damage ($)	Proportion of Loss (%)
Agriculture	$0	0.0%	$0	0.0%	$0	0%
Commercial	$364	0.0%	$8,192	0.1%	$8,556	0%
Education	$0	0.0%	$0	0.0%	$0	0%
Emergency	$0	0.0%	$0	0.0%	$0	0%
Government	$0	0.0%	$1	0.0%	$1	0%
Industrial	$11,575	0.2%	$31,986	0.5%	$43,561	1%
Religion	$0	0.0%	$0	0.0%	$0	0%
Residential	$4,761,544	67.3%	$2,264,513	32.0%	$7,026,057	99%
Total	**$4,773,483**	**67%**	**$2,304,691**	**33%**	**$7,078,174**	

Note: Total Inventory Values
1 - Building Replacement Costs = $1,323,260,139
2 - Content Replacement Costs = $784,659,353
3 - Total Value = $2,107,919,492

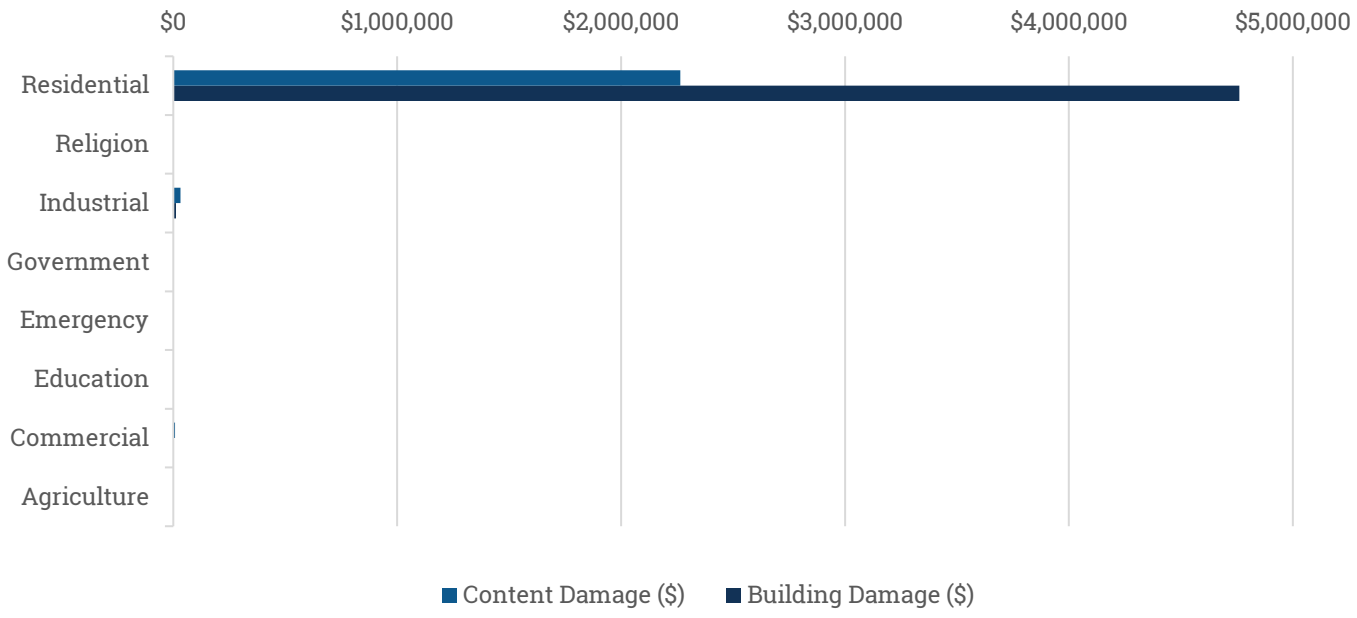


Figure 4-27: 500-YR Flood Damage Estimation by Occupancy Type

4.5.2.11 Future Trends in Development

The City is equipped to handle future growth within potential flood hazard areas through the application of strong development policies and standards. These General Plan policies and municipal code standards have been designed to help mitigate community flood hazards. The Municipal Code (§ 15.04. Provision for Flood Hazard Reduction) further limits and mitigates new development in floodplains.

The City and its Planning Committee are equipped to handle future growth within flood hazard areas. The municipal Planning Committee has a General Plan that address frequently flooded areas in its Safety Element. The planning committee has committed to linking its General Plan to this HMP. This will create an opportunity for wise land-use decisions as future growth encroaches on flood hazard areas.

4.5.2.12 Flood Hazard Problem Statements

As part of the mitigation action identification process, the Planning Committee identified issues and weaknesses, also called problem statements, for the City of Shasta Lake's facilities. Identification was based on the risk assessment and vulnerability analysis utilizing the RAMP mapping tool and flood data. Flood problem statements for the city are listed in Table 4-27.

Identifying these common issues and weaknesses assists the Planning Committee in understanding the realm of resources needed for mitigation. The goal is to have at least one mitigation action for every problem statement. See Table 5-6 for a full list of mitigation actions and the corresponding problem statements that they address. Each problem statement is coded with a problem number for cross-referencing between Table 4-27 and Table 5-6.

Table 4-27 Flood Problem Statements

Problem No.	Hazard Type	Area of Concern	Mitigation Alternatives	Primary Agency	Problem Description	Related MA
ps-FL-SL-7	Flood	Victim	PE&A - Public Education & Awareness , SP - Structural Projects	**City of Shasta Lake**	Property owners are unaware of their responsibility to maintain drainage ways or the possibility of City assistance to clear drainage ways.	ma-FL-SL-6
ps-FL-SL-8	Flood	Impact	PE&A - Public Education & Awareness , SP - Structural Projects	**City of Shasta Lake**	Many private properties have inadequately-sized culverts.	ma-FL-SL-7
ps-FL-SL-9	Flood	Threat	SP - Structural Projects	**City of Shasta Lake**	Limited drainage system in urban core and older parts of the City can create localized flooding.	ma-FL-SL-7, ma-FL-SL-8
ps-FL-SL-10	Flood	Victim	PE&A - Public Education & Awareness , SP - Structural Projects	**City of Shasta Lake**	Residents are unaware of flood risks, flood insurance and/or flood proofing concepts or measures.	ma-FL-SL-6

4.5.3 Extreme Weather Hazard Profile

Extreme weather refers to any dangerous meteorological phenomena with the potential to cause damage, serious social disruption, or loss of human life. Extreme weather may form over wide geographic areas or occur within a more limited geographic area. The HMP Planning Committee identified the following four types of extreme weather events that typically impact the City of Shasta Lake:

- High Wind
- Heavy Rain
- High Heat
- Winter Storms

These extreme weather types are also discussed in the context of climate change. The following are characteristics of extreme weather events that can occur in the City of Shasta Lake.

High Wind

Damaging winds are classified as those exceeding 60 mph. Damage from such wind accounts for half of all extreme weather reports in the lower 48 states and is more common than damage from tornadoes. Wind speeds can reach up to 100 mph and produce a damage path extending for hundreds of miles. There are several types of damaging winds:

- **Downdraft:** A small-scale column of air that sinks toward the ground. Downdraft is a general term for a common component of thunderstorms, both mild and severe, that forms as part of the convective cycle.
- **Straight-Line Wind:** Any thunderstorm wind that is not associated with rotation. This term is used primarily to differentiate from tornado winds. Most thunderstorms produce some straight-line winds as a result of outflow generated by the thunderstorm downdraft. (The National Severe Storms Laboratory, n.d.)
- **Downburst:** A strong downdraft with horizontal dimensions larger than 2.5 miles resulting in an outward burst of damaging winds on or near the ground. Downburst winds may begin as a microburst and spread out over a wider area, sometimes producing damage similar to a strong tornado. Although usually associated with thunderstorms, downbursts can occur with showers too weak to produce thunder. (*Id.*)
- **Microburst:** A small, concentrated downdraft that produces an outward burst of damaging winds at the surface. Microbursts are generally less than 2.5 miles across and short-lived, lasting only five to 10 minutes, with maximum wind speeds up to 168 mph. Microbursts may or may not be accompanied by precipitation, referred to as being wet or dry. (*Id.*)
- **Gust Front:** A gust front is the leading edge of rain-cooled air that interacts with ambient air, often warmer thunderstorm inflow. Gust fronts are characterized by a wind shift, temperature drop, and gusty winds out ahead of a thunderstorm. Sometimes winds push air up above them, forming a shelf cloud or detached roll cloud. (*Id.*)

Heavy Rain

Heavy rain can lead to flooding even on dry soil and especially on impervious surfaces. In urban areas, direct runoff is relatively extensive, not only because of the density of roofs and impermeable pavements which allow less rain to infiltrate the ground but also because storm-sewer systems carry more water directly to the streams and lakes. The average annual rainfall in the City of Shasta Lake is about 46.9 inches. Most of the precipitation falls during the winter, and substantial snowfall is limited to higher elevations. Rainfall is often from storms that move in from the northwest. Virtually no rainfall occurs during the summer months.

High Heat

Heat waves are periods of abnormally hot weather lasting days to weeks. The number of heat waves has been increasing in recent years across the Country and locally. Climate change will continue to cause extreme heat events more often. Studies show that by the end of this century, the number of days with temperatures reaching 100°F or more is projected to increase dramatically across the United States as a result of climate change. What the public now considers to be an exceptional event could become routine across much of the country. As temperatures rise and extreme heat events become longer, more severe, and more frequent, experts expect to see more health problems and deaths caused by heat. (CDC, 2013)

Extreme heat events are defined by summertime weather that is substantially hotter and more humid than average for a given location at that time of year. (CDC, 2017) Heat kills by taxing the human body beyond its abilities. Among natural hazards, only the cold of winter—not lightning, hurricanes, tornados, floods, or earthquakes—takes a greater toll. (Ready, 2021) In a normal year, about 600 Americans succumb to the demands of extreme heat. (CDC, 2021) In California, a record number of heat related deaths occurred in 2006. At least 140 deaths occurred between July 15 and August 1 and about 16,000 more emergency room visits occurred in that year due to a record-breaking heat wave. (California Office of Environmental Health Hazard Assessment, 2019)

Winter Storms

Winter storms include extreme cold, freezing rain, sleet, snow, ice, and high winds. A winter storm can last a few hours or several days and result in losses of power, heating systems, and communication services. These impacts can put vulnerable populations, including the elderly, children, and individuals with medical conditions, at greater risk. (Center for Science Education, 2021) In the City of Shasta Lake, winter storms have been known to cause localized flooding. Wet and heavy snow from later in the season can cause the tops of trees to break off, potentially impacting above-ground power lines. This also leaves dead hanging branches, which increase the spread of wildfires higher in the tree canopy and is of particular concern for the city.

4.5.3.1 Plans, Policies, and Regulatory Environment

There are very few formal regulations that pertain directly to extreme weather events. The California Building Code,[5] adopted by the City of Shasta Lake, is generally adequate to properly address development impacts from extreme weather events.

4.5.3.2 Past Events

City of Shasta Lake extreme weather events include heavy rain, high wind, high heat, and winter storms. The following summarizes National Oceanic and Atmospheric Administration (NOAA) data on the number of extreme weather events, including noteworthy injuries, deaths, or property damage and year shown in sub-bullets, since 2000 in Shasta County, the smallest reportable region.

- 28 days with high wind events
  - April of 2015 saw $1 million in damages
  - $7,198,000 in total damage since 2000
  - Seven reported deaths and 11 reported injuries
- 44 days of heavy rain events
- Five days with high heat events
  - One reported death
- 132 days of winter storm events
  - March of 2018 saw $150,000 in damages

4.5.3.3 Location

Extreme weather events have the potential to happen anywhere in the planning area. Wind events are most damaging to areas that are heavily wooded. Heavy rain events can be more impactful in more populous areas with greater impervious surfaces. The following figures show average weather conditions for the City of Shasta Lake:

- Figure 4-28: City of Shasta Lake - Average Annual Precipitation
- Figure 4-29: 30-Year Normal Maximum Temperature for July
- Figure 4-30: 30-Year Normal Minimum Temperature for January
- Figure 4-31: Annual Average Wind Speed (Power Class). Table 4-28 explains further the classes of wind power density shown in Figure 4-31.

[5] Available at https://www.dgs.ca.gov/BSC/Codes.

