City of Healdsburg

Addendum

Date:	09 February 2022
Project Name:	RFP: Community Wildfire Protection Plan (CWPP) Addition to the City LHMP
Addendum No.	1
Issued To:	All Interested Parties

The following Changes are hereby made to the RFP:

The current LHMP has been made available as a supporting document to the RFP and is included with this addendum.

A copy of this addendum, signed by the bidder, must accompany all proposals.

Authorized By

Tyler Kettmann, Central Services Manager
City of Healdsburg

Accepted By Proposer

Company (Printed)

Signature

Name and Title (Printed)

CITY OF

HEALDSBURG

2018 Local Hazard Mitigation Plan

Photo by: Al Francis / NapaSonomaPhotos.com

Photo by: Ken Porter/Press Democrat

Photo by: Jim Wilson/The New York Times

Final Plan

Adopted January 2019

Michael Baker
INTERNATIONAL

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Table of Contents

Appendices

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Acronyms

AB	Assembly Bill
ABAG	Association of Bay Area Governments
AFG	Assistance to Firefighters Grant
BMD	Best Management Practices
Cal OES	California Governor's Office of Emergency Services
CalFire	California Department of Forestry and Fire Protection
Caltrans	California Department of Transportation
CDBG	Community Development Block Grant
CFR	Code of Federal Regulations
CGS	California Geological Survey
CIP	Capital Improvement Plan
CWPP	Community Wildfire Protection Plan
DMA 2000	Disaster Mitigation Act of 2000
DRI	Disaster Recovery Initiative
EMPG	Emergency Management Performance Grants
EO	Executive Order
FEMA	Federal Emergency Management Agency
FHSZ	Fire Hazard Severity Zones
FIRM	Flood Insurance Rate Map
FMA	Flood Mitigation Assistance
FRA	Federal Responsibility Area
GIS	Geographic Information Systems
HCD	California Department of Housing and Community Development
HMGP	Hazard Mitigation Grant Program
HSGP	Homeland Security Grant Program
IRWM	Integrated Regional Water Management
LAFCO	Local Agency Formation Commission
LHMP	Local Hazard Mitigation Plan

LID	Low Impact Development
LRA	Local Responsibility Area
MMI	Modified Mercalli Intensity
MMS	Moment Magnitude Scale
NFIP	National Flood Insurance Program
PDAs	Priority Development Areas
PDM	Pre-Disaster Mitigation
RHNA	Regional Housing Need allocation
RL	repetitive loss
SRA	State Responsibility Area
SWGP	Storm Water Grant Program
SWRP	Storm Water Resource Plan
the Stafford Act	Robert T. Stafford Disaster Relief and Emergency Act
UCERF3	third Uniform California Earthquake Rupture Forecast
USC	United States Code
USGS	US Geological Survey
WUI	wildland-urban interface

Section 1. Introduction

Natural disasters can cause significant damage to property and infrastructure, as well as loss of life. These damages and losses can take a toll economically, psychologically, and financially on communities in the response and recovery processes. The City of Healdsburg (the City) Local Hazard Mitigation Plan (LHMP) is an effort undertaken by the City to mitigate the effects of natural hazards and plan for resiliency in the future that respects the character and needs of the people who live and work in Healdsburg.

The City's 2018 LHMP is written to address the local mitigation planning requirements of the Disaster Mitigation Act of 2000 (DMA 2000) for the City of Healdsburg. The 2018 LHMP supersedes the 2011 LHMP. The 2011 LHMP and its 2007 predecessor were both developed as Annexes to region-wide multi-jurisdictional hazard mitigation plans (HMPs) prepared by the Association of Bay Area Governments (ABAG). This 2018 LHMP has been developed as a stand-alone plan.

This section introduces hazard mitigation planning and describes the various sections and appendices of the 2018 LHMP.

1.1 Scope and Purpose

There are four phases of emergency management, as illustrated in **Figure 1.1**.

- **Response:** Taking action to save lives, limit injury, and prevent further damage of infrastructure in a disaster.
- **Recovery:** Returning actions to normal conditions directly following a disaster.
- **Mitigation:** Establishing strategies to prevent future disasters and/or to minimize their impacts.
- **Preparedness:** Preparing to save lives and critical infrastructure and to help response and rescue operations in and directly following a disaster.