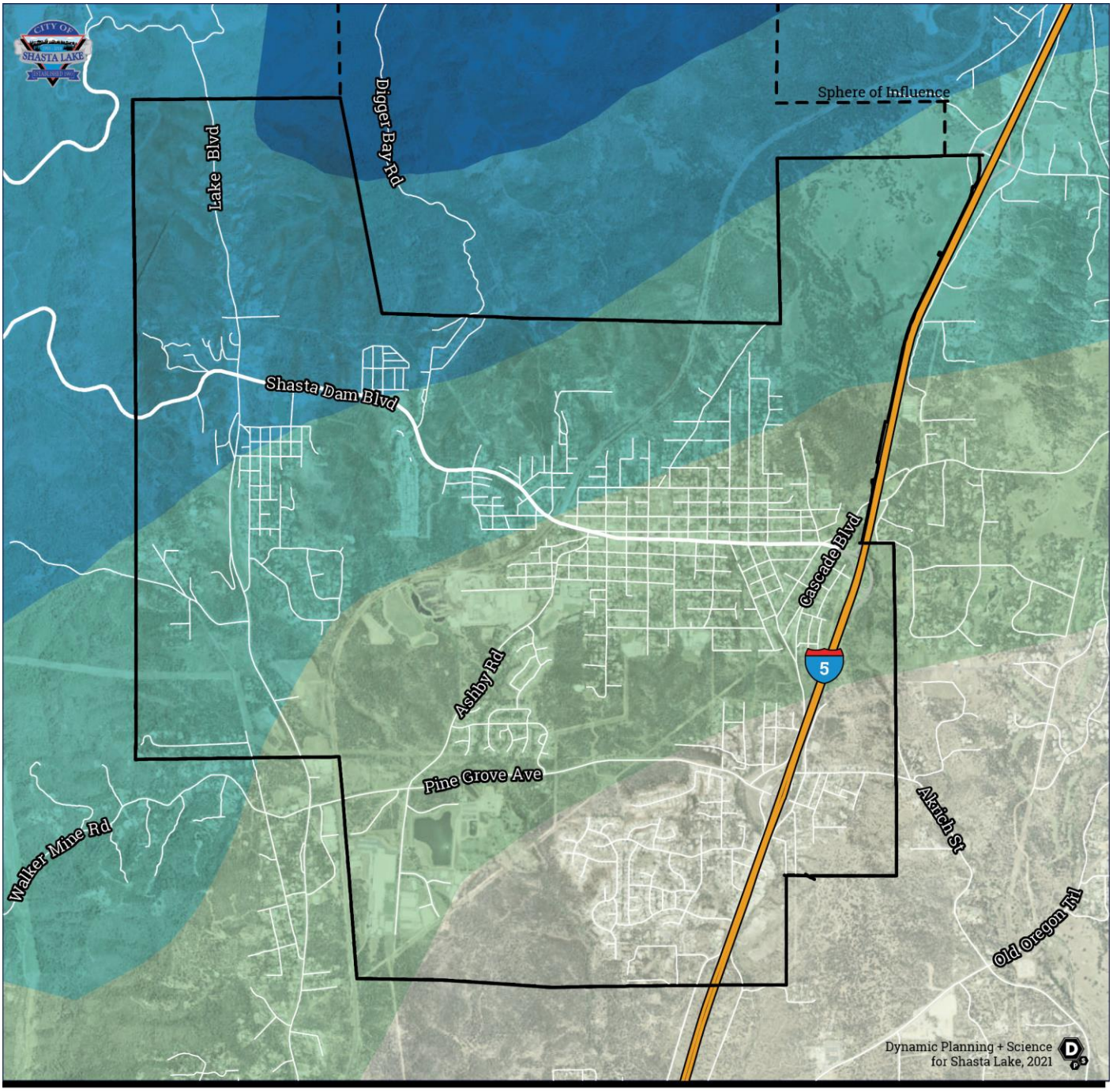


Figure 4-28: City of Shasta Lake - Average Annual Precipitation

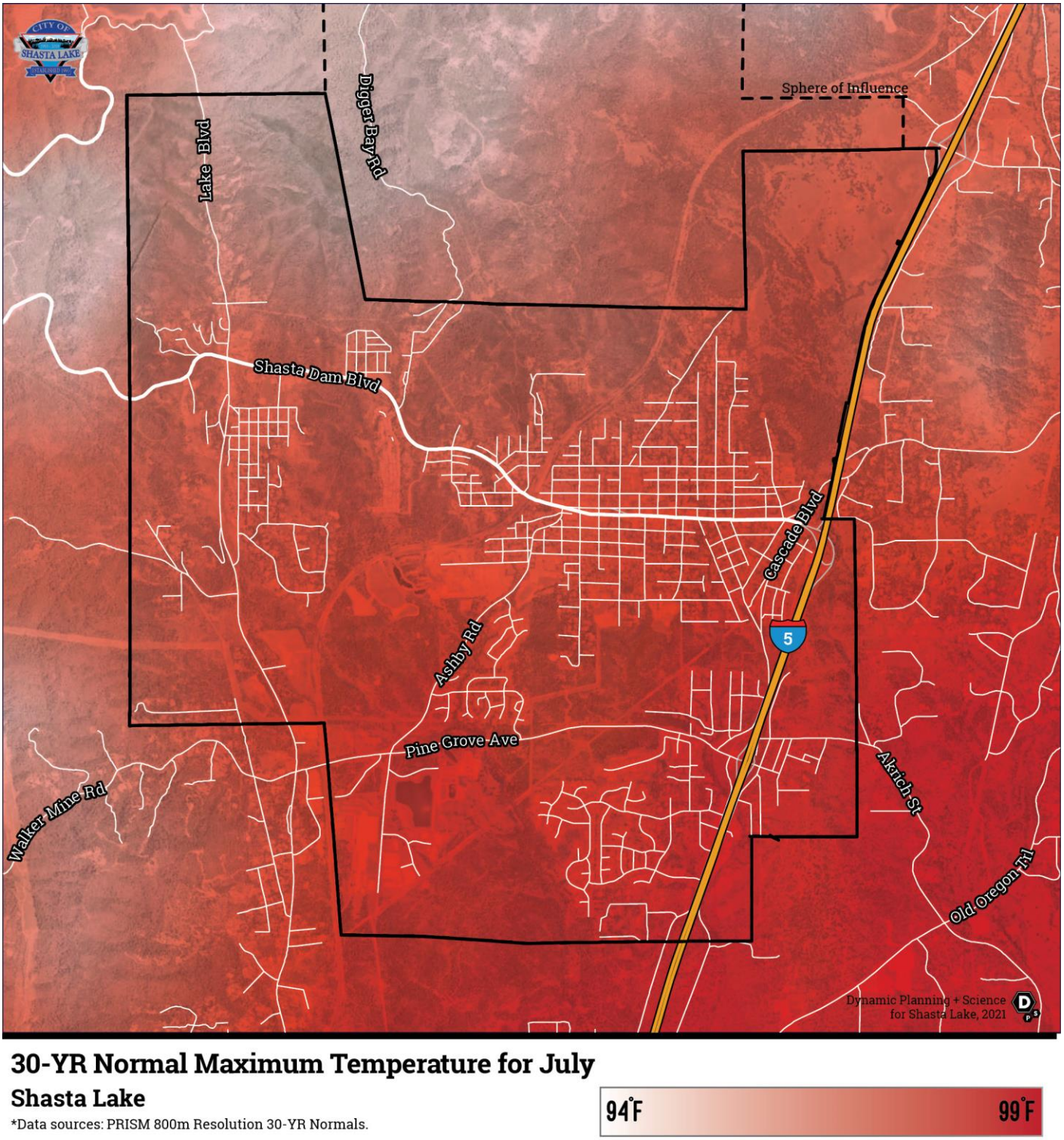


Figure 4-29: 30-Year Normal Maximum Temperature for July

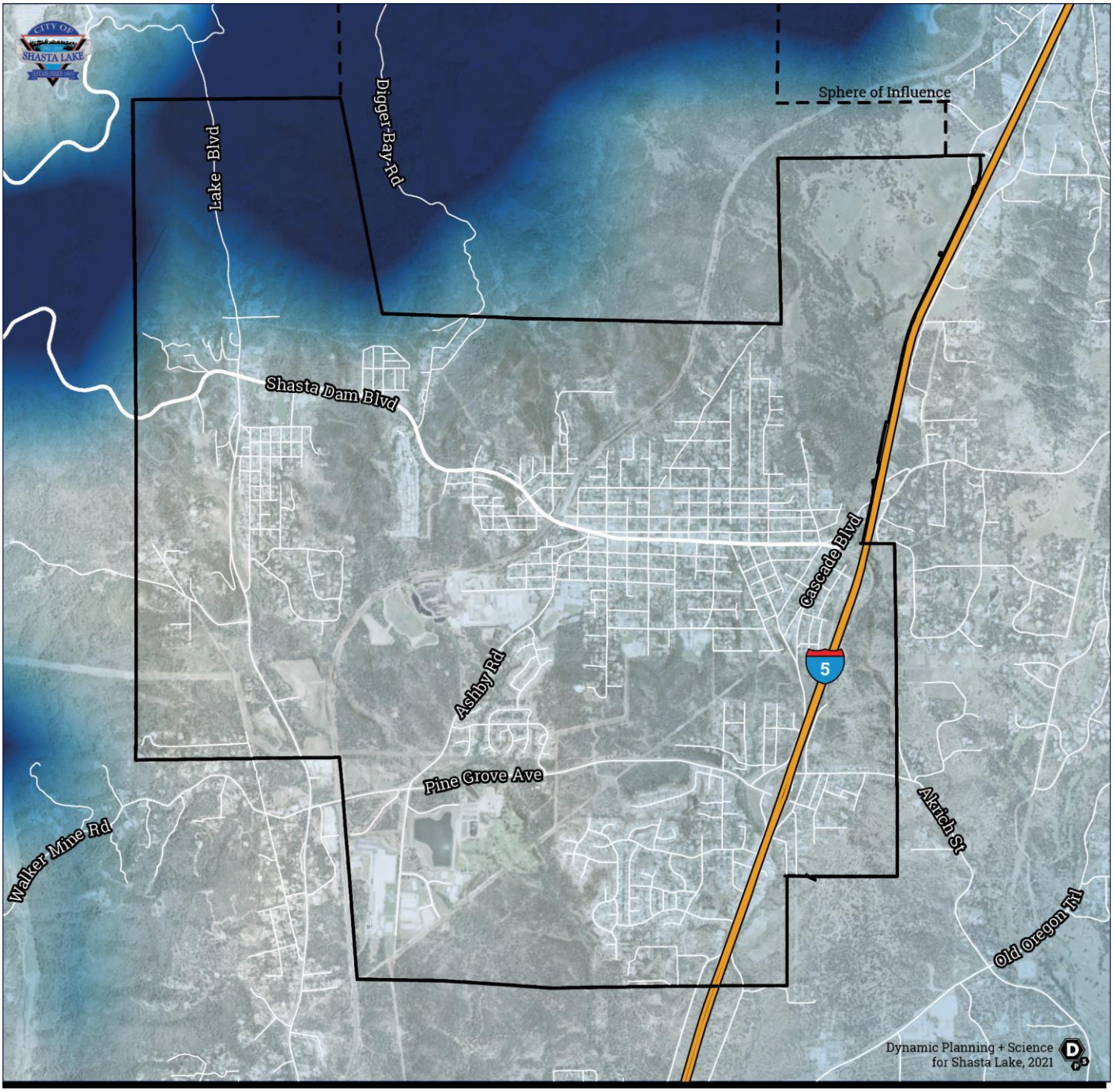


Figure 4-30: 30-Year Normal Minimum Temperature for January

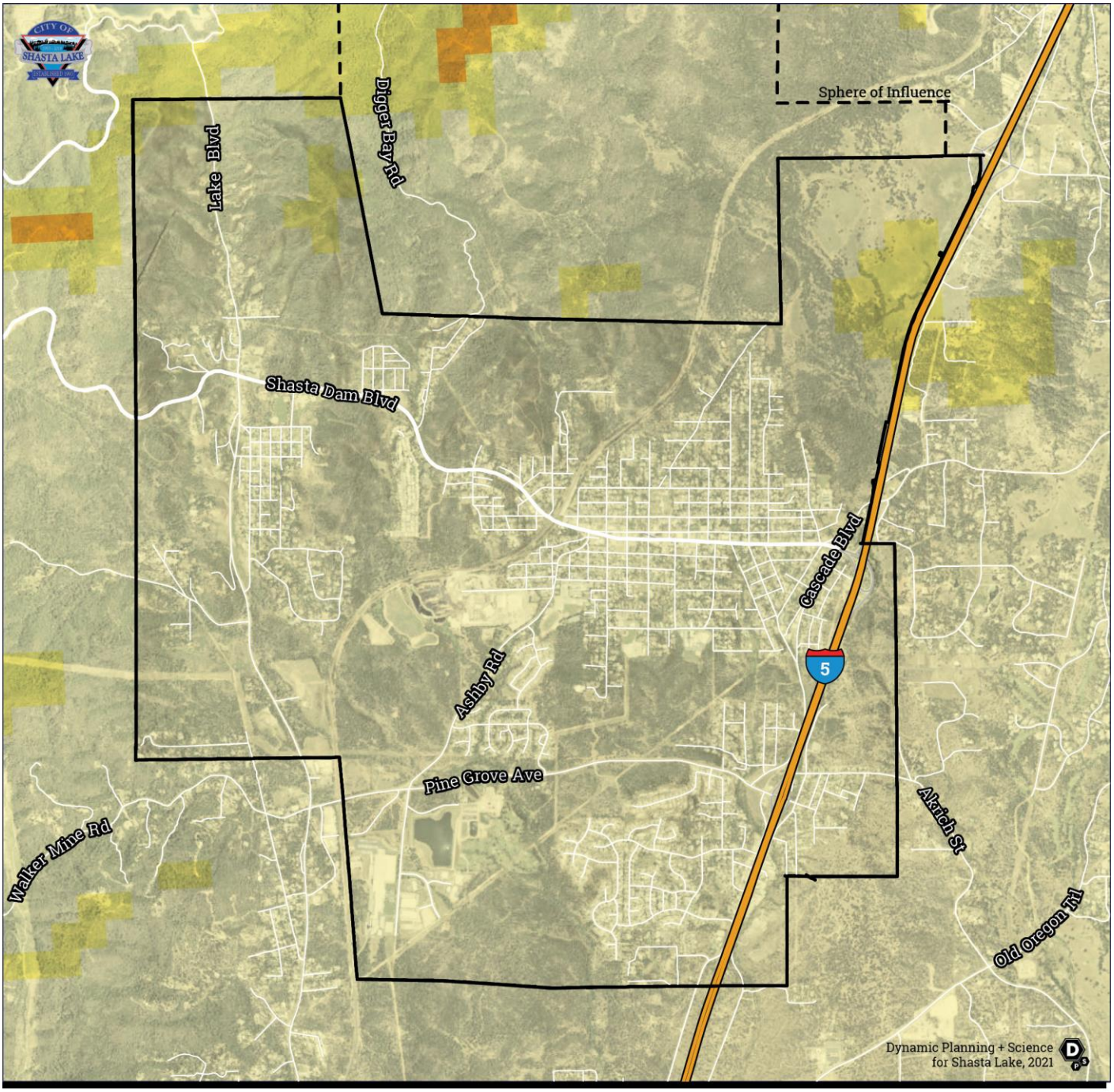


Figure 4-31: Annual Average Wind Speed (Power Class)

Table 4-28: Classes of Wind Power Density at 10 m and 50 m[a]

Wind Power Class	10 m (33 ft) Wind Power Density (W/m2)	Speed[b] m/s (mph)	50 m (164 ft) Wind Power Density (W/m2)	Speed[b] m/s (mph)
1	0	0	0	
	100	4.4 (9.8)	200	5.6 (12.5)
2	150	5.1 (11.5)	300	6.4 (14.3)
3	200	5.6 (12.5)	400	7.0 (15.7)
4	250	6.0 (13.4)	500	7.5 (16.8)
5	300	6.4 (14.3)	600	8.0 (17.9)
6	400	7.0 (15.7)	800	8.8 (19.7)
7	1000	9.4 (21.1)	2000	11.9 (26.6)

[a] Vertical extrapolation of wind speed based on the 1/7 power law.
[b] Mean wind speed is based on Rayleigh speed distribution of equivalent mean wind power density. Wind speed is for standard sea-level conditions. To maintain the same power density, speed increases 3%/1000 m (5%/5000 ft) elevation.
NOTE: Each wind power class should span two power densities. For example, Wind Power Class = 3 represents the Wind Power Density range between 150 W/m2 and 200 W/m2. The offset cells in the first column attempt to illustrate this concept.

4.5.3.4 Frequency and Probability of Future Events

Extreme weather events since the year 2000 have caused a total of $7,198,000 worth of property damage in Shasta County. Extreme weather events occur annually in Shasta County to a varying degree, not always with property damage involved.

High Wind: Figure 4-31Figure 4-31 displays average annual wind speeds by power class in the City of Shasta Lake and Table 4-28 describes wind power classes.

Heavy Rain: Figure 4-28 depicts the average annual precipitation from 1981 through 2010. Even if overall precipitation does not significantly depart from average in the future, heavy rainfall events are predicted to increase with climate change. (United States Geological Survey, n.d.)

High Heat: Figure 4-29 shows the average maximum temperature for the City of Shasta Lake in July. As discussed in more detail herein, climate change is predicted to increase the frequency of high heat events in the future.

Winter Storms: Figure 4-30 shows the average minimum temperature for Shasta Lake in January.

4.5.3.5 Severity and Extent

The most common problems associated with high wind, winter storms, and heavy rain are immobility and loss of utilities. Fatalities are uncommon but can occur. Roads may become impassable due to flooding, downed trees, ice, heavy snow, or a landslide. Power lines may be downed due to high winds, and services such as water or phone may not be able to operate without power.

High Wind: Windstorms can be a problem in the planning area and could cause damage to utilities. It is important to note that the predicted wind speed given in wind warnings issued by the National Weather Service is for a one-minute average; gusts may be 25 to 30 percent higher. High wind events have become more impactful in the past years because they trigger Public Safety Power Shutoff (PSPS) events regionally and are major drivers of wildfire spread

Heavy Rain: Heavy rain has been a problem in the City of Shasta Lake and could cause future damage to facilities and utilities in the planning area. From 2000 to 2021, heavy rain events were the second most frequent extreme weather in Shasta County.

High Heat: High heat has been a problem in the City of Shasta Lake in the past and will likely cause future damage to facilities, utilities, and residents in the planning area. Climate change will exacerbate heat extremes within the city.

Winter Storms: Winter storms have been in a problem in the City of Shasta Lake in the past. Typically, they cause immobility and loss of utilities, notably heat. Impacts have also included fallen trees, downed power and phone lines, and damaged property.

4.5.3.6 Warning Time

Even though the United States has the best radar network and coverage in the world, extreme weather can still be difficult to forecast. Meteorologists use satellites, various types of surface and aircraft weather radars, and automated surface observation systems to collect data and information which is then run through computer forecasting models to estimate what will happen next and provide advanced warning to affected areas. (NOAA) However, in mountainous regions like where the City of Shasta Lake is located, surface radar coverage may be limited as radar beams are often blocked by elevated topographic features.

High Wind: Meteorologists can often predict the likelihood of high winds, which can give several days of warning time; however, meteorologists cannot predict the exact time of onset or severity of high winds. Some storms may come on more quickly and have only a few hours of warning time. A Red Flag Warning is issued when warm temperatures, very low humidity, and stronger winds are expected to combine to produce an increased risk of fire danger. (National Weather Service)

Heavy Rain: As with high winds, meteorologists can often predict the likelihood of a storm with heavy rains. This can give several days of warning time; however, meteorologists cannot predict the exact time of onset

or severity of heavy rain, or the precise locations of heavy rainfall. Some storms may come on more quickly and have only a few hours of warning time.

High Heat: Meteorologists can often predict the likelihood of high heat weeks in advance by monitoring ocean temperatures and world-wide weather patterns. Shasta Ready, Shasta County's response website for local emergences, offers extreme heat emergency information on their webpage (https://www.co.shasta.ca.us/ready/overview/extreme-weather), including links for obtaining information on extreme heat forecasts. Interested individuals can also sign up for emergency alerts from the same webpage.

Winter Storms: Because miniscule variations in temperature define the boundary between snow and rain and because heavy snow often falls in small bands difficult to discern on larger resolution forecasting models, predicting winter weather can be a complicated process. (National Weather Service, n.d.) Forecasters use a large array of observation systems in order to forecast when potentially dangerous winter weather might occur.

4.5.3.7 Secondary Hazards

High Wind: The most significant secondary hazards associated with high winds are falling and downed trees, downed power lines, and wildfire. High winds can cause damage to properties and destruction of roadways. It can magnify wildfires and increase their rate of travel.

Heavy Rain: The most significant secondary hazards associated with heavy rains are flooding, which also includes falling and downed trees, landslides, and downed power lines. Heavy rain can cause damage to properties and destruction of roadways. Landslides occur when the soil on slopes becomes oversaturated and fails. Flooding is analyzed in Section 4.5.2.

High Heat: High heat can dry out local vegetation, thus contributing to an increase in vegetative fuels.

Winter Storms: Secondary hazards associated with winter storms include high winds, and increased wildfire intensity. Heavy, wet snow can break treetops which can increase fire risk during the dry season. Additional impacts from heavy snow include immobilized transportation due to impassable roads, downed power lines, and compromised communication infrastructure.

4.5.3.8 Climate Change

The effects of climate change are varied and include warmer and more diverse weather patterns, such as melting ice caps and poor air quality. As a result, climate change will likely worsen a number of natural hazards, including extreme weather. The effects of climate change on extreme weather are most likely to create more frequent and prolonged periods of extreme heat However, climate change will result in unpredictable temperature fluctuations that could lead to freezing events during the warmer months of the year, which could have a devastating effect on agriculture. (United States Environmental Protection Agency, 2016)

High Wind: Climate change is expected to increase the frequency and severity of high winds in portions of the City of Shasta Lake. (Houlton, Lund, 2018)

Heavy Rain: The number of extreme precipitation events by water year is expected to increase in the City of Shasta Lake under RCP 4.5 and 8.5 scenarios. (Cal-Adapt, 2021)

High Heat: Currently, the average number of consecutive days of extreme heat in the City of Shasta Lake reaches between three and four days, at a temperature of 105.3 degrees Fahrenheit. Model projections for the longest stretch of consecutive extreme heat days per year (under an RCP 8.5 scenario and at a temperature at or above 105.3 degrees Fahrenheit) in the City of Shasta Lake predict an average of 51 days per year during the years 2070 to 2099. (Cal-Adapt, 2021)

Winter Storms: Climate change will increase the variability of winter storms and cooler weather in general. With regards to cooler degree days, the number of annual cooling days is expected to increase through 2099 in Shasta County. (Cal-Adapt, 2021)

4.5.3.9 Extreme Weather Vulnerability Analysis

4.5.3.9.1 Population

The entire planning area is exposed to some extent to extreme weather events, including high wind, high rain, high heat, and winter storms. Certain areas are more exposed due to geographic location and local weather patterns. Populations living at higher elevations with large stands of trees or power lines may be more susceptible to wind damage and blackout.

Vulnerable populations, such as the elderly, low income, linguistically isolated, or people with life-threatening illnesses, may become isolated from major roads and emergency services in extreme weather events. Power outages can be life-threatening to those dependent on electricity for life support. These populations face isolation and exposure during extreme weather events and could suffer more secondary effects of the hazard; therefore, vulnerable populations are of particular concern.

High Wind: High wind can impact the mobility of vulnerable populations, notably the elderly and people with disabilities. Associated impacts from downed power infrastructure can also negatively impact these populations, many of whom rely on power for life support.

Heavy Rain: Heavy rain can pose a similar risk to vulnerable populations as high wind. In addition, heavy rain can limit mobility, decrease visibility, and isolate people who might live more remotely.

High Heat: High heat can be dangerous for vulnerable populations and even fatal, especially for the elderly or very young. Extreme heat is associated with cardiovascular and respiratory disorders as well as heat stroke. End of century predictions for annual average maximum temperatures in the City of Shasta Lake depict an increase in temperature of 4.9°F and 8.1°F under RCP 4.5 and 8.5 scenarios, respectively. (Cal-Adapt, 2021)

Winter Storms: Winter storms can critically impact the entire planning area, as well as the vulnerable populations within its boundaries, most notably the elderly and people with disabilities. Associated impacts from downed power infrastructure can negatively impact these populations, many of whom rely on power for life support.

4.5.3.9.2 Property

All property is vulnerable during extreme weather events, but properties in poor condition or in particularly vulnerable locations may risk the most damage. Those in higher elevations and on ridges may be more prone to wind damage and high rain. Property located under or near overhead lines or near large trees may be vulnerable or may be damaged in the event of a collapse. Crops may be damaged by high wind, high heat, or heavy rain.

High Wind: High winds can cause significant property damage. Associated impacts to property include roofs being blown off, trees and branches falling onto property, fences being blown down, and large infrastructure falling onto property.

Heavy Rain: Heavy rain can cause extensive property damage. It can flood properties and cause secondary impacts such as waterlogged branches or trees falling onto property.

High Heat: High heat can cause property damages in some cases. High temperatures can cause roofs to expand and warp and can weaken the structural integrity of buildings.

Winter Storms: Winter storms can cause associated property damages including losses of power and heating, downed phone lines as well as downed trees and/or broken branches.

4.5.3.9.3 Critical Facilities and Infrastructure

All critical facilities are likely exposed to high wind, heavy rain, and high heat. Additional facilities on higher ground may also be more exposed to wind damage or damage from falling trees. Roads may become impassable due to flooding, downed trees, or landslides. The most common problems associated with extreme weather is the loss of utilities. Downed power lines can cause blackouts, which may create challenges within the city. Shasta Lake is well-poised for a black out, however. Phone (landlines) work during power outages, but maybe VOIP is the issue here. Cell phone companies have done good work deploying backup power supplies throughout the area so people still have access to phone and internet via cell phone during blackouts. City's water system is largely gravity fed. Both the water treatment plan and wastewater treatment plan have backup generators, allowing them to operate during power outages.

High Wind: High winds can knock down critical infrastructure such as powerlines which can prevent information communication systems from functioning sufficiently. Severe winds can also cause structural and non-structural damage to critical facilities.

Heavy Rain: Heavy rains, especially when accompanied by a windstorm, can cause water damage to critical facilities which can compromise the functionality of the facility.

High Heat: High heat can impact the performance of critical facilities, especially ones which provide emergency services such as hospitals. Hospitals rely on well-regulated are temperatures may not have the capacity to deal with extreme temperatures. Additionally, high temperatures can cause materials to expand such as concrete and asphalt. This can cause infrastructure such as sidewalks to expand and buckle at points where two pieces of concrete or asphalt meet each other. (Federal Highway Administration, 2013)

Winter Storms: Winter storms can compromise critical infrastructure such as powerlines or phone lines, which can prevent heating systems and information communication systems from functioning sufficiently.

4.5.3.9.4 Lifelines

Loss of roads or power and communication lines are the primary lifeline failures resulting from extreme weather and are mostly due to secondary hazards, such as floods, falling and downed trees, landslides, and wildfire. Prolonged obstruction of major transportation routes can disrupt the shipment of goods and other commerce, and large, prolonged storms can have negative economic impacts on an entire region.

High Wind: Severe windstorms and downed trees can create serious impacts on power and above-ground communication lines. Loss of electricity and phone connections would leave certain populations isolated because residents would be unable to call for assistance. High winds can also cause significant damage to trees and power lines, blocking roads with debris, damaging transportation infrastructure, isolating populations, and disrupting ingress and egress routes.

Heavy Rain: Heavy rains can cause secondary hazards, such as landslides and floods, and can cause trees to fall. These secondary hazards can compromise roads and power and communication lines.

High Heat: High heat can cause transmission lines to function less efficiently. The combination of an increase in demand and warmer air can cause the lines to swell and consequently compromise parts of the infrastructure. (US Department of Energy, 2019, p. 12)

Winter Storms: Winter storms can bring heavy snow and ice, as well as high winds, that contribute to secondary impacts, such as downed trees, that can compromise power and above-ground communication lines. Damage to power or communication lines and other lifelines can leave certain populations isolated, especially when residents are unable to call for assistance, and subject the general population to freezing temperatures if heat sources are disrupted. High winds can also cause significant damage to trees and power lines, damaging transportation infrastructure, isolating populations, and disrupting ingress and egress routes.

4.5.3.9.5 Future Trends in Development

All future development will be affected by severe storms. The ability to withstand impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction. The City has adopted the California Building Code, which corresponds to the International Building Code, to meet California mandates. This code is equipped to deal with the impacts of extreme weather events including high wind, heavy rain, and high heat. Land use policies identified in general plans within the planning area also address many of the secondary impacts, such as flood and landslide, of the extreme weather hazard. With these tools, the participating jurisdictions are well equipped to deal with future growth and the associated impacts of extreme weather.

4.5.3.9.6 Extreme Weather Hazard Problem Statements

As part of the mitigation action identification process, the Planning Committee identified issues and weaknesses, also called problem statements, for the City of Shasta Lake's facilities. Identification was based on the risk assessment and vulnerability analysis utilizing the RAMP mapping tool and extreme weather data. Extreme weather problem statements for the city are listed in Table 4-29.

Identifying these common issues and weaknesses assists the Planning Committee in understanding the realm of resources needed for mitigation. The goal is to have at least one mitigation action for every problem statement. See Table 5-6 for a full list of mitigation actions and the corresponding problem statements that they address. Each problem statement is coded with a problem number for cross-referencing between Table 4-29 and Table 5-6.

Table 4-29 Extreme Weather Problem Statements

Problem No.	Hazard Type	Area of Concern	Mitigation Alternatives	Primary Agency	Problem Description	Related MA
ps-EW-SL-3	Extreme Weather	Impact	PPRO - Property Protection	**City of Shasta Lake**	Severe rain events can cause damage to roadways and culverts and block neighborhood access.	ma-EW-SL-5
ps-EW-SL-4	Extreme Weather	Impact	SP - Structural Projects	**City of Shasta Lake**	The City lacks adequate debris refuse facilities for ongoing debris maintenance in heavy rain, winter storm, and high wind events.	ma-EW-SL-21
ps-EW-SL-5	Extreme Weather	Impact	PRV - Prevention	**City of Shasta Lake**	High wind events can block roads and cause power outages.	ma-EW-SL-5
ps-EW-SL-6	Extreme Weather	Impact	ES - Emergency Services	**City of Shasta Lake**	Short periods of extreme weather events overwhelm city resources.	ma-EW-SL-5, ma-AH-SL-22
ps-EW-SL-25	Extreme Weather	Impact	SP - Structural Projects	**City of Shasta Lake**	Extreme heat can cause blackouts and loss of electricity.	ma-EW-SL-3

Problem No.	Hazard Type	Area of Concern	Mitigation Alternatives	Primary Agency	Problem Description	Related MA
ps-EW-SL-26	Extreme Weather	Victim	SP - Structural Projects	**City of Shasta Lake**	Blackouts create need for cooling centers as residents are not able to cool homes.	ma-EW-SL-4
ps-EW-SL-27	Extreme Weather	Victim	PE&A - Public Education & Awareness , SP - Structural Projects	**City of Shasta Lake**	Lack of information getting out to people about the cooling centers.	ma-EW-SL-3
ps-EW-SL-32	Extreme Weather	Impact	PRV - Prevention , SP - Structural Projects	**City of Shasta Lake**	Some CalTrans-owned culverts in the City are undersized and create localized flooding problems.	ma-EW-SL-23
ps-EW-SL-33	Extreme Weather	Impact	PRV - Prevention , PPRO - Property Protection , PE&A - Public Education & Awareness	**City of Shasta Lake**	Winter and spring snow events can break off tree canopies and leave dead tops of trees vulnerable to wildfire.	ma-AH-SL-22

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4.5.4 Drought Hazard Profile

California's water resources have been stressed by periodic drought cycles and in some places overuse, creating the need for unprecedented state and local restrictions in water use. Climate change is expected to increase drought and extreme weather. While the duration and severity of drought is always in question, it is certain that California and the City of Shasta Lake will continue to be impacted by drought. (California Drought Contingency Plan, 2010)

Drought has impacted almost every county in California at one time or another, causing more than $2.6 million in damage. Droughts exceeding three years are relatively rare in northern California, the source of much of the state's water supply. The 1929-1934 drought established the criteria commonly used in designing storage capacity and yield for large northern California reservoirs. 1977 is still the driest year on record, but four of the five driest years have occurred in the last 10 years (2013-12. 2014-25, 2019-20, 2020-21). The last decade also included the wettest year on record, 2016-17.

Drought impacts in California are felt first by those most dependent on annual rainfall, including agencies fighting wildfires, ranchers engaged in dryland grazing, rural residents relying on wells in low-yield rock formations, or small water systems lacking a reliable water source. (*Id.*)

Most of California's precipitation comes from storms moving across the Pacific Ocean. The path followed by the storms is determined by the position of an atmospheric high-pressure belt that normally shifts southward during the winter, allowing low-pressure systems to move into the state. On average, 75 percent of California's annual precipitation occurs between November and March, with 50 percent occurring between December and February. If a persistent Pacific high-pressure zone takes hold over California mid-winter, the water year tends to be dry. (Western Regional Climate Center, 2020)

A typical water year produces about 100 inches of rainfall over the North Coast and 50 inches of precipitation (a combination of rain and snow) over the Northern Sierra compared to 18 inches in the Sacramento area and 15 inches in the Los Angeles area. In extremely dry years, these annual totals can fall to as little as one half or one third of these amounts. (*Id.*)

4.5.4.1 City of Shasta Lake Water Supplies

The City of Shasta Lake's water supply is composed of surface water diverted from Shasta Lake. It includes a long-term (40 years) contract with the United States Bureau of Reclamation (USBR) as well as long- and short-term agreements with surrounding agencies and water suppliers. The city has inter-ties with the City of Redding and Bella Vista Water District in which transfers of water can be made. Raw water is pumped to the Fisherman's Point Water Treatment Plant (WTP) via the USBR Raw Water Pumping Station located at the base of Shasta Dam. The Fisherman's Point WTP is capable of treating and distributing a maximum of approximately 9.72 million gallons per day (mgd). Table 4-30 summarizes the active water supply contracts and agreements for the city. (City of Shasta Lake Water Shortage Contingency Plan, 2021)

Table 4-30: City of Shasta Lake Active Water Supply Contracts and Agreements

Water Supplier	Agreement Type	AFY	Source	Term
US Bureau of Reclamation	Purchase	4,430[1,2]	CVP	40 Years
Shasta County Water Agency	Purchase	50[2]	CVP	Annual
McConnell Foundation	Purchase	Varies	CVP	Annual
Centerville Community Services District	Purchase	Varies	CVP	Annual
MCM Properties Inc.	Transfer	325[3]	CVP	39 Years
Anderson-Cottonwood Irrigation District	Transfer	2,000[4]	CVP	5 Years

Notes:
1. *Contract 4,430 AF. Includes original contract (4,400 AF) plus the 30 AF reallocated from the Summit City Pressure Zone Agreement with the City of Redding.*
2. *During drought conditions, a percent reduction is applied to the historical average of the City's actual water usage over the prior three water years.*
3. *Transfer has not been approved due to Cold Water Pool (CWP) issues.*
4. *1,500 AF is take or pay.*
5. *CCSD = Centerville Community Services District; CVP = Central Valley Project; MCM = MCM Properties Inc*

Source: City of Shasta Lake Urban Water Management Plan (2020)

4.5.4.2 Plans, Policies, and Regulatory Environment

California Sustainable Groundwater Management Act

On September 16, 2014, Governor Brown signed into law a package of bills (SB1168, AB1739 and SB1319) collectively called the Sustainable Groundwater Management Act (SGMA). SGMA requires governments and water agencies of high and medium priority basins to halt overdraft and bring groundwater basins into balanced levels of pumping and recharge. Under SGMA, these basins should reach sustainability within 20 years of implementing their sustainability plans. For critically over-drafted basins, that date will be 2040. For the remaining high and medium priority basins, 2042 is the deadline.

California Drought Contingency Plan

The 2010 California Drought Contingency Plan was created to minimize drought impacts. The Plan identifies strategies for improving agency coordination, enhancing monitoring and early warning capabilities, conducting water shortage impact assessments, and ensuring preparedness, response, and recovery programs. An integrated regional approach to addressing drought, drought action levels, and appropriate agency responses as drought conditions change.

Statewide Emergency Water Conservation Regulations

In 2016, the State Water Resources Control Board (Water Board) adjusted emergency water conservation regulations in recognition of the differing water supply conditions and ongoing drought across the state to comply with an Executive Order from the California Governor declaring a drought emergency. Executive Order B-37-16 Making Water Conservation a California Way of Life updates temporary emergency water restrictions and transitions to permanent, long-term improvements in water use by:

- providing for wiser water use
- eliminating water waste
- strengthening local drought resilience
- improving agricultural water use efficiency and drought planning

In April of 2017, a new Executive Order lifted the drought emergency but retained many of the conservation requirements. Most regulations are still in effect with the exception of water supply "stress test" requirements and conservation standards for urban water suppliers. The temporary restrictions established a baseline of the types of benefits that are possible from water conservation requirements.

California Water Plan

The California Water Plan presents strategic plan elements, including a vision, mission, goals, guiding principles, and recommendations for current water conditions, challenges, and activities. The plan includes future uncertainties and climate change impacts, scenarios for 2050, and a roadmap for improving data and analytical tools needed for integrated water management and sustainability. The California Water Plan was updated most recently in 2018.

Urban Water Management Plans (UWMP)

Jurisdictions either supplying over 3,000 acre-feet of water annually or serving more than 3,000 urban connections are required to submit an UWMP and update these plans every five years. The City of Shasta Lake's most current UWMP is current from 2020 through 2025.

UWMPs contain important information on long-term water supply planning and managing demands in times of drought, so UWMPs are important for drought hazard planning. UWMPs also explore stormwater capacity and assist in planning and funding future stormwater needs, and as such are described in Section 4.5.2. (CDWR, 2021)

City-wide Drought and Water Shortage Contingency Plans

Drought can be particularly impactful to small, rural water systems or residents on individual wells. Urban water management and drought contingency planning are not required for these smaller systems. In the 2016 drought, this gap left these systems and residents unaware of how to react and opportunities for assistance during drought. A 2018 law, AB 1668, directed the California Department of Water Resources to identify small suppliers and rural communities at risk of drought and water shortage vulnerability and to develop recommendations for improving drought contingency planning for those areas. (DWR, 2021)

The City of Shasta Lake's most recent Water Shortage Contingency Plan was released in June of 2021. The plan applies to all persons, customers, and property served by the City.

City of Shasta Lake General Plan

The 1999 City of Shasta Lake General Plan includes a number of polices in its public service and facilities component of the plans that encourage water conservation , and the current update to the General Plan will carry most of these policies forward into the future. These provisions ensure adequate water supplies by promoting water conservation through water-efficient landscaping, reuse of treated wastewater, rainwater harvesting, and water conserving appliances.

Water Conservation Features in the City of Shasta Lake Municipal Code

The City of Shasta Lake Municipal Code aids in reducing the risks associated with drought by implementing the City's Water shortage contingency plan, which details the stages of action to be undertaken during a reduction in available water supply. In addition, Chapter 15.10 "Water Efficient Landscaping" complies with the requirements of the California Water Conservation Landscaping Act of 2006 (AB 1881), to aid in the reduction of community water use in new development.

4.5.4.3 Past Events

California experienced massive changes over the course of the twentieth century as evidenced by dramatic population increases and land use conversion. (California Department of Water Resources, 2015) The driest period in California's measured hydrologic history began in November 1975. It first drained the State's reservoirs, which then led to widespread water shortages in 1977. Additionally, 1976 is on record as the fourth driest year for California. During this period 47 of the 58 California counties declared emergencies.

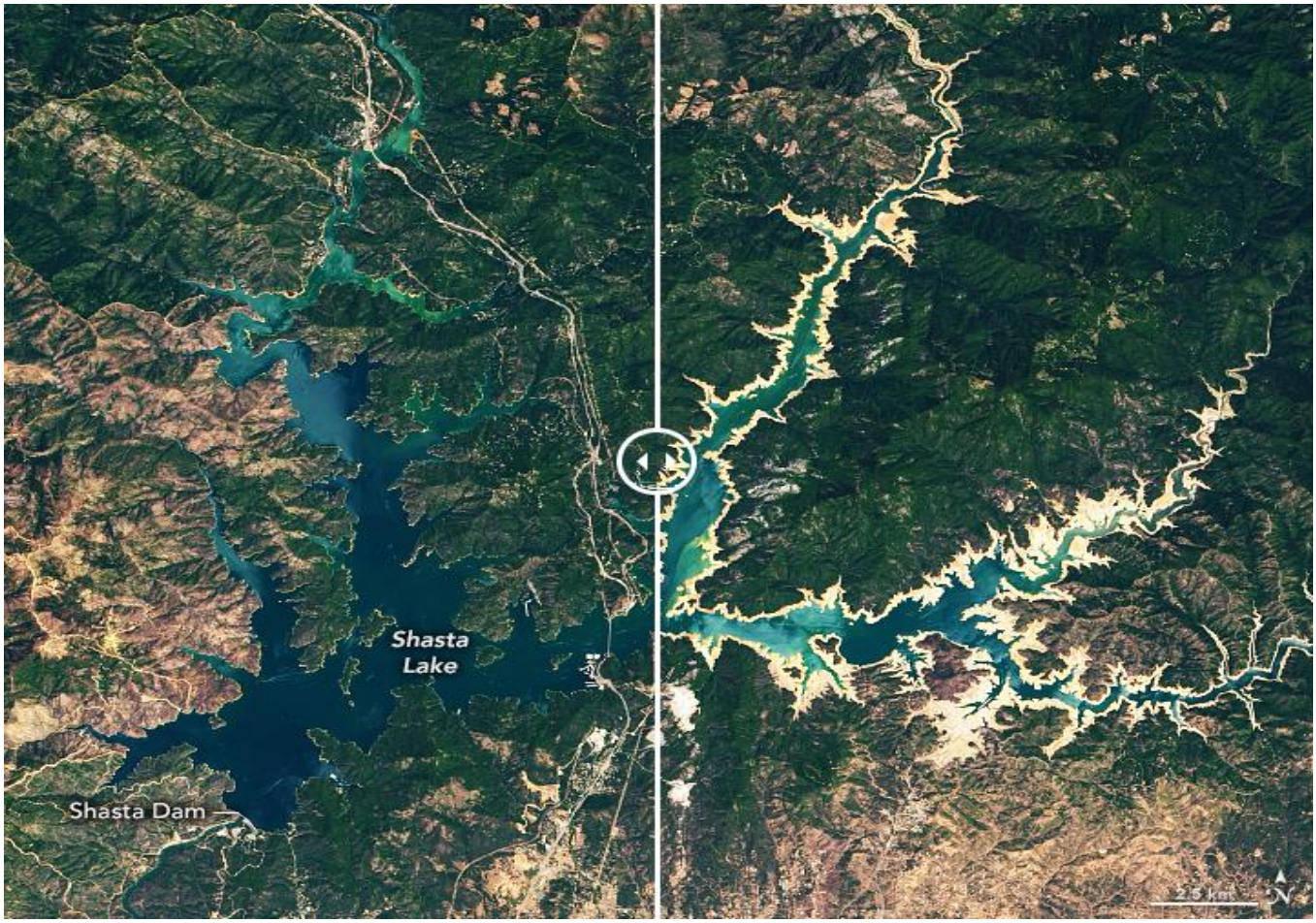

Figure 4-32: Shasta Lake Levels on July 13, 2019 (L) and June 16, 2021
Source: Nasa Observatory Images by Lauren Dauphin, earthobservatory.nasa.gov/images/148447/california-reservoirs-reflect-deepening-drought

The Shasta Lake region is currently in an extreme drought as of fall 2021 as well. Figure 4-32 shows a drought-impacted Shasta Lake current as of June 16th, 2021. As of August 3rd, 2021, Shasta Lake held 1,432,604 million acre feet (maf) of water, or about 31 percent of capacity and 45 percent of the historical average for this time of year. (California Department of Water Resources, 2021)

The most extreme drought conditions in Shasta Lake were experienced in 1991. This was part of a drought period that lasted for six years for much of California, from 1987 to 1992, and one of three significant statewide droughts during the 20th century. By the end of 1991, 23 counties had declared local drought emergencies. Other notable historic statewide droughts include the multi-year events of 1929 to 1934, 1976 to 1977, 2007 to 2009, and, most recently, 2012 to 2016. (DWR, 2020)

With California facing water shortfalls in the driest year in recorded state history, California State Governor Jerry Brown declared a drought state of emergency on January 17, 2014. In the emergency declaration, Governor Brown directed state officials to assist farmers and communities that are economically impacted by dry conditions and to ensure the state can respond if Californians face drinking water shortages. The governor also directed state agencies to use less water and hire more firefighters and initiated a greatly expanded water conservation public awareness campaign. On April 17, 2017, Brown issued Executive Order B-40-17, officially ending the drought state of emergency in all California counties except Fresno, Kings, Tulare, and Tuolumne. As is the case with some of California's other iconic droughts, the 2012 to 2016 drought came to an abrupt end after a significantly wet year in 2017.

The United States Department of Agriculture (USDA) also issues disaster declaration for agriculture-related natural disaster events. The USDA has declared 18 drought disaster declarations for Shasta County since 2012. See Table 4-31). These declarations are issued by the Secretary of Agriculture and qualify producers in affected primary and contiguous counties to receive emergency (EM) loans as well as other emergency assistance programs. (USDA, 2021) The declaration process is significantly expedited (a.k.a. "fast tacked") for severe drought which occurs during the growing season – that is, eight consecutive weeks of D2 drought intensity value, or any duration of D1 or D0 drought intensity as reported by the U.S. Drought Monitor. The most recent declarations have all been fast tracked because of the severity of the current drought.

Table 4-31: USDA Drought Disaster Declarations for Shasta County, 2012 - 2021

USDA #	Begin Date	End Date	Fast Track?
S3248	10/1/2011	continuing	No
S3268	2/21/2012	5/14/2012	Yes
S3491	1/1/2013	2/25/2013	Yes
S3565	6/18/2013	8/12/2013	Yes
S3569	5/25/2013	8/19/2013	Yes
S3637	1/14/2014	continuing	Yes
S3743	1/1/2014	continuing	No
S3784	1/1/2015	N/A	Yes
S3943	1/2/2015	continuing	No
S3952	1/1/2016	N/A	Yes
S4467	10/1/2018	N/A	Yes
S4675	4/21/2020	N/A	Yes
S4691	4/14/2020	N/A	Yes
S4741	7/21/2020	N/A	Yes
S4824	9/29/2020	N/A	Yes
S4916	10/1/2020	N/A	Yes

The National Drought Monitor provides drought data and maps nationally and on a localized, watershed scale. The National Drought Monitor categorizes the level of drought from D0 through D4, with D4 being the highest "exceptional drought." Table 4-32 depicts drought classifications and impacts from the level of drought occurrence in California. Figure 4-33 shows a time series of the level of drought in the Clear Creek-Sacramento River Watershed, as well as the watersheds in and near the city, from 2000 to 2021 as reported by the National Drought Monitor.

Table 4-32: Drought Classifications and Impacts for California

Category	Description	Possible Impacts
D0	**Abnormally Dry**	▪ Soil is dry; irrigation deliver 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 patters begin to change ▪ Stock ponds and creeks are lower than usual
D2	**Severe Drought**	▪ Producers increase water efficiency methods and drought-resistant crops; ▪ Grazing land inadequate ▪ Fire season is longer, with high burn intensity, dry fuels, and large fire spatial extent; more fire crews on staff ▪ Lake- and river-based tourism declines; boat ramps close ▪ Trees are stressed; plants increase reproductive mechanisms; wildlife diseases increase ▪ Water temperatures increase; programs to divert water to protect fish begin ▪ River flows decrease; reservoir levels are low and banks are exposed
D3	**Extreme Drought**	▪ Livestock need expensive supplemental feed, cattle and horses are sold; little pasture remains ▪ Federal water not adequate to meet irrigation contracts, extracting supplemental groundwater is expensive ▪ Fire season lasts year-round; fires occur in typically wet parts of the state; burn bans are implemented ▪ Low water 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, reservoir levels drop significantly, surface water is nearly dry, flows are very low; water theft occurs ▪ Well and aquifer levels decrease; homeowners drill new wells
D4	**Exceptional Drought**	▪ Fire season is very costly; number of fires and areas burned are extensive ▪ Many recreational activities are affected ▪ Fish rescue and relocation begins; pine beetle infestation occurs; forest mortality is high; wetlands dry up; wildlife death is widespread; algae blooms appear ▪ Poor air quality affects health; greenhouse gas emissions increase as hydropower production decreases; West Nile outbreaks rise ▪ Water shortages are widespread; surface water is depleted; federal irrigation water deliveries are curtailed; water prices are extremely high; wells are dry, more and deeper wells are drilled; water quality is poor

Adapted from U.S. Drought Monitor Drought Classifications and Impacts. The U.S. Drought Monitor is jointly produced by the National Drought Mitigation Center at the University of Nebraska-Lincoln, the United States Department of Agriculture, and the National Oceanic and Atmospheric Administration. droughtmonitor.unl.edu/Data/StateImpacts.aspx

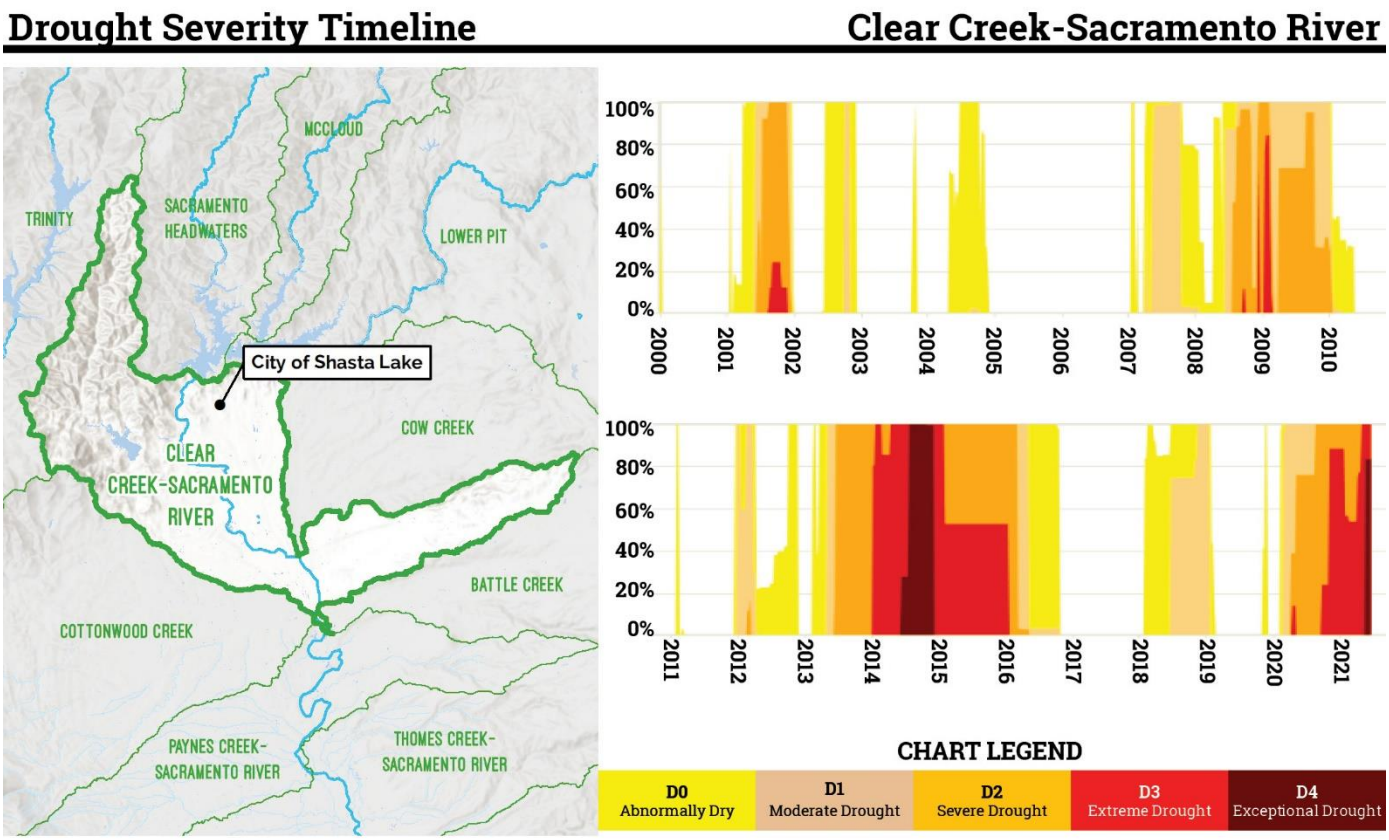

Figure 4-33: Clear Creek-Sacramento River Drought Severity Timeline 2000-2021

4.5.4.4 Location

Drought is one of the few hazards with the potential to impact the entire population of the City of Shasta Lake directly or indirectly through water restrictions, higher water and food prices, reduced air or water quality, or restricted access to recreational areas. No portion of the city is immune from drought conditions.

Lack of winter snowfall in the mountains can eventually lead to agricultural impacts due to decreased stream flows. Reduced base flows may introduce additional challenges for communities that depend on direct drinking water supplies from rivers and tributaries. Droughts of just a few weeks during critical periods of plant development can have disastrous effects on agriculture production. Reduced reservoir storage from decreased runoff in the mountains can lead to water shortages. Droughts that occur in populated areas may not have direct effects on the residents but may increase the threat of wildfire in the wildland-urban interface areas.

4.5.4.5 Frequency and Probability of Future Occurrences

Predicting the precise probability of future drought depends on comprehensive and reliable data. Cal-Adapt, an authority on climate variance in California, projects an extended period of drought over a 20-year period. (Cal-Adapt, 2020) Empirical studies conducted over the past century have shown that meteorological

drought is never the result of a single cause. It is the result of many causes, often synergistic in nature; these include global weather patterns that produce persistent, upper-level high-pressure systems along the West Coast with warm, dry air, resulting in less precipitation.

According to the results of the risk factor exercises for the participating jurisdiction, the probability of drought occurring in the City of Shasta Lake is highly likely (100% annual probability). Figure 4-33 provides a time series from the National Drought Monitor that shows the City of Shasta Lake has been in some form of drought for much of the period from 2000 to 2021.

4.5.4.6 Severity and Extent

The severity and extent of a drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the more severe the potential impacts. Droughts are not usually associated with direct impacts on people or property, but they can have significant impacts on agriculture, which can impact people indirectly.

Unlike most disasters, droughts normally occur slowly and last a long time. On average, the nationwide annual impacts of drought are greater than the impacts of any other natural hazard. They are estimated to be between $6 billion and $8 billion annually in the United States and occur primarily in the agriculture, transportation, recreation and tourism, forestry, and energy sectors. Social and environmental impacts are also significant, although it is difficult to put a precise cost on these impacts.

Drought eventually affects groundwater sources but generally not as quickly as surface water supplies; groundwater supplies generally 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 there is less precipitation and after snowmelt ends. Reduced groundwater levels mean that even less water will enter streams when stream flows are lowest.

A drought directly or indirectly impacts all people in affected areas. A drought can result in farmers not being able to plant crops or the failure of planted crops. This results in loss of work for farm workers and those in food processing and winemaking jobs. Other water-dependent industries are commonly forced to shut down all or a portion of their facilities, resulting in further layoffs. A drought can harm recreational companies that use water (e.g., swimming pools, water parks, and river rafting companies) as well as landscape and nursery businesses because people will not invest in new plants if water is not available to sustain them. Table 4-32 describes the impacts of the various severity levels of drought in California according to the National Drought Monitor classifications.

4.5.4.7 Warning Time

Droughts are climatic patterns that occur over long periods of time. Only generalized warning can take place due to the numerous variables that scientists have not pieced together well enough to make accurate and precise predictions. Predicting drought depends on the ability to forecast precipitation and temperature. Meteorologists can often predict the likelihood of high heat weeks in advance by monitoring ocean temperatures and world-wide weather patterns; however, predicting precipitation is more difficult. Anomalies of precipitation and temperature may last from several months to several decades. How long they last depends on interactions between the atmosphere and the oceans, soil moisture and land surface processes, topography, internal dynamics, and the accumulated influence of weather systems on a global scale. (National Institute of Water and Atmospheric Research, 2016)

4.5.4.8 Secondary Hazards

The secondary hazard most associated with drought is wildfire. A prolonged lack of precipitation dries out vegetation, which becomes increasingly susceptible to ignition as the duration of the drought extends. The Rush Fire and the Rough Fires are examples of how drought conditions, combined with increased fuel loads, can cause more frequent and intense wildfires. (Syphard J. K., 2019)

4.5.4.9 Climate Change Impacts

The long-term effects of climate change on regional water resources are less known, but globally, water resources are already stressed from a growing population, poor water quality, groundwater overdrafts, and aging urban water infrastructure. Climate change will likely exacerbate many of these stresses.