Figure 1.1:
Emergency Management Phases

This plan focuses on the mitigation component of the cycle. Hazard mitigation plays an important role in reducing the impacts of disasters by identifying effective and feasible actions to reduce the risks posed by potential hazards. Hazard mitigation is defined by the Federal Emergency Management Agency (FEMA) as "any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event." As such, hazard mitigation is any work that minimizes the impacts of any type of hazard event before it occurs. A hazard event cannot be prevented from occurring, but the impact it will have on our communities can be reduced. Looking at results of 23 years of federally funded mitigation grants, the National Institute of Building Science completed a study to assess future savings from mitigation activities. The study found that 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, evidence that mitigation activities are highly cost-effective (National Institute 2017).

This plan develops mitigation actions to strengthen community resilience, which helps ensure coordinated and consistent hazard mitigation activities across the city. The City has developed the 2018 LHMP to be consistent with current standards and regulations, ensuring that the understanding of hazards facing its communities reflects best available science and current conditions. This plan is also consistent with FEMA requirements, and the mitigation measures included in the plan are grounded in best practices and available resources.

1.2 Authority

1.2.1 Federal

The federal Robert T. Stafford Disaster Relief and Emergency Act (the Stafford Act), as amended by DMA 2000 and supported by various pieces of regulation, directs hazard mitigation planning activities such as this plan. The Stafford Act requires state, local, and tribal governments that wish to be eligible for federal hazard mitigation grant funds to submit a HMP that outlines the processes for identifying the natural and man-made hazards, risks, and vulnerabilities of the jurisdiction (United States Code [USC] Title 42, Section 5156[a]). FEMA has promulgated Code of Federal Regulations (CFR) Title 44, Part 201 to carry out the hazard mitigation planning requirements in the Stafford Act. These regulations direct the planning process, plan content, and FEMA approval for HMPs. The City of Healdsburg is subject to many kinds of hazards; thus, access to these federal grant funds is vital.

This LHMP complies with the Stafford Act and DMA 2000, along with the appropriate sections of CFR Title 44, including Part 201 (Regulation Checklist boxes illustrating the various hazard mitigation requirements are found throughout this plan; accompanied by the text/data supporting the regulations).

1.2.2 State

The State of California passed Assembly Bill (AB) 2140 in 2006, enacting California Government Code Sections 8685.9 and 65302.6. These sections concern federal requirements mandating that jurisdictions have a valid HMP to be eligible for certain grants. Specifically, Section 8685.9 limits the State of California to paying no more than 75 percent of disaster relief funds not covered by FEMA to a local community, unless the affected community (1) has a valid HMP that is consistent with DMA 2000 and (2) has adopted the HMP as part of its general plan. If this is the case, the State may pay for more than 75 percent of the disaster relief funds not covered by FEMA. Section 65302.6 authorizes local communities to adopt HMPs as part of their safety element or a comparable section of their general plan.

1.2.3 Plan Use and Organization

Information in this plan will be used to help guide and coordinate mitigation activities and decisions for City land use policies in the future. Proactive mitigation planning will help reduce the cost of disaster response and recovery to communities and their residents by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruptions. With the memory of the impacts from past hazard events, the City of Healdsburg is committed to reducing future impacts from similar hazard events and maintaining eligibility for mitigation-related federal funding.

Objectives of the LHM include the following:

- Establish and foster a basis for coordination and collaboration among City departments, and other key stakeholders.

- Work in conjunction with other local planning efforts, including the City's General Plan.
- Increase community awareness and empowerment.
- Meet the requirements of federal assistance grant programs, including FEMA's Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM) funding.
- Reduce the risk of loss and damage from hazard events, especially repetitive loss and damage.
- Coordinate hazard mitigation planning activities between City departments and in concert with resource management, land use planning, and emergency operation activities.

The LHMP is organized into seven sections to reflect the logical progression of activities undertaken to develop the plan and includes all relevant documentation required to meet the necessary criteria for FEMA approval. Each section is briefly described below.

- **Section 1, Introduction,** describes the background and purpose of the plan.
- **Section 2, Community Profile,** describes the city's history and general background of the community, historical trends for population and housing, and trends in land use and development.
- **Section 3, Planning Process,** describes the 2018 LHMP planning process, as well as the meetings and outreach activities undertaken to engage the Planning Team members and the public.
- **Section 4, Hazard Assessment,** identifies, describes, and prioritizes the hazards that threaten Healdsburg. This chapter discusses past events, risks of future events, and the effects of future conditions for each type of hazard.
- **Section 5, Vulnerability Assessment,** describes the risks posed by each hazard type to city residents, particularly those who are more likely to be socially vulnerable, and to critical facilities.
- **Section 6, Capability Assessment,** identifies and evaluates the legal and regulatory, human and technical, and financial resources available to accomplish mitigation.
- **Section 7, Mitigation Strategy,** identifies mitigation goals, assesses the City's capabilities to implement mitigation actions, and identifies and prioritizes mitigation actions.
- **Section 8, Plan Implementation and Maintenance,** discusses plan adoption and implementation, as well as the process to monitor, evaluate, and update the plan.
- **Section 9, References**
- **Appendices**
  - **Appendix A**, Planning Process Documents
  - **Appendix B**, Public Outreach
  - **Appendix C**, Hazard and Vulnerability Figures
  - **Appendix D**, Plan Maintenance Forms
  - **Appendix E**, Adoption Resolution
  - **Appendix F**, FEMA Plan Review Tool

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Section 2. Community Profile

The Community Profile provides a general history and background of the community, historical trends for population and housing, and trends in land use and development.

2.1 History

The area that now comprises Healdsburg was originally inhabited by Native Americans—the Southern Pomo and Wappo tribes in the Dry Creek and Alexander Valleys, respectively. Their population once numbered close to 10,000 before it was decimated by small pox epidemics and hostility from Mexican people who came to the area and later by secondary Euro-American settlement in the 1850s. Those who survived were displaced to missions or rancherias (Healdsburg, City of 2009).

The territory that is now Healdsburg was claimed in 1841 by Captain Henry Fitch, brother-in-law of Governor Mariano Vallejo, as part of Fitch's 48,880-acre Sotoyome Rancho. In 1851, would-be gold seeker Harmon Heald, a native of Ohio, built a cabin on the west side of the well-traveled path between San Francisco and the northern mines (now Healdsburg Avenue). Heald built a small general store and opened a post office in the store in 1854, around which a small settlement grew. In 1857, Heald hired a surveyor to lay out a central plaza with streets and 85 lots, and a town was born, populated by 300 (non-native) residents (Healdsburg Museum & Historical Society 2018). In 1867, Healdsburg was incorporated as a city.

In 1871, the railroad opened new markets for farm produce and established Healdsburg as a prosperous agricultural district. By the 1880s, the major regional revenue besides tourism was derived from grapes, lumber, and hops. The bottom dropped out of Healdsburg's flourishing wine industry with passage of the Volstead Act in 1919 and Prohibition. During the 1920s, most of Healdsburg's vineyards were pulled up and replanted with fruit trees, especially French prunes, Imperial prunes, and apples. By 1930, prunes were the most important industry in Healdsburg and remained the largest cash crop until the 1970s when many orchards were removed, with the land again planted with vineyards (Healdsburg Museum & Historical Society 2018).

2.2 Geography

Healdsburg is in Sonoma County, situated in an inland valley defined principally by US Highway 101, the Russian River, surrounding agricultural lands, and mountains to the east and west. US Highway 101 is the principal coastal route between San Francisco and the Oregon border. The Russian River flows through Healdsburg on its way to the Pacific Ocean, approximately 20 miles to the west. The city lies at the intersection of three rich agricultural valleys—Russian River Valley, Dry Creek Valley, and Alexander Valley—and is at an elevation of between 100 and 430 feet above sea level. East and west beyond the agricultural lands rise subsystems of the Coastal Mountain Range. As of 2009, the Healdsburg city limits contain 4.1 square miles Healdsburg, City of, 2018). **Figure 2.1** illustrates the city's location.