With a warmer climate, droughts are projected to increase in severity, frequency, and duration. The associated costs from diminished water resources will also be significant. According to the UC Davis Center for Watershed Sciences, water shortages in 2016 were projected to cost the agricultural industry a total of $550 million in direct costs and 1,815 in lost jobs. More frequent extreme events such as droughts could end up being more cause for concern than the long-term change in temperature and precipitation averages. (University of California, Davis Center for Watershed Sciences, 2020) According to California's Fourth Climate Change Assessment, variances in precipitation trends towards shorter winters and prolonged dry seasons in addition to increased frequency of drought, could limit water supplies from more local sources. (Grantham, 2018)

4.5.4.10 Drought Vulnerability Analysis

All people, property, and environments in the City planning area would be exposed to the impacts of moderate to extreme drought conditions.

Drought produces a complex web of impacts that spans many sectors of the economy and reaches well beyond the area experiencing physical drought. This complexity exists because water is integral to the ability to produce goods and provide services. Drought vulnerability of an activity usually depends on its water demand, how the demand is met, and what water supplies are available to meet the demand. California's 2018 Water Plan indicates that water demand in the state will continue to increase.

4.5.4.10.1 Population

The residents of the city rely on healthy watersheds to provide adequate water for domestic and agricultural purposes. The City of Shasta Lake has experienced population growth and is projected to continue growing. During drought years, the reduced availability of water supplies for irrigation and food processing has been associated with poor water quality and historical outbreaks of gastrointestinal illness and other infections. Contaminants can be spread quickly during infrequent storms, which result in agricultural and urban runoff that can transmit contaminants and pathogens. (California Senate Office of Research, 2018) The effects of drought are otherwise limited as life or health impacts within the planning area.

4.5.4.10.2 Property

During drought years, property owners with shallow wells can be impacted by drought with increased demand on groundwater resources. Surface water supplies are often lower, which can reduce available supplies and increase cost. This sometimes encourages growers who historically use surface water to switch to groundwater, which has a permanent impact on those reliant on groundwater.

No structures will be directly affected by drought conditions, though some structures may become vulnerable to wildfires, which are more likely following years of drought. Droughts can also have significant impacts on landscapes, which could cause a financial burden to property owners. However, these impacts are not considered critical in planning for impacts from the drought hazard.

The agricultural sector is particularly susceptible to drought impacts. Agricultural drought impacts are normally felt earliest by those relying on unmanaged water supplies: entities carrying out dryland grazing and non-irrigated crop production, usually grain crops. Impacts on irrigated agriculture depend on the source and nature of the irrigation water supply, whether it be local groundwater, local surface water, or imported surface water, and any water rights or contractual provisions that may be associated with the source. The extent to which producers may mitigate water shortage impacts depends on multiple factors but is heavily influenced by economic considerations. Factors involved in making decisions about mitigating irrigation water shortages include availability and costs of pumping groundwater, price of alternative surface water sources, capital investments associated with maintaining permanent plantings, and status of international crop markets. (California Drought Contingency Plan, 2010)

4.5.4.10.3 Critical Facilities

Critical facilities, as defined for this plan, will continue to be operational during a drought. Critical facility elements such as landscaping may not be maintained due to limited resources, but the risk to the planning area's critical facilities inventory will be largely aesthetic. For example, when water conservation measures are in place, landscaped areas will not be watered and may die. These aesthetic impacts are not considered significant.

4.5.4.11 Future Trends in Development

The City will face challenges in providing sufficient water supplies in the future due to climate change effects, coupled with an increasing population (i.e., mostly in the incorporated areas) and increasing water demand. While the City has already taken steps towards achieving long-term water supply sustainability, there is still a possibility that water supply availability may change in the future and will need to be further addressed.

The City of Shasta Lake designated a water conservation coordinator in 2014 in order to supervise best management practices, implementation, the evaluation of effectiveness, and the communication of goals to the community. They are a resource for information on water issues in the City of Shasta Lake and provide tips for water conservation. (City of Shasta Lake, 2021) The City of Shasta Lake Water Treatment Department also offers a residential water conservation rebate program. Water customers are incentivized to replace their domestic water use appliances with more efficient technologies such as low-flush toilets, high performance clothes washer, and, for outdoor appliances, automatic irrigation controllers. (City of Shasta Lake)

The City of Shasta Lake has a General Plan that includes policies directing land use and dealing with issues of water supply and the protection of water resources. This plan provides the capability at the local level to protect future development from the impacts of drought. The City of Shasta Lake reviewed its general plan as part of its hazard mitigation capability assessment. Deficiencies identified by these reviews can be identified as mitigation actions to increase the capability to deal with future trends in development.

4.5.4.12 Drought Hazard Problem Statements

As part of the mitigation action identification process, the Planning Committee identified issues and weaknesses, also called problem statements, for the City of Shasta Lake's facilities. Identification was based on the risk assessment and vulnerability analysis utilizing the RAMP mapping tool and drought data. Drought hazard problem statements for the city are listed in Table 4-33.

Identifying these common issues and weaknesses assists the Planning Committee to understand the realm of resources needed for mitigation. The goal is to have at least one mitigation action for every problem statement. See Table 5-6 for a full list of mitigation actions and corresponding problem statements that they

address. Each problem statement is coded with a problem number for cross-referencing between Table 4-33 and Table 5-6.

Table 4-33: Drought Problem Statements

Problem No.	Hazard Type	Area of Concern	Mitigation Alternatives	Primary Agency	Problem Description	Related MA
ps-DR-SL-29	Drought	Victim	PRV - Prevention , PE&A - Public Education & Awareness	**City of Shasta Lake**	City faces cuts in water delivery from Shasta Lake during drought	ma-DR-SL-21, ma-DR-SL-24
ps-DR-SL-30	Drought	Victim	PRV - Prevention , PPRO - Property Protection , PE&A - Public Education & Awareness , NRP - Natural Resource Protection	**City of Shasta Lake**	Drought conditions increase wildfire probability and intensity.	ma-DR-SL-21, ma-WF-SL-11, ma-WF-SL-12, ma-DR-SL-24

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4.5.5 Climate Change Hazard Profile

Climate change refers to any distinct change in measures of climate lasting for a long period of time, more specifically major changes in temperature, rainfall, snow, or wind patterns. Climate change may be limited to a specific region or may occur across the whole Earth. Climate change may result from:

- Natural factors, such as changes in the sun's energy or slow changes in the Earth's orbit around the sun;
- Natural processes within the climate system, such as changes in ocean circulation; or
- Human activities that change the atmosphere's make-up, and the land surface, such as burning fossil fuels, cutting down forests, planting trees, or building developments in cities and suburbs.

Changes in extreme weather and climate events, such as heatwaves and droughts, are the primary way that most people experience climate change. Human-induced climate change has already increased the number and strength of these extreme events. Over the last 50 years, much of the U.S. has seen increases in prolonged periods of excessively high temperatures, heavy downpours, and in some regions, severe floods, and droughts. (National Climate Assessment, 2014)

The effects of climate change are varied and include extremes in precipitation and temperature. Slower average increases in temperature, precipitation, and sea-level rise can result in compounding impacts such as ocean acidification, increasing insect outbreaks, and shifts in biological patterns, to name a few. (Food and Agriculture Organization of the United Nations, 2014) Table 4-34 is a list of localized climate change impacts relevant to the Shasta County area and the reference to where it is addressed in this HMP.

Table 4-34: Climate change-related hazards and cross-references in HMP

Climate change hazard	Reference in HMP
Agriculture and Forestry Pests and Diseases	Section 4.5.1 (Sudden Oak Death in Wildfire Profile)
Drought	Section 4.5.4 (Drought Hazard Profile)
Extreme Heat	Section 4.5.5.5 (Climate Change Severity & Extent)
Inland Flooding	Section 4.5.2 (Flood Hazard Profile)
Extreme Weather	Section 4.5.3 (Extreme Weather Hazard Profile)
Wildfire	Section 4.5.1 (Wildfire Hazard Profile)

California is already experiencing the impacts of climate change, including prolonged drought, increased coastal flooding and erosion, and tree mortality. The state has also seen increased average temperatures, more extreme heat days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, a decreased summertime fog of 33%, and both snowmelt and rainwater running off sooner in the year. (Cal OES, 2018) Long term trends in fog depict a decline of some 12 to 20% in California from 1900 through 2070. Climate experts suggest that warmer temperatures resulting from climate change create conditions where air fails to reach cool enough temperatures necessary for the

production of fog. Warmer temperatures are simultaneously able to evaporate any fog which is able to form. (Grantham, Teodore; University of California, Berkeley, 2018)

The intensity of extreme weather events is also increasing. Extreme weather events and resulting hazards, such as heatwaves, wildfires, droughts, and floods are already being experienced. (United States Geological Survey, n.d.) The vulnerability analysis touches on extreme weather impacts from climate change.

Methodology for Predicting Climate Change Impacts

Climate change impacts will vary depending on the amount of greenhouse gas (GHG) emissions and atmospheric GHG concentrations may change over time. Various climate models explore a range of emission scenarios globally. There are six representative GHG emission scenarios, called Representative Concentration Pathways (RCPs). The three most-used representative scenarios include a low-end scenario of GHG emissions (RCP2.6), which incorporates strong GHG emission reductions now and in the future, a moderate scenario (RCP4.5), which incorporates stabilizing GHG emissions through 2050, and a high-end (RCP8.5), which maintains a fossil fuel-intensive, "business-as-usual" emission scenario.

Mapping in this HMP uses the moderate emissions scenario, RCP 4.5, and the high emissions RCP 8.5 scenario. Because this document is primarily aimed at long-range planning and adaptation, it does not depict RCP 2.6, which shows the very important difference in long-term climate change impacts if greenhouse gas emissions are sharply curbed. *See* (OPR Planning and Investing for a Resilient California, p. 19)

4.5.5.1 Policies, Plans, and Regulatory Environment

Successful efforts to address the challenges of climate change begin at the local level and include the implementation of environmentally sustainable practices designed to meet present and future energy needs.

2013 California Green Building Standards

The City has adopted the 2013 California Green Building Standards, also known as CALGreen Code. CALGreen Code establishes regulations for green building, nonresidential and residential buildings. Topics covered in the regulations include planning and design, energy efficiency, water efficiency and conservation, material conservation and resource efficiency and environmental quality. The code also includes voluntary measures for residential, nonresidential and health facilities.

California Sustainable Communities and Climate Protection Act of 2008

The Sustainable Communities and Climate Protection Act of 2008 (Sustainable Communities Act, SB 375, Chapter 728, Statutes of 2008) looks to reduce GHG emissions through coordinated transportation and land use planning with the goal of more sustainable communities. Regional targets are established for GHG emissions reductions from passenger vehicle use by the sustainable communities strategy (SCS) established by each metropolitan planning organization (MPO). The SCS is an integral part of regional

transportation plans (RTP) and contains land use, housing, and transportation strategies to meet GHG reductions targets.

2018 California's Fourth Climate Change Assessment

California's Fourth Climate Change Assessment utilizes best available data to present a range of future predicted impacts from climate change. The assessment includes regional reports that provide more localized information that previous iterations, along with a more broad overview summary and other focus reports. The assessment provides important information and policy recommendations to inform state and local decision making. (California's Fourth Climate Change Assessment, 2018)

2020 California Adaptation Planning Guide (APG)

California has been taking action to address climate change for over 20 years, focusing on both greenhouse gas emissions reduction and adaptation. The California Adaptation Planning Guide (APG) provides guidance and support for communities addressing the unavoidable consequences of climate change. The 2020 APG presents an updated, step-by-step process that communities can use to plan for climate change.

California Senate Bill 379: General Plan Safety Element and Climate Adaption

California SB 379 requires all cities and counties to include climate adaptation and resiliency strategies in the Safety Elements of their General Plans upon the next revision beginning January 1, 2017. The bill requires the climate adaptation update to include a set of goals, policies, and objectives for their communities based on the vulnerability assessment, as well as implementation measures, including the conservation and implementation of natural infrastructure that may be used in adaptation projects.

California Senate Bill 1000: General Plan Safety and Environmental Justice Elements

Senate Bill 1000 requires local governments to include an Environmental Justice element in General Plans. SB 1000 has four basic requirements, whether those requirements are combined into a single environmental justice element or distributed throughout other existing elements, including:

- Identifying disadvantaged communities;
- Incorporating policies to reduce the environmental health impacts that adversely affect residents in disadvantaged communities;
- Incorporating policies to include residents of disadvantaged communities in decision-making processes; and
- Incorporating policies that prioritize improvements and projects in disadvantaged communities.

Shasta County Climate Action Plan (2012)

Chapter 4 of the Draft Shasta Regional Climate Action Plan is dedicated to potential climate change impacts in the City of Shasta Lake. Although this plan was not formally adopted, the plan provides an emissions inventory for the city, an emission reduction target for the jurisdiction, specific policies, measures, and programs meant to collectively address the emission reduction target, and a clearly defined mechanism for monitoring the plan's implementation progress.

4.5.5.2 Past Events

Climate change has never been directly responsible for any declared disasters. Past flooding, wildfire, extreme weather, and drought disasters may have been exacerbated by climate change, but it is difficult to make direct connections to individual disasters. Hazard profiles for flood, wildfire, extreme weather, and drought include information on past events that show increase occurrences in many instances, especially considering wildfire, extreme heat, and drought events.

Climate change is an on-going hazard, and many communities are already experiencing the effects. Other effects may not be seriously experienced for decades or may be avoided altogether by mitigation actions taken today.

4.5.5.3 Location

The effects of climate change are not limited by geographical borders. The City of Shasta Lake, the State of California, the United States, and the rest of the world are all at risk of climate change. As such, the entire city is at risk to the effects of climate change.

4.5.5.4 Frequency and Probability of Future Occurrences

Climate change is one of the few natural hazards where the probability of occurrence is influenced by human action. In addition, unlike earthquake and floods that occur over a finite time period, climate change is an ongoing hazard. Temperature-related impacts are the most likely near-term climate change exposure facing the City of Shasta Lake and should be addressed and prioritized in future adaptation planning efforts.

California's Fourth Climate Change Assessment (2018) delineates how climate change may impact and exacerbate natural hazards in the future, including wildfires, extreme heat, floods, and drought. Climate change is expected to lead to increases in the frequency, intensity, and duration of extreme heat events and heat waves in the City and the rest of California, which are likely to increase the risk of mortality and morbidity due to heat-related illness and exacerbation of existing chronic health conditions. Those most at risk and vulnerable to climate-related illness are the elderly and infants; individuals with chronic conditions, such as heart and lung disease, diabetes, and mental illnesses; the socially or economically disadvantaged; and those who work outdoors. Higher temperatures will melt the Sierra snowpack earlier and drive the snowline higher, resulting in less snowpack to supply water to California users, and droughts are likely to become more frequent and persistent in the 21st century. Further, intense rainfall events, periodically ones with larger than historical runoff, will continue to affect California with more frequent and more extensive flooding. Storms and snowmelt may coincide and produce higher winter runoff from the landward side, while accelerating sea-level rise will produce higher storm surges during coastal storms. (California's Fourth Climate Change Assessment, 2018)

Warmer weather, reduced snowpack, and earlier snowmelt can be expected to increase wildfire through fuel hazards and ignition risks. These changes can also increase plant moisture stress and insect populations,

both of which affect forest health and reduce forest resilience to wildfires. An increase in wildfire intensity and extent will increase public safety risks, property damage, fire suppression and emergency response costs, watershed and water quality impacts, vegetation conversions, and habitat fragmentation

Climate change is also predicted to increase frequency or probability of various hazards. Climate change impacts on frequency and severity are discussed in other hazard profiles.

4.5.5.5 Severity and Extent

Climate change severity and extent in the City of Shasta Lake is varied and can generally be categorized into several key effects. These effects are identified in the Sacramento Valley Region Report [6] from California's Fourth Climate Change Assessment (2018). General climate change impacts for this Region include:

- Predicted annual maximum temperatures will increase by 4.2°F under the RCP 4.5 scenario and 7.2°F under the RCP 8.5 scenario by the end of the 21st century. (Houlton, Lund, 2018, p. 18). See, Figure 4-39, to compare current annual average maximum temperatures with those predicted for the City of Shasta Lake in 2100.
- Annual precipitation is likely to be delivered in more intense storms, with shorter wet seasons and prolonged dry seasons.
- An "average" rainfall year will become less common with a higher occurrence of extreme wet and dry years.
- Increased extreme weather events will increase the severity and extent of flooding.
- Streamflows in the summer dry season are predicted to decline, and peak flows in the wetter winter months are likely to increase.
- Wildfires will continue, with projections for a longer wildfire season, increased frequency, and expansion of the area susceptible to fire. (Grantham, 2018)
- Frost occurrences may become longer and more frequent. In February 2018, for example, grape growers prepared for extended frost threat, while coping with a lack of rainfall during what are typically the wettest months of the year. As climate change continues, bud break or the appearance of shoots that will eventually yield grapes will begin sooner, leaving the delicate new growth exposed to the hazards of frost and rain for a longer stretch of the growing season. (Lutz, 2018)

These impacts are predicted to significantly impact communities through habitat loss, including cold-water fish species such as salmon, increased flood and landslide risks to critical infrastructure, increased public health risks from wildfire, floods, heatwaves, and disease vectors. (*Id.*)

[6] The Sacramento Valley Region for California's Fourth Climate Change Assessment includes Sacramento, Yolo, Sutter, Yuba, Colusa, Glenn, Butte, Tehama, Shasta, the eastern half of Solano, and western part of Placer Counties.

Note: Mapping in this HMP uses the moderate range RCP 4.5 as well as the high-end range RCP 8.5, as HMP mapping depicts projected temperature increases in the later half of the century with an adaptive lens. See (OPR Planning and Investing for a Resilient California, p. 19)

Current and Projected Average Maximum Temperatures Under RCP 4.5 and 8.5 Scenarios

Overall, temperatures in California are projected to rise by 5.6°F under an RCP 4.5 scenario and 8.8°F under an RCP 8.5 scenario by the end of this century. (Bedsworth, 2018, p. 23) Figure 4-36 depicts the current average maximum temperature for the City of Shasta Lake. Figure 4-34 and Figure 4-35 illustrate the average maximum annual temperature for the City of Shasta Lake from 1950 through 2100 under the RCP 4.5 and RCP 8.5 scenarios respectively. Figure 4-37 and Figure 4-38 depict average maximum temperature projections through 2100 under the RCP 4.5 and RCP 8.5 scenarios respectively. The final figure, Figure 4-39, summarizes this information by juxtaposing the current average maximum temperature in the City with projected average annual maximum temperatures in 2100 under the RCP 4.5 and RCP 8.5 scenarios respectively.

These projections differ depending on the time of year and the type of measurement (highs vs. lows), all of which have different potential effects to the city's ecosystem health, agricultural production, water use and availability, and energy demand. Under the RCP 4.5 scenario, the city is projected to experience increases in maximum temperatures near 80°F. Under the RCP 8.5 scenario, portions of the city are projected to experience maximum temperatures closer to 90°F.

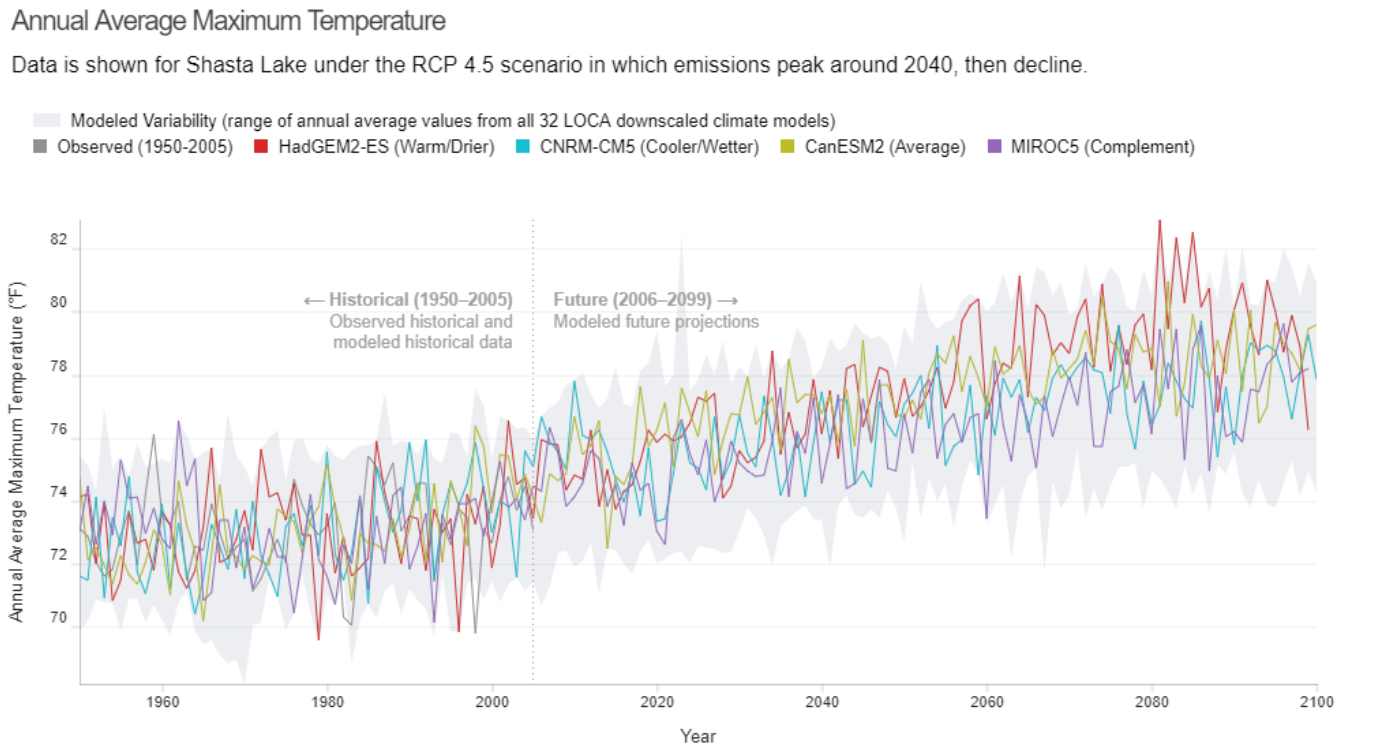


Figure 4-34: Annual Average Maximum Temperature (RCP 4.5 Scenario)
Source: cal-adapt.org

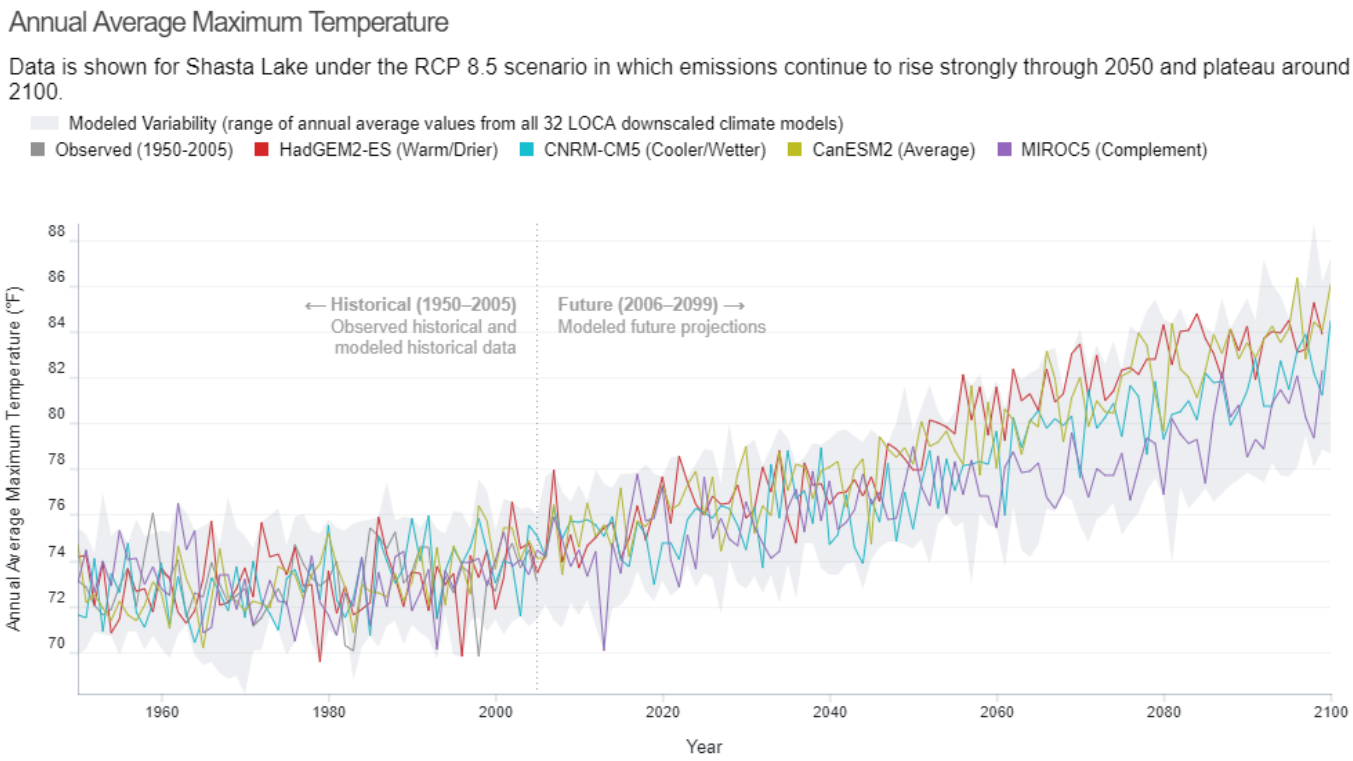


Figure 4-35: Annual Average Maximum Temperature (RCP 8.5 Scenario)
Source: cal-adapt.org

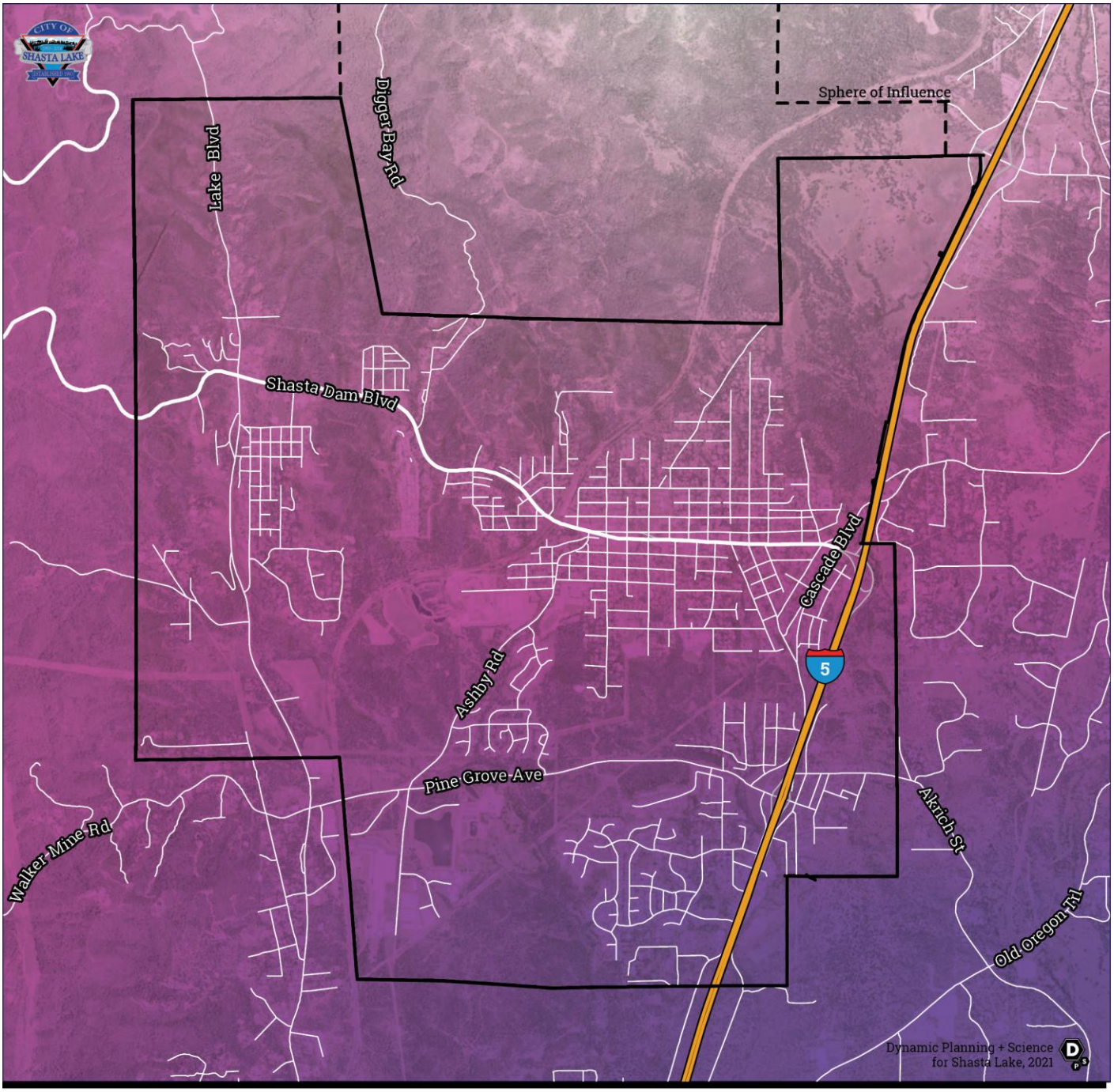


Figure 4-36: Current Average Max Temperature

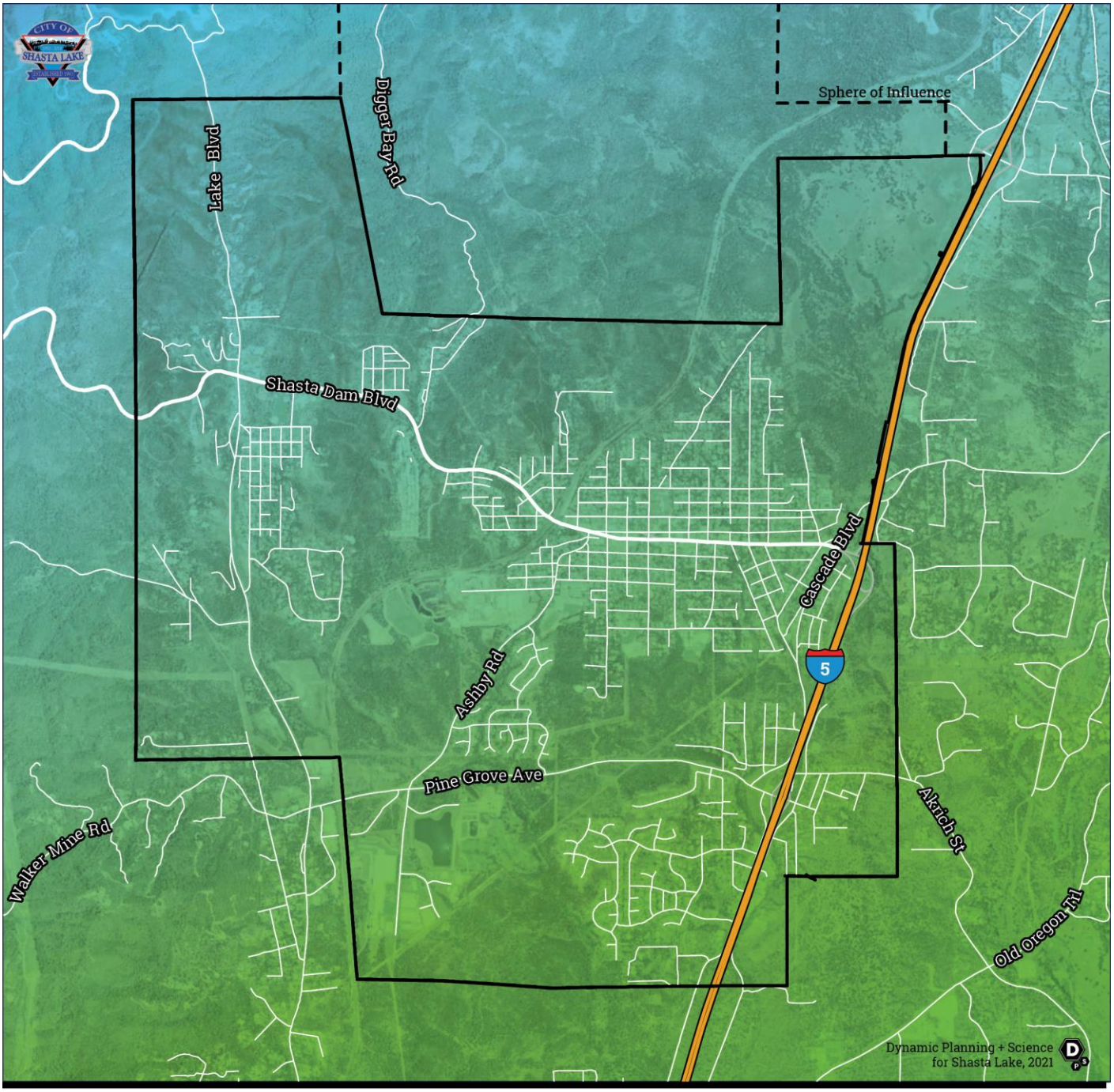


Figure 4-37: Projected Average Max Temperature RCP 4.5 2100

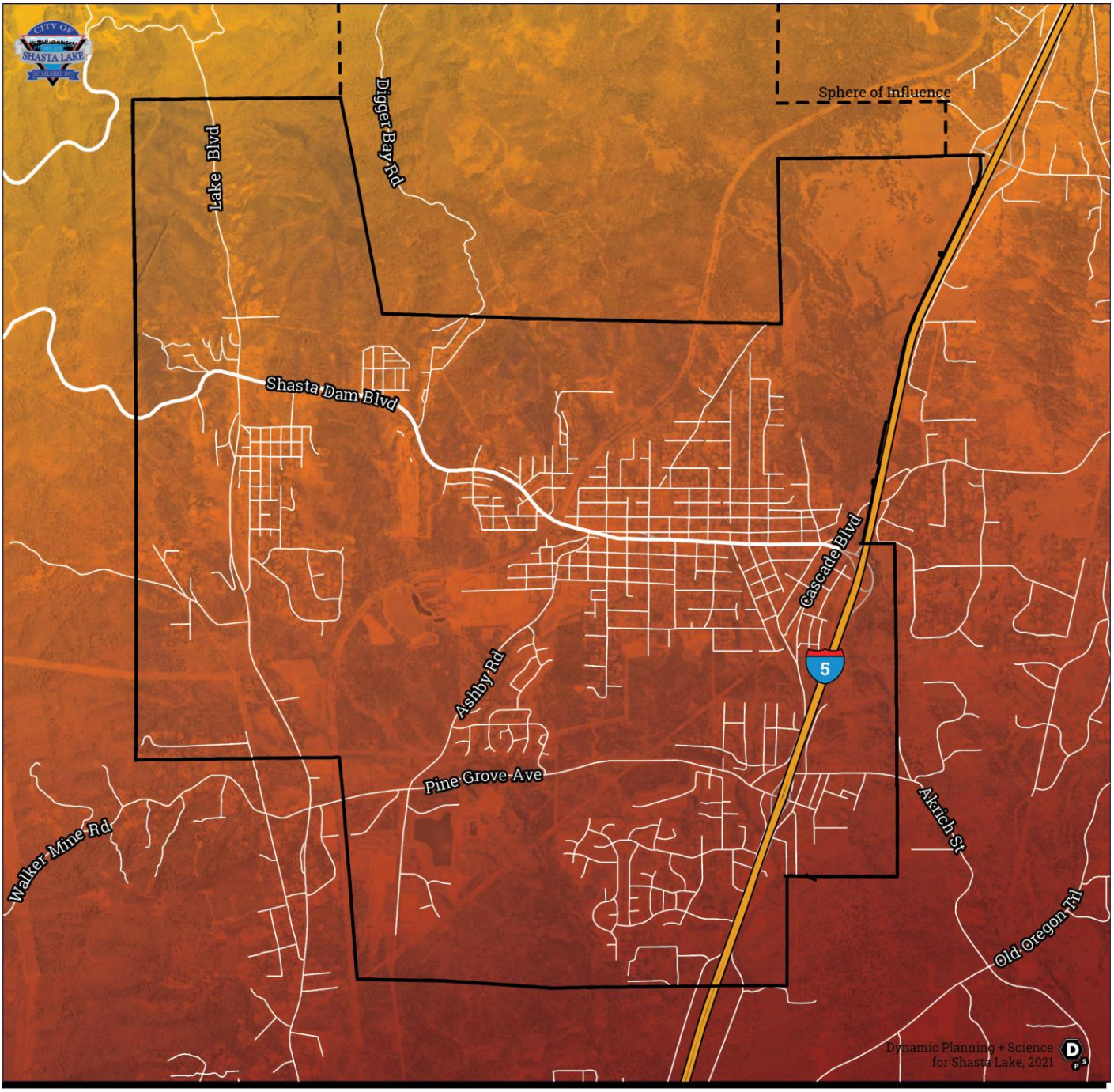


Figure 4-38: Projected Average Max Temperature RCP 8.5 2100

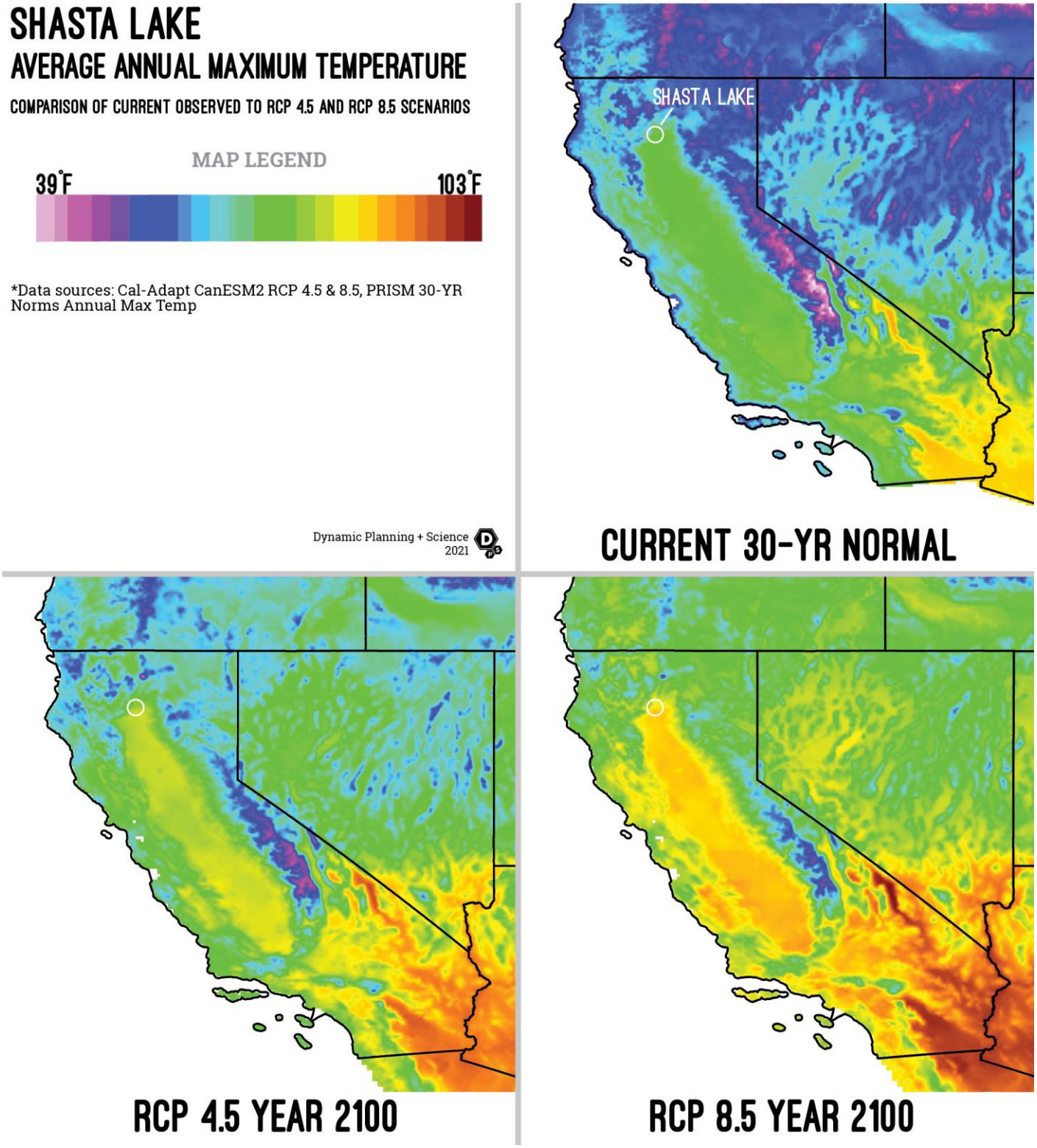


Figure 4-39: Annual Average Maximum Temperature

4.5.5.6 Warning Time

As this section has described, many existing hazards could be intensified as a result of climate change, decreasing warning times and exacerbating impacts. Warning times are discussed under the various other hazards. Other climate change impacts are more long-term; scientists have a high confidence in predicting the rise in global temperatures and have reached a consensus on the future impacts of climate change and the time frame in which they will occur.

4.5.5.7 Secondary Hazards

Secondary hazards of climate change include flood, extreme weather, drought, wildfire, extreme heat, and heavy rain events. Climate change will increase the frequency at which extreme weather events occur. Secondary hazards of climate change that will have the greatest impact on the city of Shasta Lake include flood, drought, and extreme weather. Many of these impacts are discussed in other hazard profiles.

4.5.5.8 Vulnerability Assessment

This section outlines vulnerabilities of the City of Shasta Lake to impacts from climate change. This HMP Vulnerability Assessment summarizes population, including vulnerable populations in a more general context, property, and critical facilities within known hazard areas.

4.5.5.8.1 Population

The total number of city-wide households containing individuals aged 65 and older is approximately 29%. Approximately 10% of the population is Hispanic or Latino origin. Consequently, the city's projected climate change exposures have the potential to leave sensitive populations in the city especially vulnerable to increased risk. (American Community Survey, 2018)

Higher frequency of extreme heat conditions can cause serious public health impacts, increasing the risk of conditions directly related to heat such as heat stroke and dehydration. Older adults, particularly seniors, are more likely to experience respiratory and/or cardiovascular health complications than younger individuals. Approximately 4,079 households within the city contain elderly occupants. These are populations are more likely to live alone with limited mobility. These conditions create the potential to exacerbate health risks associated with extreme heat. (*Id.*)

Heat stress can seriously affect those working outside, by reducing overall productivity and in extreme exposures could lead to illness, disability, or death. The portion of the Hispanic population that is low-income, works primarily outdoors, and that speaks predominantly Spanish are especially vulnerable and would be impacted by extreme heat or extreme weather events associated with climate change. Renters are also more vulnerable, as they are less likely to reinforce buildings and buy insurance because the decision to make major home improvements typically lies with the property owner. Additionally, disaster recovery services target homeowners; renters may not receive as much outreach.

Regional populations especially vulnerable to climate change include the very young and the very old, individuals with chronic medical conditions or psychiatric illness, as well as people taking multiple medications, people who are carless or lack access to public transit, people who are isolated socially, and people living in institutions. Climate change can magnify existing health disparities. Disadvantaged communities, such as those with low social support, poverty, low education, racially segregated, or those experiencing income inequality are more likely to face disproportionate climate-related health burdens.

4.5.5.8.2 Property

Climate change could lead to an increased likelihood of extreme floods. This could lead to the destruction of crops, erosion of topsoil, and deposits of debris and sediment on croplands. Conversely, as average temperatures increase with climate change, agricultural and domestic demand for water could intensify under extreme heat conditions, under which water evaporates faster, and plants need more water to move through their circulatory systems to stay cool. More specifically, attempts to maintain agricultural productivity and quality in the face of warming may be associated with increased water use for irrigation, a change to different varieties of agricultural crops through misting or sprinkling. As noted earlier, increased average temperatures and changes in timing and amounts of precipitation could affect local aquifer recharge for groundwater and reservoir supplies in the future, which could in turn affect water supplies for agricultural and domestic uses.

4.5.5.8.3 Critical Facilities

Some critical infrastructure (i.e., roads, hospitals, schools, emergency facilities, and properties) are at increased risk of flooding in the city. For example, the adult resource facility, located on Cascades Boulevard, is vulnerable to climate change induced flooding and climate induced wildfires. It is located in a 500-year, FEMA-designated floodplain and designed "high" for wildfire risk.

4.5.5.9 Future Trends in Development

The City is committed to continuing to address and reduce existing climate-related risks and future impacts on a holistic and programmatic level in partnership with regional entities working on the same. The Shasta Regional Transportation Agency was awarded funds from the Caltrans Transportation Planning Grant program to study climate change and extreme weather and create adaptation measures to mitigate for their impacts on critical facilities. The assessment includes the City of Shasta Lake planning area.

With several ordinances and programs that cover a range of climate exposures and related impacts, the City is well equipped to handle current issues of extreme heat events and water supply issues but could still likely face increasing challenges as changes occur. Shasta Lake has also adopted the Green Building Standards Code, which exemplifies the actionable steps that the City is taking in order to set a precedent for reduced energy use, building with more sustainable materials, and employing better water conservation tactics.

4.5.5.10 Climate Change Hazard Problem Statements

As part of the mitigation action identification process, the Planning Committee identified issues and weaknesses, also called problem statements, for the City of Shasta Lake's facilities. Identification was based on the risk assessment and vulnerability analysis utilizing the RAMP mapping tool and climate change data. Climate change hazard problem statements are listed in Table 4-35.

Identifying these common issues and weaknesses assists the Planning Committee in understanding the realm of resources needed for mitigation. The goal is to have at least one mitigation action for every problem statement. See Table 5-6 for a full list of mitigation actions and corresponding problem statements that they address. Each problem statement is coded with a problem number for cross-referencing between Table 4-35 and Table 5-6.