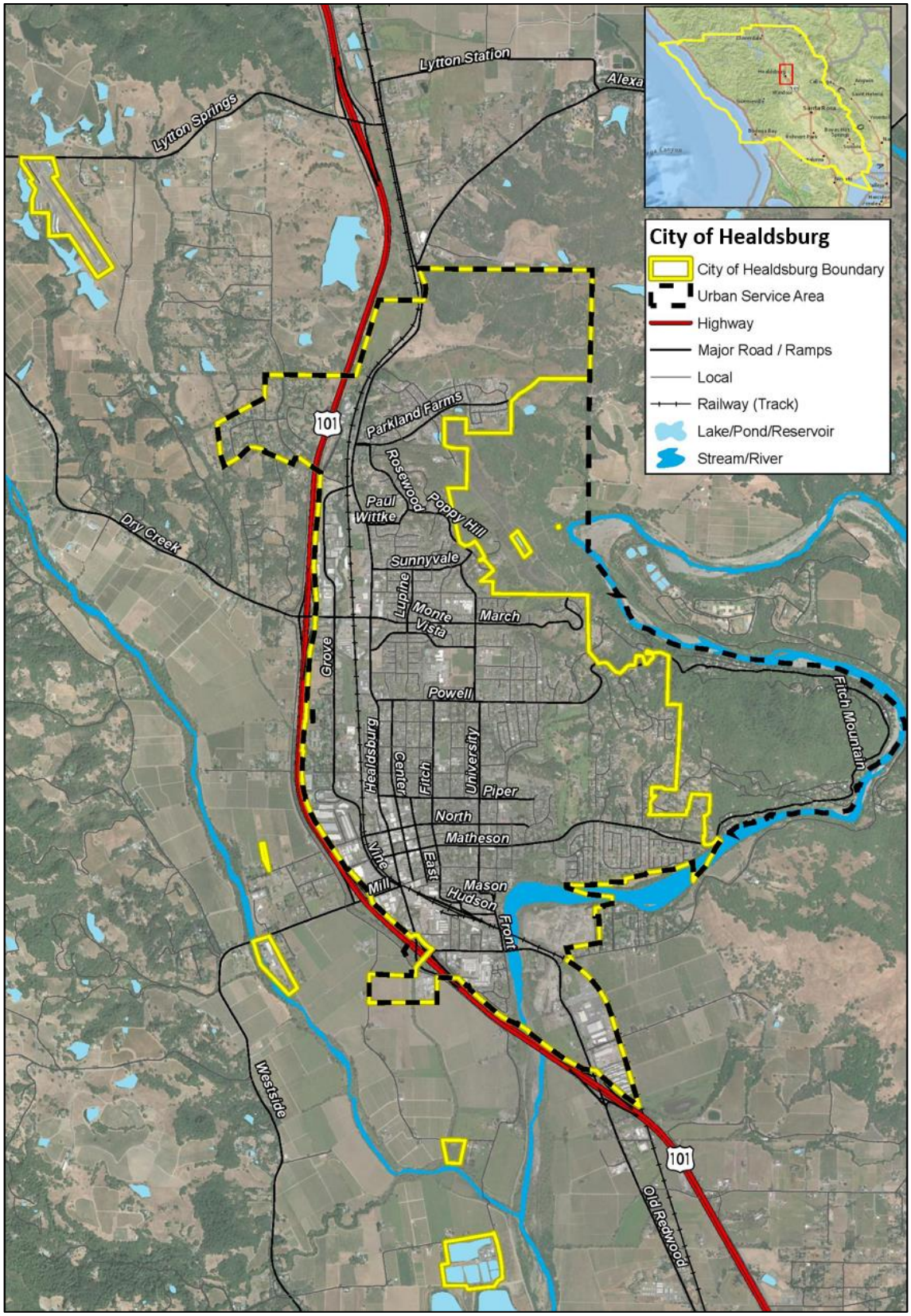

Figure 2.1: City of Healdsburg Location Map

Healdsburg's city limits include more than 100 acres of noncontiguous, City-owned land. These properties contain several critical facilities, including the Healdsburg Municipal Airport, Corporation Yard, and Wastewater Treatment Plan.