Table 4-35: Climate Change Problem Statements

Problem No.	Hazard Type	Area of Concern	Mitigation Alternatives	Primary Agency	Problem Description	Related MA
ps-CC-SL-36	Climate Change	Impact	PRV - Prevention , PE&A - Public Education & Awareness	**City of Shasta Lake**	Droughts are likely to become more frequent and persistent.	ma-DR-SL-21, ma-DR-SL-24
ps-CC-SL-37	Climate Change	Impact	PRV - Prevention , PPRO - Property Protection , PE&A - Public Education & Awareness , NRP - Natural Resource Protection	**City of Shasta Lake**	Intense rainfall events, periodically ones with larger than historical runoff, will continue to affect	ma-EW-SL-23, ma-EW-SL-5
ps-CC-SL-38	Climate Change	Impact	PRV - Prevention , PPRO - Property Protection , NRP - Natural Resource Protection , ES - Emergency Services	**City of Shasta Lake**	Wildfires will continue, with projections for a longer wildfire season, increased frequency, and expansion of the area susceptible to fire	ma-WF-SL-9, ma-WF-SL-11, ma-WF-SL-12, ma-WF-SL-13, ma-WF-SL-15, ma-WF-SL-17
ps-CC-SL-39	Climate Change	Victim	PRV - Prevention , PE&A - Public Education & Awareness , ES - Emergency Services	**City of Shasta Lake**	Climate change is expected to lead to increases in the frequency, intensity, and duration of extreme heat events and heat waves in the city which are likely to increase the risk of mortality and morbidity due to heat-related illness and exacerbation of existing chronic health conditions	ma-EW-SL-3, ma-EW-SL-4

Section 5. Mitigation Strategy

The mitigation strategy is the guidebook to future hazard mitigation administration for the City, capturing the key outcomes of the HMP planning process. The mitigation strategy is intended to reduce vulnerabilities outlined in the previous section with a prescription of policies and physical projects. These mitigation actions should be compatible with existing planning mechanisms and should outline specific roles and resources for implementation success. The Planning Committee conducted the hazard mitigation planning process through typical problem-solving, as did the Steering Committees for the City. Those steps included:

- Estimate the impacts (see Vulnerability Assessments);
- Describe the problem (see Problem Statements);
- Assess what resources exist to lessen impacts and problem (see Capability Assessments);
- Develop Goals and Objectives to address the problems (see Goals and Objectives); and
- Determine what can be done and develop actions that are appropriate for the community (see Mitigation Action Matrix).

5.1 Mitigation Alternative Examples

During Planning Committee Meeting #3 on June 23rd, 2021, the HMP Planning Committee developed and reviewed mitigation actions with a wide range of alternatives using FEMA's six broad categories of mitigation alternatives described below. The HMP Planning Committee considered many mitigation alternatives for implementation under each mitigation category, both county-wide and for individual participating jurisdictions. The City of Shasta Lake also met several times before and after the large group meeting to review specific hazard-related problem statements and develop mitigation actions. These meetings relied on the following framework to explore mitigation actions.

The Planning Committee chose the most efficient and cost effective alternatives based on assessed vulnerability and risk, the capabilities assessment, and group consensus to address identified hazard problems, which are captured in Section 5.5.

PREVENTION (PRV)

Preventative activities keep hazard problems from getting worse and typically are administered through government programs or regulations addressing building and land development. Preventative actions are particularly effective in reducing a community's future vulnerability in areas where development has not occurred, or capital improvements have not yet been substantial. Examples of preventative activities include:

- Planning and zoning ordinances
- Open space preservation
- Stormwater management regulations
- Capital improvements programming
- Building codes
- Floodplain regulations
- Drainage system maintenance
- Riverine or fault zone setbacks

LOCAL PRV ALTERNATIVES

1. Regularly review and revise as needed ingress/ egress standards for future development.
2. Enhance the county's GIS database and capabilities related to hazards information.
3. Maintain detention basins.
4. Conduct detailed studies and mapping of floodplains for Churn Creek and its tributaries, targeting problematic floodplains.
5. Update and distribute wildfire risk mapping for the City of Shasta Lake.
6. Restrict new development in dam inundation zones.

PROPERTY PROTECTION (PPRO)

Property protection measures involve the modification of existing buildings and structures to help them better withstand the forces of a hazard, or removal of the structures from hazardous locations. Examples include:

- Elevation of buildings
- Retrofitting (e.g., seismic design techniques, etc.)
- Critical facilities protection
- Insurance

LOCAL PPRO ALTERNATIVES

5. Continue to work with the Shasta Lake Fire Protection to conduct mitigation projects with homeowners. Provide homeowners easily accessible resources for mitigating the risk of wildfire around their homes.
6. Implement additional fuel reduction projects.
7. Bring existing buildings located within the 100 year floodplain into compliance with adopted standards for new construction within the floodplain whenever possible and to the greatest extent possible.
8. Relocate farm work centers from flood risk areas.
9. Encourage privately owned critical facilities (e.g., churches, hotels, other gathering facilities) to evaluate the ability of the buildings to withstand earthquakes and to address any deficiencies identified.
10. Identify and harden critical lifeline systems (i.e., critical public services such as utilities and roads) to meet "Seismic Design Guidelines and Standards for Lifelines" or equivalent standards, such as American Lifelines Alliance (ALA) guidance.
11. Consider participation in the Community Rating System or other ways to increase participation in the NFIP.
12. Review construction plans for all bridges to determine their susceptibility to collapse and retrofit problem bridges.
13. Ensure new and existing utility infrastructure is designed to resist effects of vertical/lateral shaking.
14. Strengthen and retrofit non-reinforced masonry buildings and non-ductile concrete facilities that are particularly vulnerable to ground shaking.
15. Install shutoff valves and emergency connector hoses where water mains cross fault lines.
16. Continue to incentivize drought-tolerant landscape design.

PUBLIC EDUCATION AND AWARENESS (PE&A)

Public education and awareness activities advise students, staff, parents, nearby residents, and elected officials about hazards, hazardous areas, and mitigation techniques they can use to protect themselves and their property. Measures to educate and inform the public include:

- Speaker series/ demonstration events
- Real estate disclosures
- School children educational programs
- Outreach projects, including neighborhood and community outreach
- Hazard mapping
- Materials library
- Hazard expositions

LOCAL PE&A ALTERNATIVES

1. Continue to work with the Shasta Lake Fire Protection District to educate homeowners on reducing the risk of wildfire on their property, including understanding their wildfire risk and free site visits.
2. Distribute public education materials relating to natural hazards and emergency notifications in English, Spanish, and to include the Mien community in the city and region.
3. Partner with local water agencies such as the City of Redding, Bella Vista Water District, etc., in their public education and conservation campaigns in both English and Spanish.
4. Encourage businesses to build financial reserves as part of economic development.
5. Improve information on floodplain management, severe weather, drought, wildfire mitigation and preparedness, and other hazards on the City's website.
6. Distribute National Flood Insurance Program and floodplain development information at City Hall and libraries for access by the public.
7. Focus a public education program around neighborhoods with egress/ingress issues and narrow roads.
8. Improve interactive hazard mapping resources available to the public.
9. Develop a public information campaign on 72-hour disaster preparedness kits.
10. Develop a "Natural Hazard Awareness Week" campaign and conduct corresponding outreach to the community and all interested parties.
11. Conduct outreach to builders, architects, engineers, and inspectors about building susceptibility to earthquakes and proper design and building requirements.
12. Educate the public on the importance of drought-tolerant landscaping, low flow indoor fixtures, and other water savings techniques to better withstand periods of drought.

NATURAL RESOURCE PROTECTION (NRP)

Natural resource protection activities reduce the impact of natural hazards by preserving or restoring natural areas and their protective functions. Such areas include floodplains, wetlands, steep slopes, and sand dunes. Parks, recreation, or conservation agencies and organizations often implement these protective measures. Examples include:

- Floodplain protection
- Vegetation management (e.g., fire resistant landscaping, fuel breaks, etc.)
- Wetland and habitat preservation and restoration
- Watershed management
- Erosion and sediment control

LOCAL NRP ALTERNATIVES

1. Protect and restore wetlands, riparian areas, and natural buffers to flooding. In particular, continue to implement restoration of the City of Shasta Lake creek corridors.
2. Continue to implement the Stillwater-Churn Creek Watershed Action Plan.
3. Complete vegetation management projects as prescribed in local Community Wildfire Protection Plans.
4. Encourage and incentivize drought-tolerant landscape design.

EMERGENCY SERVICES (ES)

Although not typically considered a mitigation technique, emergency service measures do minimize the impact of a hazard event on people and property. These commonly are actions taken immediately prior to, during, or in response to a hazard event. Examples include:

- Warning systems
- Construction of evacuation routes
- Sandbag staging for flood protection
- Installing temporary shutters on buildings for wind protection

LOCAL ES ALTERNATIVES

1. Install back up power generators for fire stations, pump houses, emergency shelters, and cooling centers.
2. Develop a website for vulnerable populations to register information such as where the individual in question lives, medications, restrictions, etc. Map registrants or tie information to the Nixle alert system.
3. Focus capital improvements on evacuation or emergency access routes needing attention.
4. Construct or improve egress for wildfire emergencies in wildland-urban interface (WUI) areas.
5. Coordinate with responsible agencies to conduct evacuation drills (including contraflow traffic management) on key corridors.
6. Evaluate evacuation bottlenecks and secondary access constraints.

STRUCTURAL PROJECTS (SP)

Structural mitigation projects are intended to lessen the impact of a hazard by modifying the environment and natural progression of the hazard event through construction. They are usually designed by engineers and managed or maintained by public works staff. Examples include:

- Stormwater diversions/ detention and retention infrastructure
- Utility Upgrades

LOCAL SP ALTERNATIVES

1. Continue to work with the Western Shasta Resource Conservation District (RCD) to maintain conservation projects.
2. Continue to work with the Western Shasta RCD on projects such as clean water, habitat restoration, and watershed enhancement.
3. Improve water supply and delivery systems to be more resilient during times of drought.
4. Construct and develop alternative water supplies to augment single sources of water delivery.
5. Construct rainwater catchment systems to recharge groundwater in government rights-of-way.
6. Install water monitoring devices and drought-tolerant landscaping on government-owned facilities.
7. Improve stormwater drainage capacity; construct or improve stormwater basins city-wide to accomplish 100-year protection.
8. Create an inventory and establish a priority list for culvert replacement that takes into account fish passage, flood depth reduction, and future losses avoided.

5.2 Identifying the Problem

As part of the mitigation action identification process, the HMP Planning Committee identified the areas of concern and potential impacts of each of the identified hazards on the community. Developing these "problem statements" for areas of concern, which describe the nature of the consequences or effects of a hazard occurrence on the community and its assets, ensures the identified mitigation actions are tailored to the specific problems created by various hazard scenarios and are specific to the city. The City's problem statements are available as part of the Mitigation Action Support Tool (MAST), which is summarized in STEP 3: Develop a Mitigation Strategy, and available on mitigatehazards.com.

See Section 5.5 for city-wide mitigation actions.

5.3 Capabilities and Adaptive Capacity Assessment

This section examines the City of Shasta Lake's planning and regulatory, administrative, technical, financial, educational, and outreach capabilities to augment known issues and weaknesses from identified natural hazards.

Capabilities assessments in this HMP include considerations of a community's adaptive capacity for climate change, as outlined in Cal OES' 2020 California Adaptation Planning Guide. Adaptive capacity is a community or region's existing ability to moderate climate change impacts. Assessing adaptive capacity includes analysis of policies, plans, programs, funding, and staffing capacity. (Cal. Adaptation Planning Guide, 2020, p. 94)

The tables in this section explore various local planning mechanisms, administrative capacity, financial capabilities, and education and outreach initiatives. For more information on the regulatory environment surrounding each hazard, see hazard-specific sections of Section 4.5.The columns in each table represent deeper dives into the following questions:

- Is the existing planning or regulatory mechanism used currently? (Column 1, Status)
- Has the HMP been integrated into the planning mechanism currently so that the named mechanism is currently used in HMP planning? (Column 2, Current Mitigation Use)
- Is there a future opportunity to expand, improve upon, and incorporate this 2020 HMP Update into the planning or regulatory mechanism? (Column 3, Future Opportunity)

The capabilities assessment is easily-digestible and based on color coding to indicate which policies and plans are adequate, need improvement, or for which the HMP could be integrated. Each table includes a legend that explains how each one of these questions are being answered according to the color indicated: green, yellow, or orange.

5.3.1 Planning and Regulatory Mitigation Capabilities

The information in Table 5-1 is used to align mitigation actions with the existing planning and regulatory capabilities of the city. Planning and regulatory tools typically used by local jurisdictions to implement hazard mitigation activities are building codes, zoning regulations, floodplain management policies, and other municipal planning documents.

Table 5-1: City of Shasta Lake Planning and Regulatory Mitigation Capabilities

CAPABILITY ASSESSMENT LEGEND

Status	Current Mitigation Use	Future Opportunity
Currently in use or present.	Used widely for mitigation.	Opportunity to expand and integrate.
(Sort of) Seldomly used or limited presence.	Limited use in mitigation planning.	Limited opportunity to expand and integrate.
(No) Not present or available.	Not used in mitigation planning.	No opportunity to expand or integrate.

	HMP Integration			
Resource	Status	Current Mitigation Use	Future Opportunity	**Notes / Additional Detail**
Planning and Regulatory Capabilities				
Construction and Future Development Regulations				
Building Codes				2019 California Building Codes
Building Code Effectiveness Grading Schedule (BCEGS) Rating				Unknown at this time.
Public Protection (ISO Class)				ISO Rating of 4 (Shasta Lake Fire Prot District)
Hazard Related Development Standards				Floodplain Management (Chapter 15.04); Site Development Standards (17.70.050); Grading, Erosion Control and Hillside Development (Chapter 1.08); Water Efficient Landscaping (Chapter 15.10); Stormwater Management (1.10.120);
Hazard-Specific Ordinance				Article V. -Provisions for Flood Hazard Reduction; Water Conservation and Drought Contingency Plan (Chapter 13.14)
Zoning Ordinance				Designated Floodway (F-1) District (Title 17 - Zoning, Chapter 17.22); Restrictive Flood (F-2) District (Title 17 Zoning, Chapter 17.70)
Growth Management Ordinance				

Resource	HMP Integration: Status	HMP Integration: Current Mitigation Use	HMP Integration: Future Opportunity	Notes / Additional Detail
Planning and Regulatory Capabilities				
Hazard Reduction Programs (Annually Conducted)				
Capital Improvements Program (CIP) or Plan				City maintains a capital improvement program (project tracking) spreadsheet which is updated after annual inspections.
Erosion/Sediment Control Program				Construction General Permits.
Hazard-Related Public Outreach Program				See Education & Outreach Capabilities for more specifics.
Stormwater Management Program (Annual Inspections)				MS4 annual report.
Seismic Safety Program (Non-structural Inspections)				
Earthquake Modernization Program (Building Safety Inspections)				
Hazard Plans				
General Plan Safety Element				Current update of 1999 Safety Element in progress; expected completion: 2021
Noteworthy Area/ Specific Plan with Hazard Focus				Shasta - Trinity Unit 2020 Strategic Fire Plan; Electric Department Wildfire Mitigation Plan
Community Wildfire Protection Plan (CWPP)				Shasta County CWPP (2016; Western Shasta RCD); CAL FIRE Shasta - Trinity Unit 2008 Fire Plan
Wildfire Vulnerability Assessment				Electric Department Wildfire Mitigation Plan (2020)
Urban or Integrated Regional Water Management Plan				Northern Sacramento Valley Integrated Regional Water Management Plan (2014); City of Shasta Lake Urban Water Management Plan (2020)
Floodplain Management Plan				Stillwater-Churn Creek Watershed Action Plan (2008)
Stormwater Management Plan				California Statewide Stormwater Management Plan (2016)
Ground Water Management Plan(s)	N/A	N/A	N/A	Not a direct member of the local GSA (Enterprise Anderson Groundwater Sustainability Agency), but Shasta County is a member
Open Space and Land Management Plan(s)				1999 General Plan includes an Open Space Element; Shasta County Parks, Trails, and Open Space Plan (2009)
Emergency Operations Plan				Shasta County Emergency Operations Plan (2014)

Resource	HMP Integration: Status	HMP Integration: Current Mitigation Use	HMP Integration: Future Opportunity	Notes / Additional Detail
Planning and Regulatory Capabilities				
Climate Action Plan, Vulnerability Ass'mt, or Adaptation Plan				Draft Shasta Regional Climate Action Plan (2012); Resilient Shasta -Extreme Climate Event Mobility and Adaptiation Plan: Transportation Adaptation Plan (2021); City of Shasta Lake Water Shortage Contingency Plan (2021)
Sustainable Community Plan (SB 375)				Shasta Regional Transportation Agency is responsible for incorporating SB 375 into their next Regional Transportation Plan
Downtown Plan with hazard focus				
Community Health Assessment(s)				City of Shasta Lake Community Health Assessment (2009)
National Flood Protection Program (NFIP)				
Floodplain Management Regulations				Floodplain Management (15.04)
Flood Insurance Education and Technical Assist.				Yes, general information
Flood Hazard Mapping / Re-Mapping				2011 Flood Insurance Study
Community Rating System (CRS)				

5.3.2 Administrative and Technical Capabilities

Table 5-2 shows the administrative and technical capabilities of the City of Shasta Lake.

Table 5-2: City of Shasta Lake Administrative and Technical Capabilities

CAPABILITY ASSESSMENT LEGEND

Status	Current Mitigation Use	Future Opportunity
Currently in use or present.	Used widely for mitigation.	Opportunity to expand and integrate.
(Sort of) Seldomly used or limited presence.	Limited use in mitigation planning.	Limited opportunity to expand and integrate.
(No) Not present or available.	Not used in mitigation planning.	No opportunity to expand or integrate.

Resource	HMP Integration: Status	HMP Integration: Current Mitigation Use	HMP Integration: Future Opportunity	Notes / Additional Detail
Administrative and Technical				
Community Planning and Development Services				
Community Planner				
Civil Engineer				
Building Code Official				
Floodplain Administrator				City Manager or person appointed by them (15.04.130)
Fire Marshall				Fire Chief
Dedicated Public Outreach Personnel				Administrative Services
GIS Specialist and Capability				GIS Coordinator
Emergency Manager				County Office of Emergency Services Director
Grant Manager, Writer, or Specialist				

Resource	HMP Integration: Status	HMP Integration: Current Mitigation Use	HMP Integration: Future Opportunity	Notes / Additional Detail
Administrative and Technical				
Warning Systems/Services				
General				Code Red Emergency Notification (Shasta County): web alerts on City website via: Alert Center.
Flood				Code Red Emergency Notification (Shasta County): web alerts on City website via: Alert Center. Flood Risk: California Department of Water Resources Flood Risk Notification Program
Wildfire				Code Red Emergency Notification (Shasta County): web alerts on City website via: Alert Center.
Geological Hazards				Code Red Emergency Notification (Shasta County): web alerts on City website via: Alert Center. USGS pre-alert system uses earthquake science and technology to detect significant earthuakes quickly so that people can be alerted before they are impacted by shaking. See ShakeAlert.org (nation-wide)

5.3.3 Financial Capabilities

Table 5-3 identifies the financial tools or resources that the City has used to fund mitigation activities.

Table 5-3: City of Shasta Lake Fiscal Capabilities Summary

CAPABILITY ASSESSMENT LEGEND

Status	Current Mitigation Use	Future Opportunity
Currently in use or present.	Used widely for mitigation.	Opportunity to expand and integrate.
(Sort of) Seldomly used or limited presence.	Limited use in mitigation planning.	Limited opportunity to expand and integrate.
(No) Not present or available.	Not used in mitigation planning.	No opportunity to expand or integrate.

Resource	HMP Integration: Status	HMP Integration: Current Mitigation Use	HMP Integration: Future Opportunity	Notes / Additional Detail
Fiscal Capabilities				
Financial Resources for Hazard Mitigation				
Levy for Specific Purposes with Voter Approval				Generally, the city funds hazard mitigation efforts through grants and partnerships with other local and regional agencies.
Utilities Fees				Utilized for general upgrades to specific utilities that may include hazard mitigation and resiliency components.
Benefit assessments				
System Development Fee				
Various Bonds to Incur Debt				
Stormwater Service Fees				
Capital Improvement Project Funding				Utilized for general upgrades that may include hazard mitigation and resiliency components

5.3.4 Education and Outreach

Table 5-4 lists the local citizen groups that communicate hazard risks.

Table 5-4: City of Shasta Lake Education/ Outreach Capabilities Summary

CAPABILITY ASSESSMENT LEGEND

Status	Current Mitigation Use	Future Opportunity
Currently in use or present.	Used widely for mitigation.	Opportunity to expand and integrate.
(Sort of) Seldomly used or limited presence.	Limited use in mitigation planning.	Limited opportunity to expand and integrate.
(No) Not present or available.	Not used in mitigation planning.	No opportunity to expand or integrate.

Resource	HMP Integration: Status	HMP Integration: Current Mitigation Use	HMP Integration: Future Opportunity	Notes / Additional Detail
Education / Outreach Capabilities				
Education/Outreach Resources				
Website Dedicated to Hazard Topics				Emergency preparedness webpage
Dedicated Social Media				Facebook page for general purposes; could include dedicated page under "groups" for emergency information
Hazard Info. Avail. at Library/ Planning Desk				
Annual Public Safety Events				Not annual, but Safety and Emergency Preparedness Committee Meetings listed in Main City Calendar
Ability to Field Public Tech. Assistance Requests				
Public Safety Newsletters or Printed Outreach				
Fire Safe Councils				Limited City participation in Shasta County Fire Safe Council; updating CWPP in Fall 2021
Resource Conservation Districts				Western Shasta Resource Conservation District
Other				

5.3.5 Capability and Adaptive Capacity Opportunities

The above assessment offers ample opportunity for the City of Shasta Lake to consider strengthening its capabilities and adaptive capacity. The reflections in this section are meant as an example, not an exhaustive list of next steps to increase capacity. Prioritized opportunities to increase capacity in the county are shown as mitigation actions in Section 5.5.2.

The Capability Assessment identifies an opportunity to explore revisions to the city code to incorporate lessons learned from recent wildfires and floods; there is an opportunity for the City to consider weed abatement, siting, access routes, defensible space and fuel breaks, and a variety of other topics. Some guidance documents are also aging.

The following federal and state funding opportunities are provided as opportunities to leverage to increase county and jurisdictional capacity.

5.3.6 Federal and State Funding Opportunities

Table 5-5 is a list of available funding sources from state and federal agencies. This includes the FEMA Hazard Mitigation Assistance grant program, which is described in more detail in Section 6.3.5. This list serves as a resource and is not exclusive.

Table 5-5: Federal and State Funding Opportunities

Agency / Grant Name	Potential Programs/Grants
FEMA Hazard Mitigation Assistance Grants	See Section 6 for FEMA/ HMA grant details. For more information on current grants visit https://www.fema.gov/hazard-mitigation-assistance ▪ Hazard Mitigation Grant Program (HMGP): https://www.fema.gov/hazard-mitigation-grant-program ▪ Building Resilient Infrastructure and Communities (BRIC): https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities ▪ Flood Mitigation Assistance Grant Program (FMA): https://www.fema.gov/flood-mitigation-assistance-grant-program
FEMA other grant programs	Including: ▪ Assistance to Firefighters Grant Program. Assistance to Firefighters Grants, Fire Prevention & Safety, and Staffing for Adequate Fire and Emergency Response. https://www.fema.gov/welcome-assistance-firefighters-grant-program ▪ Emergency Management Performance Grants (EMPG). Good for Equipment, Back Up Generators, Etc. https://www.fema.gov/emergency-management-performance-grant-program ▪ Regional Catastrophic Preparedness Grant Program (RCPGP). Housing and Logistics and Supply Chain Management, encouraging

Agency / Grant Name	Potential Programs/Grants
	innovative regional solutions to issues related to catastrophic incidents, and building on existing regional efforts. https://www.fema.gov/regional-catastrophic-preparedness-grant-program
U.S. Dept. of Energy / Energy Efficiency and Conservation Block Grant Program	***Provides funding for weatherization of structures and development of building codes/ordinances to ensure energy efficiency and restoration of older homes.*** https://www.energy.gov/eere/wipo/energy-efficiency-and-conservation-block-grant-program
State and County Community Development Dept. Block Grants (CDBG)	Through Cal. Dept. of Housing and Community Development Dept. (HCD) Programs Include: ▪ Community Development (CD) ▪ Economic Development (ED) ▪ Disaster Recovery Initiative (DRI) ▪ Neighborhood Stabilization Program (NSP) ▪ https://www.hcd.ca.gov/grants-funding/active-funding/cdbg.shtml
Cal OES **Proposition 1B Grants Programs**	The Highway Safety, Traffic Reduction, Air Quality and Port Security Bond Act of 2006, approved by the voters as Proposition 1B at the November 7, 2006 general election, authorizes the issuance of $19,925,000,000 in general obligation bonds for specified purposes, including grants for transit system safety, security, and disaster response projects. http://www.caloes.ca.gov/cal-oes-divisions/grants-management/homeland-security-prop-1b-grant-programs/proposition-1b-grant
California Proposition 1: the Water Bond (AB 1471)	Authorize $7.545 billion in general obligation bonds for state water supply infrastructure projects, such as public water system improvements, surface and groundwater storage, drinking water protection, water recycling and advanced water treatment technology, water supply management and conveyance, wastewater treatment, drought relief, emergency water supplies, and ecosystem and watershed protection and restoration. The State Water Resources Control Board (State Water Board) will administer Proposition 1 funds for five programs. The estimated implementation schedule for each is outlined in Five Categories: ▪ Small Community Wastewater ▪ Water Recycling ▪ Drinking Water ▪ Stormwater ▪ Groundwater Sustainability http://www.waterboards.ca.gov/water_issues/programs/grants_loans/proposition1.shtml

Agency / Grant Name	Potential Programs/Grants
Assistance to Firefighters Grant Program (AFG); Fire Prevention and Safety (FP&S)	The primary goal of the FP&S Grants is to enhance the safety of the public and firefighters with respect to fire and fire-related hazards. The Grant Programs Directorate administers the FP&S Grants as part of the AFG Program. FP&S Grants are offered to support projects in two activity areas: 1). Fire Prevention and Safety (FP&S) Activity Activities designed to reach high-risk target groups and mitigate the incidence of death and injuries caused by fire and fire-related hazards. 2). Research and Development (R&D) Activity To learn more about how to prepare to apply for a project under this activity, please see the FP&S Research and Development Grant Application Get Ready Guide. https://www.fema.gov/fire-prevention-safety-grants
California Housing and Community Development (HCD) Emergency Solutions Grant (ESG) Program	***To fund projects that serve homeless individuals and families with supportive services, emergency shelter/transitional housing, assisting persons at risk of becoming homeless with homelessness prevention assistance, and providing permanent housing to the homeless population. The Homeless Emergency Assistance and Rapid Transition to Housing (HEARTH) Act of 2009 places new emphasis on assisting people to quickly regain stability in permanent housing after experiencing a housing crisis and/or homelessness.*** http://www.hcd.ca.gov/fa/esg/index.html
CalTrans Division of Local Assistance / Safe Routes to School Program	California Dept. of Transportation. Federal funding administered via Caltrans. Local 10% match is the minimum requirement. http://www.dot.ca.gov/hq/LocalPrograms/saferoutes/saferoutes.htm Active transportation grant program. Creating mobility and connectivity. Prioritize projects, and preparation of PED for active transportation projects.
Property Assessed Clean Energy (PACE) Programs	PACE financing allows property owners to fund energy efficiency, water efficiency and renewable energy projects with little or no up-front costs. With PACE, residential and commercial property owners living within a participating district can finance up to 100% of their project and pay it back over time as a voluntary property tax assessment through their existing property tax bill.
HazMat Emergency Preparedness Grant	The purpose of this grant program is to increase effectiveness in safely and efficiently handling hazardous materials accidents and incidents; enhance implementation of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA); and encourage a comprehensive approach to emergency training and planning by incorporating the unique challenges of responses to transportation situations. http://www.caloes.ca.gov/cal-oes-divisions/fire-rescue/hazardous-materials/hazmat-emergency-preparedness-grant

Agency / Grant Name	Potential Programs/Grants
CERT Program Manager Course	The purpose of this Community Emergency Response Team (CERT) Program Manager course is to prepare CERT Program Managers for the tasks required to establish and sustain an active local CERT program. http://www.californiavolunteers.org/index.php/CERT/PM/
California Residential Mitigation Program	The California Residential Mitigation Program (CRMP) was established to carry out mitigation programs to assist California homeowners who wish to seismically retrofit their houses. http://www.californiaresidentialmitigationprogram.com/
Earthquake Brace + Bolt (EBB)	EBB, part of the California Residential Mitigation Program, was developed to help homeowners lessen the potential for damage to their houses during an earthquake by offering eligible homeowners up to a $3,000 incentive to seismically retrofit their homes. https://www.earthquakebracebolt.com/
California Air Resources Board Air Pollution Incentives, Grants and Credit Programs	These programs have hundreds of millions of dollars in grants available over the next several years to reduce emissions from on- and off-road vehicles and equipment. https://www.arb.ca.gov/ba/fininfo.htm
California Department of Water Resources Grants and Loans	https://water.ca.gov/Work-With-Us/Grants-And-Loans Agency offers a variety of grants and loans related to integrated regional water management, flood mitigation, water conservation and efficiency, environmental restoration, groundwater, water quality, and water supply.
US Bureau of Reclamation WaterSMART Grants	Annual funding available for: ▪ Water Reclamation and Reuse funding ▪ Drought Resiliency Project funding ▪ Water and Energy Efficiency Grant funding https://www.usbr.gov/watersmart/

5.4 Mitigation Goals

Hazard mitigation plans must identify goals for reducing long-term vulnerabilities to identified hazards (44 C.F.R. § 201.6(c)(3)(i)). The HMPC established a set of goals for this plan, based on review of the City of Shasta Lake's previous goals, goals from other jurisdictions' hazard mitigation plans, and from the California Hazard Mitigation Plan. The HMPC also considered the preliminary risk assessment and public outreach results. The HMPC ultimately determined to adopt similar goals to the California Hazard Mitigation Plan.

Goals discussed in this section describe what future actions should occur to continue mitigating hazards. The goals form the basis for the development of the Mitigation Action Strategy and specific mitigation projects. The process consists of 1) setting goals, 2) considering mitigation alternatives, 3) identifying strategies or "actions", and 4) developing a prioritized action plan resulting in a mitigation strategy.

The goals and mitigation actions in this plan all support each other. Actions were prioritized based on their ability to achieve multiple goals. A mitigation strategy is considered effective based on how well the goals of the strategy are achieved. The abbreviations reflected in parenthesis below are used to match mitigation actions with each goal in Table 5-6.

The following are the goals for this plan:

Goal 1: Significantly reduce risk of injuries and loss of life during disaster events. ("People")

Goal 2: Minimize damage to critical infrastructure and property and minimize interruption of essential services and activities. ("Infrastructure")

Goal 3: Protect the environment. ("Environment")

Goal 4: Promote community resilience through integration of hazard mitigation with public policy and standard business practices. ("Resilience")

5.5 Mitigation Actions

Mitigation actions were developed based upon planning committee priorities, risk assessment results, and mitigation alternatives. Most importantly, the newly-developed mitigation actions acknowledge updated risk assessment information outlined in Section 3.

Mitigation actions are available on MAST linked through mitigatehazards.com; the format allows for regular updating and easy sorting by jurisdiction and hazard. Figure 5-1 illustrates the mitigation actions entered through MAST.

Table 5-6 establishes mitigation actions for the City. The City developed mitigation actions specifically tailored to their vulnerabilities and capabilities. Those mitigation actions are available as part of the Executive Summary, Table ES 1, and are available on the Mitigation Action Application.

Some mitigation actions support ongoing activities of participating jurisdictions, while other actions are intended to be completed when funding is available. All mitigation actions will be reviewed annually.

Figure 5-1: Mitigation Action Application

5.5.1 Prioritization of Mitigation Actions

Implementing the identified mitigation can be overwhelming for any local jurisdiction or district, especially with limited staffing and fiscal resources; prioritizing the identified mitigation actions can help greatly with this. To ensure this HMP realistically reflects available resources, mitigation actions are prioritized by considering the cost/benefit review, public input, and HMP Planning Committee agreement.

5.5.1.1 Cost/Benefit Review

The action plan must be prioritized according to a cost/benefit analysis of the proposed projects and their associated costs (44 C.F.R. §201.6(c)(3)(iii)). The benefits of proposed projects were weighed against estimated costs as part of the project prioritization process. This review does not meet FEMA Hazard Mitigation Grant Program (HMGP) and Building Resilient Infrastructure and Communities (BRIC) grant program requirements. A less formal, less costly approach was used because some projects may not be implemented for up to 10 years, and associated costs and benefits could change dramatically in that time. Parameters were established for assigning subjective ratings (high, medium, and low) to the costs and benefits of these projects. Cost ratings were defined as follows:

- **High**—Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).
- **Medium**—The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
- **Low**—The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.

Benefit ratings were defined as follows:

- **High**—Project will provide an immediate reduction of risk exposure for life and property.
- **Medium**—Project will have a long-term impact on the reduction of risk exposure for life and property, or will not provide an immediate reduction in the risk exposure for property.
- **Low**—Long-term benefits of the project are difficult to quantify in the short term.

Using this approach, projects with positive benefit versus cost ratios (such as high over high, high over medium, medium over low, etc.) are considered cost-beneficial and are prioritized accordingly. For many of the strategies identified in this action plan, the City may seek financial assistance under the HMGP or BRIC programs, both of which require detailed cost/benefit analyses. These analyses will be performed on projects at the time of application using the FEMA cost/benefit model. For projects not seeking financial assistance from grant programs that require detailed analysis, the City may reserve the right to define "benefits" according to parameters that meet the goals and objectives of this HMP.

5.5.1.2 Public Input

An eight-question community survey was distributed by the City of Shasta Lake its website, social media, and partner email blasts. A total of 85 survey responses were received. The results of the survey were used to ensure that the priorities of the county and participating jurisdictions match those of the residents and community members.

Specific question responses heavily influenced the prioritization of mitigation actions, including the following summarized questions and responses:

- **Property at risk?** 84% of participants believe their property is at risk from a natural hazard disaster.
- **Hazards experienced?** Respondents have experienced these top hazards:
    - Severe summer weather- high heat, high wind (72%)
    - Wildfire (69%)
    - Drought (62%)
    - Pandemic (52%)
    - Earthquakes (18%)

    Only 6% of respondents had not experienced a natural hazard.
    - **Consider risk of hazards with home purchase?** 49% of participants considered the risk of naturally occurring hazards when choosing their home.
- **Informed about hazard risks?** 49% of respondents felt they were well-informed about the dangers of natural hazards, while 45% felt somewhat informed and 6% felt uninformed.
- **What incentives would encourage home protection from hazards?** Top three responses:
    - Rebate programs or reimbursement of upfront costs (68%)
    - Insurance premium discounts (62%)
    - Building permit fee waivers (59%)
- **Top mitigation projects for local governments to focus on?** Top responses:
    - Replant vegetation after wildfires to prevent landslides and flooding (68%)
    - Assist vulnerable property owners with securing funding to mitigate their property(s) (67%)
    - Work on improving damage resistance of utilities (64%)
    - Ensure emergency shelters, the Emergency Operations Center, and communication towers have backup power generators (60%)
    - Retrofit and strengthen essential facilities (60%)
    - Replace inadequate or vulnerable bridges and roadways (54%)

As a result of the public survey, the City adjusted many of the priorities of various mitigation actions. Some were moved from medium to high priority based on community feedback, or vice versa. The top mitigation projects for the City paralleled top mitigation projects identified for the city, with vegetation management topping the list for both. Thankfully, the City does not have any current wildfire scarring in need of mitigation, but the City will focus on vegetative fuel management as a top priority following this HMP update, continuing the progress it made before this HMP update. This City also moved up its priority for assisting private landowners with hazard mitigation efforts. Finally, the City will continue to prioritize improving damage resistance of utilities and strengthening the same, in line with public feedback.

The complete survey results summary can be found in Appendix B.

5.5.2 Mitigation Action Plan

Table 5-6 lists each mitigation action for the City of Shasta Lake. The actions detailed in Table 5-6 and MAST contain both new action items developed for this plan Update as well as old actions that were yet to be completed from the 2014 Plan. The action numbers indicate whether the action is new or from the 2014 plan and the hazard type being mitigated, along with assigning a distinct number to each mitigation action for easy identification. Figure 5-2 provides a key to understand the mitigation action numbering system.

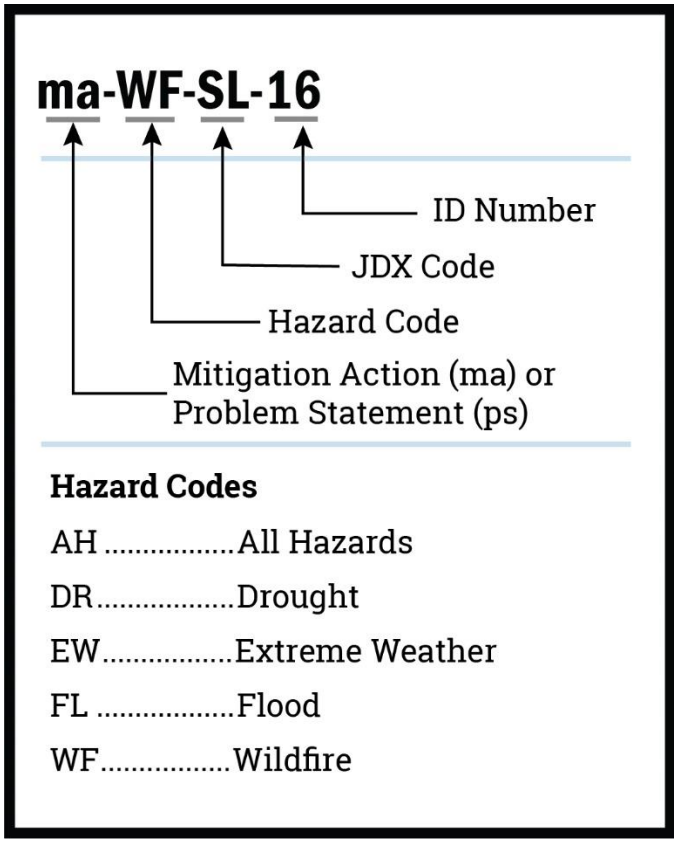


Figure 5-2. Mitigation Action Key

The city mitigation actions are available for city updates, review, and additional information on MAST. Each mitigation action identifies the overall mitigation goal being addressed, responsible party, time frame, potential funding source, implementation steps and resources needed to implement these priority mitigation actions. As a living document, hazard problem statements and mitigation activities will be updated through MAST.

Section 2, What's New, illustrates progress towards new and previous mitigation action and indicates how many actions have been completed, deleted, or are ongoing or pending.

Important to note: The Planning Committee realizes that new needs and priorities may arise as a result of a disaster or other circumstances and reserves the right to support new actions and edit existing actions as necessary as long as they conform to the overall goals of the plan.

Table 5-6: City of Shasta Lake Mitigation Action Tracker

Mitigation No.	Hazard Type	Mitigation Type	Status	Year	Primary Agency	Title/Description	Responsible Party	Estimated Cost	Estimated Benefit	Time Frame	HMA Activity Type	Potential Grant Source	Priority	Related Problem Statements
ma-WF-SL-16	All Hazard	ES - Emergency Services	Pending	2021	City of Shasta Lake	Assess emergency access routes for multiple egress options and adequate turn arounds and infrastructure; maintain and improve wildfire emergency access where needed.	Public Works; SLFPD	High - Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).	High - Project will provide an immediate reduction of risk exposure for life and property.	3-5 Years	Planning	HMGP / BRIC , EMPG , CAL FIRE	High	ps-WF-SL-20, ps-WF-SL-24
ma-AH-SL-18	All Hazard	ES - Emergency Services	Pending	2021	City of Shasta Lake	Ensure addresses and locations are easily visible and accessible during emergencies, especially in the Wildland Urban Interface (WUI).	SLFPD; CoSL Development Services Department (DSD)	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	High - Project will provide an immediate reduction of risk exposure for life and property.	3-5 Years	N/A	CDBG DRI , EMPG , Internal Funding , CAL FIRE	High	ps-WF-SL-19
ma-AH-SL-19	All Hazard	SP - Structural Projects	Pending	2021	City of Shasta Lake	Partner with the Shasta Lake Fire Protection District (SLFPD) to plan and implement retrofits to main fire station for hazard resiliency.	SLFPD, CoSL DSD	High - Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).	High - Project will provide an immediate reduction of risk exposure for life and property.	1-3 Years	Planning	HMGP / BRIC , CDBG DRI , Internal Funding	Medium	ps-AH-SL-35
ma-AH-SL-20	All Hazard	ES - Emergency Services	Pending	2021	City of Shasta Lake	Implement pre-identified emergency evacuation zones, such as Zone Haven, in coordination with Sheriff and County OES.	SLFPD, City in partnership with Shasta County, City of Redding	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	High - Project will provide an immediate reduction of risk exposure for life and property.	Ongoing	5%	HMGP / BRIC	High	ps-AH-SL-34
ma-AH-SL-22	All Hazard	PPRO - Property Protection	Ongoing	2021	City of Shasta Lake	Improve removal of dead or downed trees or those with dead canopies to be more resilient to wildfire, high winds, and extreme rain or snowstorms.	SLFPD; CoSL Public Works	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	High - Project will provide an immediate reduction of risk exposure for life and property.	Ongoing	N/A	N/A	High	ps-EW-SL-33, ps-EW-SL-6
ma-DR-SL-21	Drought	PRV - Prevention	Pending	2021	City of Shasta Lake	Review and strengthen the City's water conservation ordinance where needed to limit outdoor watering during drought periods.	CoSL DSD, Water Department	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	Medium - Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.	1-3 Years	Planning	HMGP / BRIC , Internal Funding	High	ps-DR-SL-29, ps-DR-SL-30, ps-CC-SL-36

Mitigation No.	Hazard Type	Mitigation Type	Status	Year	Primary Agency	Title/Description	Responsible Party	Estimated Cost	Estimated Benefit	Time Frame	HMA Activity Type	Potential Grant Source	Priority	Related Problem Statements
ma-DR-SL-24	Drought	PE&A - Public Education & Awareness	Pending	2021	City of Shasta Lake	Develop a robust public education campaign to encourage water conservation during drought periods.	CoSL DSD, Water Department	High - Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).	High - Project will provide an immediate reduction of risk exposure for life and property.	Ongoing	5%	HMGP / BRIC	Medium	ps-DR-SL-29, ps-DR-SL-30, ps-CC-SL-36
ma-EW-SL-3	Extreme Weather	PE&A - Public Education & Awareness	Ongoing	2014	City of Shasta Lake	Improve HVAC and other weatherization items (insulation, windows/doors) in homes and businesses.	CoSL Electric, City Manager (Promote rebate assistance programs for local residents and specifically low-income residents); DSD (Public Outreach)	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	High - Project will provide an immediate reduction of risk exposure for life and property.	1 - 5 Years	5%	HMGP / BRIC , CDBG DRI , Internal Funding	Medium	ps-EW-SL-25, ps-EW-SL-27, ps-CC-SL-39
ma-EW-SL-4	Extreme Weather	SP - Structural Projects	Pending	2014	City of Shasta Lake	Construct back-up power facilities for community-based Cooling Centers.	CoSL Public Works / Electric. Support: Gateway School District, CoSL DSD, City Manager	High - Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).	High - Project will provide an immediate reduction of risk exposure for life and property.	1 - 5 Years	Project	HMGP / BRIC , Internal Funding	High	ps-EW-SL-26, ps-CC-SL-39
ma-EW-SL-5	Extreme Weather	PPRO - Property Protection	Ongoing	2014	City of Shasta Lake	Harden critical facilities against the effects of a severe rain or winter storm.	Public Works; Building Official; DSD	High - Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).	High - Project will provide an immediate reduction of risk exposure for life and property.	3-5 Years	Project	HMGP / BRIC , CDBG DRI , Internal Funding	High	ps-EW-SL-5, ps-EW-SL-6, ps-EW-SL-3, ps-CC-SL-37
ma-EW-SL-21	Extreme Weather	NRP - Natural Resource Protection	Pending	2021	City of Shasta Lake	Identify alternative debris collection sites and/or removal methods for debris resulting from extreme weather events.	Public Works	Low - The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	High - Project will provide an immediate reduction of risk exposure for life and property.	1-3 Years	Planning	N/A	Extreme	ps-EW-SL-4
ma-EW-SL-23	Extreme Weather	PRV - Prevention	Pending	2021	City of Shasta Lake	Work with outside agencies to evaluate and prioritize replacement of undersized culverts in the city.	Public Works; Cal Trans	High - Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).	High - Project will provide an immediate reduction of risk exposure for life and property.	5-10 Years	Planning	HMGP / BRIC	Medium	ps-EW-SL-32, ps-CC-SL-37

Mitigation No.	Hazard Type	Mitigation Type	Status	Year	Primary Agency	Title/Description	Responsible Party	Estimated Cost	Estimated Benefit	Time Frame	HMA Activity Type	Potential Grant Source	Priority	Related Problem Statements
ma-FL-SL-6	Flood	PE&A - Public Education & Awareness	Pending	2014	City of Shasta Lake	Increase awareness of flood risk and safety.	CoSL DSD; Partner with Cal OES / FEMA	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	High - Project will provide an immediate reduction of risk exposure for life and property.	3-5 Years	5%	HMGP / BRIC	Medium	ps-FL-SL-7, ps-FL-SL-10
ma-FL-SL-7	Flood	PRV - Prevention	Ongoing	2014	City of Shasta Lake	Routinely inspect storm water channels, inlets and outfalls for vegetation build up / encroachment, trash / debris, silt / gravel build up, erosion or bank failure, structural damage, and vandalism. Prioritize clean up and repair as needed.	CoSL Public Works, DSD	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	High - Project will provide an immediate reduction of risk exposure for life and property.	1 - 5 Years	Project	HMGP / BRIC	High	ps-FL-SL-8, ps-FL-SL-9
ma-FL-SL-8	Flood	SP - Structural Projects	Ongoing	2014	City of Shasta Lake	Implement drainage improvements from the City of Shasta Lake 2008 Drainage Master Plan.	Public Works; DSD	High - Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).	High - Project will provide an immediate reduction of risk exposure for life and property.	5 - 10 Years	Project	HMGP / BRIC	High	ps-FL-SL-9
ma-WF-SL-9	Wildfire	PRV - Prevention	Pending	2014	City of Shasta Lake	Develop a city-wide implementation plan, in collaboration with SLFPD, for defensible space code administration and enforcement.	SLFPD; Support: CoSL Development Services, City Council	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	High - Project will provide an immediate reduction of risk exposure for life and property.	1 - 5 Years	Planning	HMGP / BRIC	High	ps-WF-SL-17, ps-WF-SL-18, ps-CC-SL-38
ma-WF-SL-10	Wildfire	SP - Structural Projects	Pending	2014	City of Shasta Lake	Construct and upgrade city water supply for fire suppression in Wildland Urban Interface (WUI) areas.	SLFPD; CoSL Public Works	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	High - Project will provide an immediate reduction of risk exposure for life and property.	1-5 Years	Planning	HMGP / BRIC , FP&S , CDBG DRI , EMPG	Extreme	ps-WF-SL-21, ps-WF-SL-23
ma-WF-SL-11	Wildfire	PE&A - Public Education & Awareness	Ongoing	2014	City of Shasta Lake	Develop and maintain a Wildfire Preparedness Guide, to provide residents with education and information on defensible space maintenance.	SLFPD. Support: Shasta County Fire Prevention Officer, Western Shasta RCD, Gateway School District ,CoSL DSD, BLM	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	High - Project will provide an immediate reduction of risk exposure for life and property.	1-5 Years	5%	HMGP / BRIC , Internal Funding	High	ps-WF-SL-23, ps-DR-SL-30, ps-CC-SL-38

Mitigation No.	Hazard Type	Mitigation Type	Status	Year	Primary Agency	Title/Description	Responsible Party	Estimated Cost	Estimated Benefit	Time Frame	HMA Activity Type	Potential Grant Source	Priority	Related Problem Statements
ma-WF-SL-12	Wildfire	PPRO - Property Protection	Ongoing	2014	City of Shasta Lake	Ensure properties are cleared in accordance with weed abatement ordinance for Seniors, disabled and low income populations.	SLFPD. Support: Western Shasta RCD, Faith Based Community Programs, CoSL Public Works Dept.	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	High - Project will provide an immediate reduction of risk exposure for life and property.	5 - 10 Years	Project	HMGP / BRIC , Internal Funding	High	ps-WF-SL-16, ps-WF-SL-17, ps-WF-SL-18, ps-WF-SL-23, ps-DR-SL-30, ps-CC-SL-38
ma-WF-SL-13	Wildfire	PE&A - Public Education & Awareness	Pending	2014	City of Shasta Lake	Join and collaborate with local Fire Safe Council to protect homes, the community, and environment from wildfires. (Shasta County Fire Safe Council reestablished 2021)	SLFPD. Support: Western Shasta RCD	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	High - Project will provide an immediate reduction of risk exposure for life and property.	1 - 5 Years	N/A	Internal Funding	Extreme	ps-WF-SL-23, ps-WF-SL-17, ps-WF-SL-18, ps-CC-SL-38
ma-WF-SL-14	Wildfire	PRV - Prevention	Ongoing	2014	City of Shasta Lake	Continue to implement projects in City Electric Department Wildfire Vulnerability Plan, County CWPP, and Cal Fire Shasta-Trinity Unit Plan.	SLFPD. Support: Shasta County Fire Safe Council, Western Shasta RCD	High - Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).	High - Project will provide an immediate reduction of risk exposure for life and property.	1 - 5 Years	Project	HMGP / BRIC , EMPG , Internal Funding	Extreme	ps-WF-SL-16, ps-WF-SL-22, ps-WF-SL-31
ma-WF-SL-15	Wildfire	PRV - Prevention	Pending	2021	City of Shasta Lake	Complete additional fuel break projects focused on north and northeast portions of the City as identified by the CWPP (also see Electric Department Wildfire Mitigation Plan for additional fuel reduction projects).	SLFPD; Western Shasta RCD	High - Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).	High - Project will provide an immediate reduction of risk exposure for life and property.	3-5 Years	Project	HMGP / BRIC , Internal Funding , CAL FIRE	Extreme	ps-WF-SL-22, ps-WF-SL-16, ps-CC-SL-38
ma-WF-SL-17	Wildfire	PPRO - Property Protection	Pending	2021	City of Shasta Lake	Seek funding to develop a cost share program for residential defensible space and fuel reduction mitigation and fireproofing retrofits.	Western Shasta RCD. Support: CoSL DSD, Public Works	High - Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).	High - Project will provide an immediate reduction of risk exposure for life and property.	3-5 Years	Project	HMGP / BRIC	High	ps-WF-SL-17, ps-WF-SL-18, ps-CC-SL-38

Note: As a living document, project descriptions and actions in the tables above will be modified to reflect current conditions over time in MAST.

Section 6. Plan Implementation and Maintenance

It is important that this plan becomes a usable, used tool for all planning committee to ensure reductions in possible damage from a natural hazard event. This section discusses adopting, implementing, monitoring, evaluating, and updating the HMP, which should help ensure that the HMP remains relevant. This section describes the incorporation of the HMP into existing planning mechanisms, and how the jurisdictions will continue to engage the public.

6.1 Plan Adoption

To comply with DMA 2000, the City of Shasta Lake Board has officially adopted the City of Shasta Lake Hazard Mitigation Plan. The adoption of the HMP recognizes the City's commitment to reducing the impacts of natural hazards within the City. A copy of the HMP adoption resolution is included immediately following the Executive Summary.

6.2 Plan Implementation

Over time, implementation strategies for mitigation actions will become more detailed. MAST will be extremely useful to plan for updates to this HMP and to update individual mitigation actions as implemented or revised. In conjunction with the progress report processes, implementation strategy worksheets will be extremely useful as a plan of record tool for updates. Each implementation strategy worksheet provides individual steps and resources need to complete each priority mitigation action. The following are considerations for developing future implementation strategies:

- **Use processes that already exist.** Take advantage of the tools and procedures identified in the capability assessment in Section 5.3. Using planning mechanisms already in use and familiar to planning committee will give the planning implementation phase a strong initial boost.
- **Updated work plans, policies, or procedure.** Incorporating hazard mitigation concepts and activities can help integrate the HMP into daily operations. These changes can include how major development projects and subdivision reviews are addressed in hazard-prone areas or ensure that hazard mitigation concerns are considered in the approval of major capital improvement projects.
- **Job descriptions.** Working with department or agency heads to revise job descriptions of government staff to include mitigation-related duties, including designating a "mitigation lead" within a department, can further institutionalize hazard mitigation with little financial expenditure or programmatic overhaul.

6.2.1 Steering Committee

The Steering Committee oversaw the development of the plan and made recommendations on key elements of the plan, including the maintenance strategy. The Steering Committee recommended that an

oversight committee referred to herein as the HMP Steering Committee, should have an active role in the plan maintenance strategy. Therefore, it is recommended that the HMP Steering Committee become involved in key elements of the plan maintenance strategy. The new HMP Steering Committee should strive to include representation from the Planning Committee, as well as other stakeholder groups and members of the public in the planning area. Keeping this new HMP Steering Committee intact will also jump-start future updates.

The new HMP Steering Committee will develop annual progress reports to provide input to the City of Shasta Lake City Council on possible improvements or action steps to be considered at the next update. It will be the HMP Steering Committee's role to create a report in an effort to identify revisions and issues needing to be addressed by future plans.

6.3 Monitoring, Evaluating and Updating the HMP

This section describes the schedule and process for monitoring, evaluating, and updating the HMP. The Mitigation Action Support Tool (MAST) has been developed for the City to use as a primary resource for updating and monitoring mitigation actions. See subsection 6.3.2 below for more information on MAST.

6.3.1 Schedule

Monitoring the progress of the mitigation actions will be ongoing throughout the five-year period between the adoption of the HMP and the next update effort. The newly-formed HMP Steering Committee will meet biannually to monitor the implementation of mitigation actions and develop updates as necessary.

The HMP will be updated every five years, as required by DMA 2000. The update process will begin at least one year prior to the expiration of the HMP. However, should a significant disaster occur within the County, the HMP Steering Committee will reconvene within 30 days of the disaster to review and update the HMP as appropriate. The Board of County Commissioners will adopt written updates to the HMP as a DMA 2000 requirement.

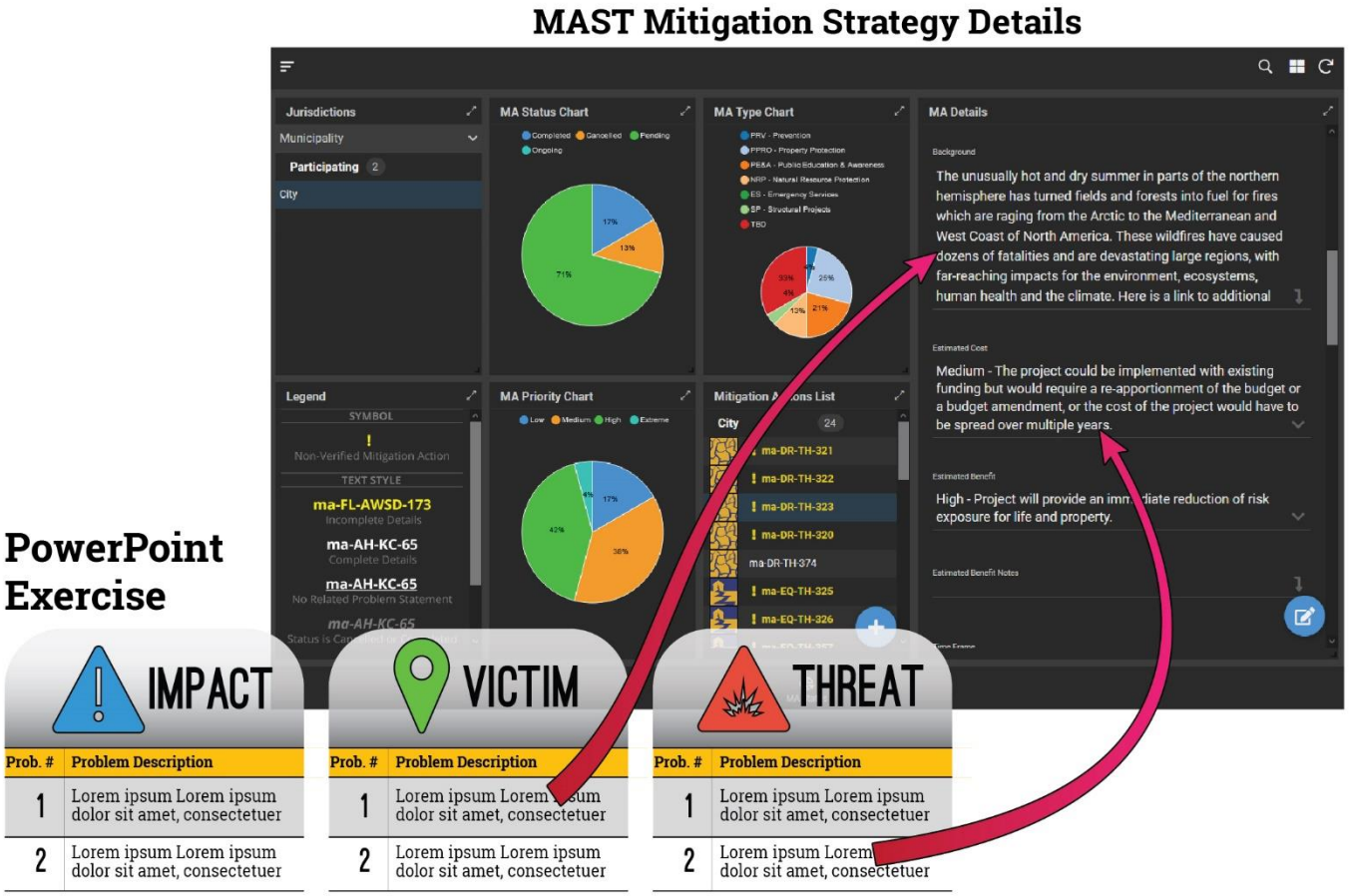
6.3.2 Mitigation Action Support Tool (MAST) Updates

Hazard problem statements and mitigation activities will be updated through a web interface application developed specifically for the City of Shasta Lake, available on the project website, (mitigatehazards.com/shastalakehmp/) to ensure this HMP remains a living document.

MAST is a web-based interactive tool that enables multiple users to search, view, enter, and update mitigation actions, ideas or projects, and other information. MAST provides city staff and plan reviewers (Cal OES/FEMA) access to valuable mitigation information that can be leveraged by future planning or other risk reduction efforts. Users can update the status of their mitigation projects throughout the planning lifecycle and this web-based tool will improve participating jurisdiction's ability to apply for FEMA's Hazard Mitigation Assistance (HMA) grant programs including the initial grant application processes through Cal OES.

6.3.3 Process

The HMP Steering Committee will coordinate with responsible agencies/organizations identified for each mitigation action. These responsible agencies/organizations will monitor and evaluate the progress made on the implementation of mitigation actions and report to the HMP Steering Committee on an annual basis. These responsible departments will assess the effectiveness of the mitigation actions and modify them as appropriate. MAST will assist mitigation project managers in reporting on the status and assessing the effectiveness of the mitigation actions. Most updates to the HMP will occur easily through MAST.



6-1: Diagram of MAST viewing details

Information from the mitigation leads within responsible departments will be used to monitor mitigation actions and annual evaluation of the HMP. The following questions will be considered in evaluating HMP effectiveness:

- Has the nature or magnitude of hazards affecting the City changed?
- Are there new hazards that have the potential to impact the City?
- Do the identified goals and actions address current and expected conditions?

- Have mitigation actions been implemented or completed?
- Has the implementation of identified mitigation actions resulted in expected outcomes?
- Are current resources adequate to implement the HMP?
- Should additional local resources be committed to address identified hazards?

Future updates to the HMP will account for any new hazard vulnerabilities, special circumstances, or new information that becomes available. Issues that arise or updates made during monitoring and evaluating the HMP will be incorporated into the next update of the HMP in 2026. The questions identified above would remain valid during the preparation of the 2026 update.

6.3.4 Continuing Public Involvement

During the five-year update cycle, City staff will involve the public through public workshops and meetings. Information on upcoming public events related to the HMP or solicitation for comments will be announced via newspapers, mailings, and on the City HMP website (mitigatehazards.com/shastalakehmp/). An electronic copy of the current HMP document will be accessible through the city website as well as at the County Courthouse in the County of Shasta. The HMP Planning Committee will, as much as practicable, incorporate the following concepts into its public outreach strategy to ensure continued public involvement in the HMP planning process:

- Work with public service clubs, i.e., the Mt. Shasta Rotary Club, and the Shasta County Library.
- Collaborate with faith-based organizations, i.e., First Baptist Church of Shasta Lake City, Shasta Lake Community United Methodist Church, Shasta Lake Calvary Chapel, etc.
- Create story ideas for media outlets, such as newspapers, local radio, and TV
- Distribute emails and postcards/mailers to County/ City/ Town residents about hazard mitigation updates
- Post meeting announcements at City Halls, community centers, coffee houses, grocery stores, etc.
- Educate and collaborate with insurance companies.
- Participate in other existing local community meeting places, i.e., Shasta Lake Farmers Market, Shasta College Students and Graduates Career Fair, City of Shasta Lake Nights, etc.
- Distribute information through K-12 schools
- Continue to use the City website as a distribution point of hazard mitigation information

6.3.5 HMA Monitoring

FEMA's Hazard Mitigation Assistance (HMA) Program is the catalyst that drives increased understanding and supports proactive community action to reduce losses from natural hazards. To support this vision, FEMA funds three grant programs under HMA. The three programs are the Hazard Mitigation Grant Program (HMGP), the Flood Mitigation Assistance (FMA) Program, and Building Resilient Infrastructure and Communities (BRIC) Program.[7] Per FEMA:

- **HMGP** assists in implementing long-term hazard mitigation planning and projects following a Presidential major disaster declaration
- **BRIC** provides funds for hazard mitigation planning and projects on an annual basis
- **FMA** provides funds for planning and projects to reduce or eliminate risk of flood damage to buildings that are insured under the National Flood Insurance Program (NFIP) on an annual basis.

HMGP funding is generally 15% of the total amount of Federal assistance provided to a State, Territory, or federally-recognized tribe following a major disaster declaration. BRIC and FMA funding depends on the amount congress appropriates each year for those programs. The HMGP supports cost-effective post-disaster projects and is the longest-running mitigation program among FEMA's three grant programs. A 2017 study by the National Institute of Building Sciences' (NIBS) Multihazard Mitigation Council has shown that every federal dollar spent on mitigation saves six dollars in response and recovery costs. (NIBS, 2018)

MAST will be extremely useful in applying for Cal OES funding. Plan maintenance will be primarily done through MAST. Figure 6-2 demonstrates how MAST information will translate into Cal OES NOIs and grant Sub application requests.

[7] In August of 2020, the BRIC program replaced Pre-Disaster Mitigation (PDM) grant program.

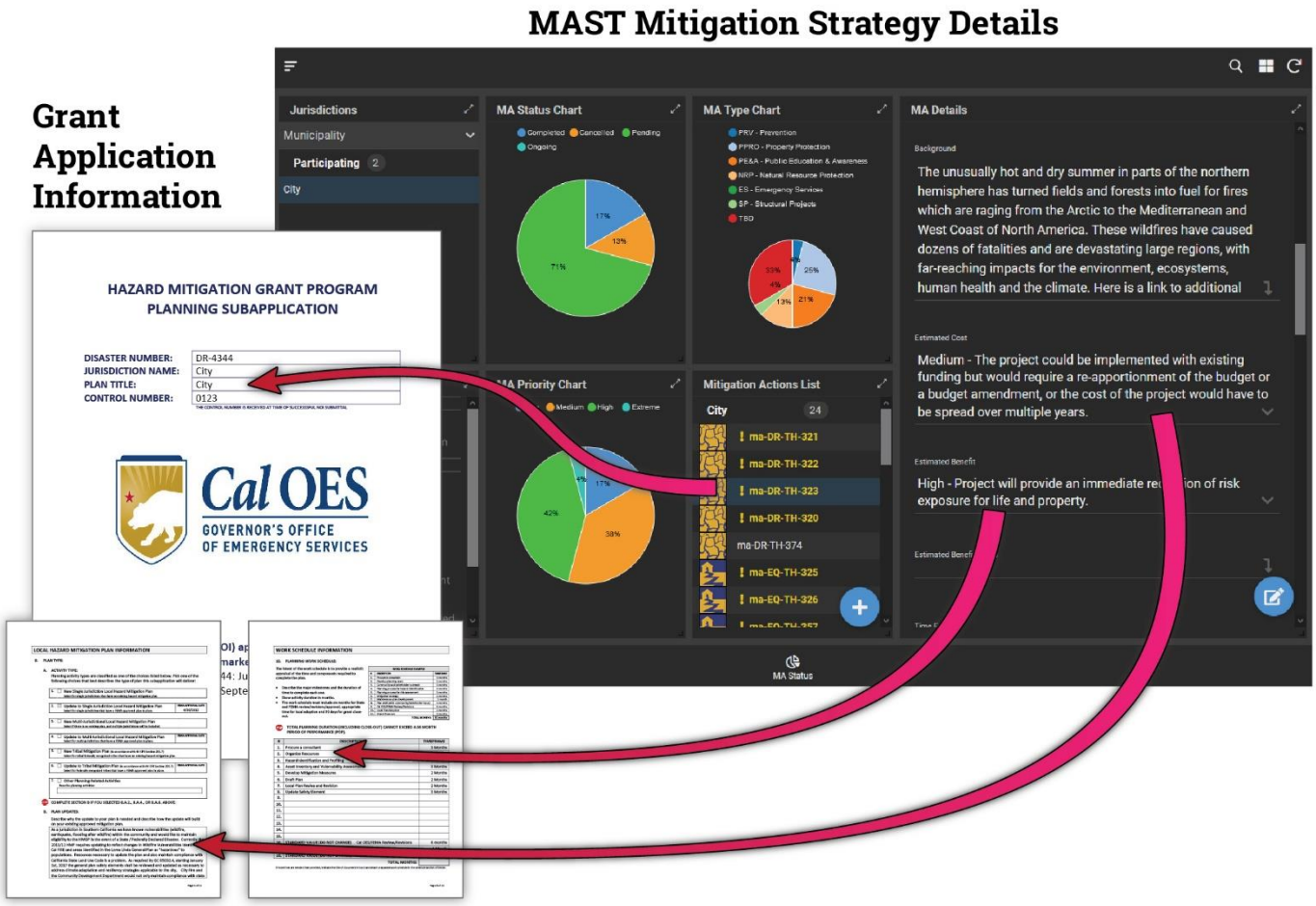


Figure 6-2: MAST and Cal OES Grant Applications

Following a disaster, California Office of Emergency Services (Cal OES) and local City of Shasta Lake officials in a joint effort with FEMA will perform Preliminary Damage Assessments (PDA) of the areas that sustained damage. Cal OES submits, through the FEMA Regional Office, the information collected along with a damage estimate to request a declaration from the President. A Presidential Major Disaster Declaration provides for the availability of HMGP funds at the request of a state's Governor in eligible communities within a state, tribe, or territory. Figure 6-3 depicts this.

Figure 6-3 shows a timeline of how projects should be developed and administered by local government and FEMA under the HMGP program. HMGP grant recipients will have 36 months from the close of the application period to complete projects.

Figure 6-3: HMGP Timeline

For more information on HMGP project development process, visit FEMA and CalOES

6.3.6 Incorporation into Other Planning Mechanisms

For the HMP to be successful, the recommendations and underlying principles of the HMP should be incorporated into community planning and development such as capital improvement budgeting, building and zoning codes, general plans and regional plans. Integration into a variety of departments at the City level provides an opportunity to network, identify, and highlight mitigation activities and opportunities at all levels of government. It is also important to monitor funding opportunities that can be leveraged to implement the mitigation actions.

Information from this HMP can be incorporated into:

- **City of Shasta Lake General Plan:** The HMP will provide information that can be incorporated into the Safety, Land Use, and Conservation Elements of the City's General Plan as they are updated. In particular, the City may decide to update the Safety Element of the General Plan to incorporate the HMP in compliance with AB 2140. Specific risk and vulnerability information from the City of Shasta Lake HMP will assist in identifying areas where development may be at risk to potential hazards, which in turn can be incorporated into General Plans. For example, the City may want to consider instituting a hazard overlay zone that requires additional scrutiny because of close proximity to certain hazards.
- **Building / Development Codes and Zoning Ordinances:** The HMP provides information to enable the City to make decisions on appropriate building/development codes and ordinances. Appropriate building codes and ordinances can increase resilience against natural disasters. Some municipal mitigation actions directly recommend updates or new regulations as mitigation for hazard risks; those mitigation actions indicate priorities for regulatory updates in participating jurisdictions.
- **Community Wildfire Protection Plans (CWPP):** The HMP will provide information that can be incorporated into CWPPs and Strategic Fire Plan updates for areas within or near the City. The HMP likewise captured mitigation actions derived from CWPPs.
- **Water/ Flood Management Plans:** The HMP will provide information that can be included in updates to or the development of the Northern Sacramento Valley Integrated Regional Water Management Plan, the City of Shasta Lake Urban Water Management Plan, the Stillwater-Churn Creek Watershed

Action Plan, and other water/ flood management plans. While the process for updating these types of plans will vary by jurisdiction, the flood data developed for the HMP can be used in other mechanisms along with exposure and damage estimation information.

6.3.7 Planning Integration Processes

With adoption of this plan, the City of Shasta Lake and Planning Committee will be responsible for the plan implementation and maintenance. The City and the HMP Steering Committee will continue to:

- Act as a forum for hazard mitigation issues,
- Disseminate hazard mitigation ideas and activities to City of Shasta Lake communities,
- Ensure hazard mitigation risk assessments and maps remain a consideration for safety decisionmakers,
- Report on plan progress and recommended changes, and
- Inform and solicit input from the public.

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