The Sonoma County General Plan limits urban development in unincorporated areas by establishing Urban Service Boundaries, which designate geographic areas planned for a full range of public services and infrastructure, such as sewer, water, roads, and police and fire protection. Healdsburg's Urban Service Area coincides with an Urban Growth Boundary adopted by City voters and a Sphere of Influence determined by Sonoma Local Agency Formation Commission (LAFCO). The Urban Service Area includes more than 1,000 acres located outside the incorporated city, including the Fitch Mountain area. Bounded by the City to the west and the Russian River to the north, east, and south, this portion of unincorporated Sonoma County includes low-density residential development on the flanks of the mountain. The higher portions of the mountain remain open space that is permanently protected by a conservation easement.

2.3 Population and Housing

According to the 2012–2016 American Community Survey, the population of Healdsburg was estimated to be 11,614 (11,254 per the 2010 Census). **Table 2-1** presents information on changes in population and households between the three most recent US Censuses.

The data illustrates that while Healdsburg's population continues to grow, the rate at which the city is growing has reduced significantly, from 13.2 percent growth in 2000 to 5.0 percent growth in 2010. A large factor in the City's population growth during the 1990s was the annexation of land, known as "Area A," to the north (Sonoma LAFCO 2006). Nevertheless, the reduction in growth after 2000 reflects similar trends seen in Sonoma County and across the entire state.

Table 2-1: Population and Household Changes

	Healdsburg	Sonoma County	California
Population			
2010	11,254	483,878	37,253,956
2000	10,722	458,614	33,871,648
1990	9,469	388,222	29,760,021
Growth (2000–2010)	5.0%	5.5%	10.0%
Growth (1990–2000)	13.2%	18.1%	13.8%
Households			
2010	4,378	185,825	12,577,498
2000	3,968	172,403	11,502,870
1990	3,541	149,011	10,381,206
Average Household Size			
2010	2.56	2.55	2.90
2000	2.69	2.60	2.87
1990	2.67	2.61	2.87

Sources: Healdsburg, City of. 2009., US Census Bureau. 2018.

A household is defined as a person or group of persons living in a housing unit. According to the 2010 Census, there were 4,378 households in Healdsburg and the average household size was 2.56. Most

residents live in single-family housing or mobile homes. **Table 2-2** illustrates the composition of the housing stock in 2000, 2010, and 2016, and the percentage change over time, based on data from the US Census Bureau.

Table 2-1: Healdsburg Housing Units, 2000, 2010, 2016

Unit Type	2000		2010		2016	
	Number	Percentage	Number	Percentage	Number	Percentage
Single-Family	3,257	78.4	3,761	79.5	4,008	79
2–4 Units	423	10.2	475	10.1	640	12.7
5–9 Units	156	3.8	162	3.4	82	1.6
10+ Units	218	5.3	262	5.5	272	5.4
Mobile Home & Other	98	2.4	69	1.5	73	1.5
Totals	4,152	100	4,729	100	5,075	100.2

Source: US Census Bureau. 2018.

2.4 Land Use and Development Trends

Table 2-3 shows the various land uses and their acreage within the Planning Area in 2004. According to the 2030 General Plan, approximately 68 percent of the city's land was developed in 2004. The Planning Area, which includes the entire Sphere of Influence/Urban Service Area contains a significant amount of vacant or underdeveloped acreage, including approximately 492.13 acres in the northern part of the Planning Area (Areas A, B, and C). Areas B and C, however, include 158.87 acres that the Sonoma County Agricultural and Open Space District owns or controls through conservation easements that prohibit development. Therefore, the northern Planning Area has a total of about 333.26 acres that remains potentially developable. The Grove Street area (Area G) also contains a relatively significant amount of land that is vacant or underdeveloped. Although within the Urban Growth Boundary, the Fitch Mountain area (Area K) is not expected to accommodate growth due to infrastructure and environmental constraints.

Table 2-3: Land Uses within Healdsburg Planning Area (2004)

General Plan Land Use Designation	Total Acreage	Developed Acres	Vacant Acres
Agricultural	16.69	16.69	0
Residential	1,733.04	1,351.22	381.82
Commercial	204.67	181.25	23.42
Mixed Uses	16.91	16.91	0
Light Industrial	124.37	113.25	11.12
Heavy Industrial	203.26	130.92	72.34
Institutional (Public & Semi-Public)	342.12	342.12	0
Open Space	432.75	n/a	n/a

Source: Healdsburg, City of. 2009.

Current land uses, as identified in the 2030 General Plan, are illustrated in **Figure 2.2**.

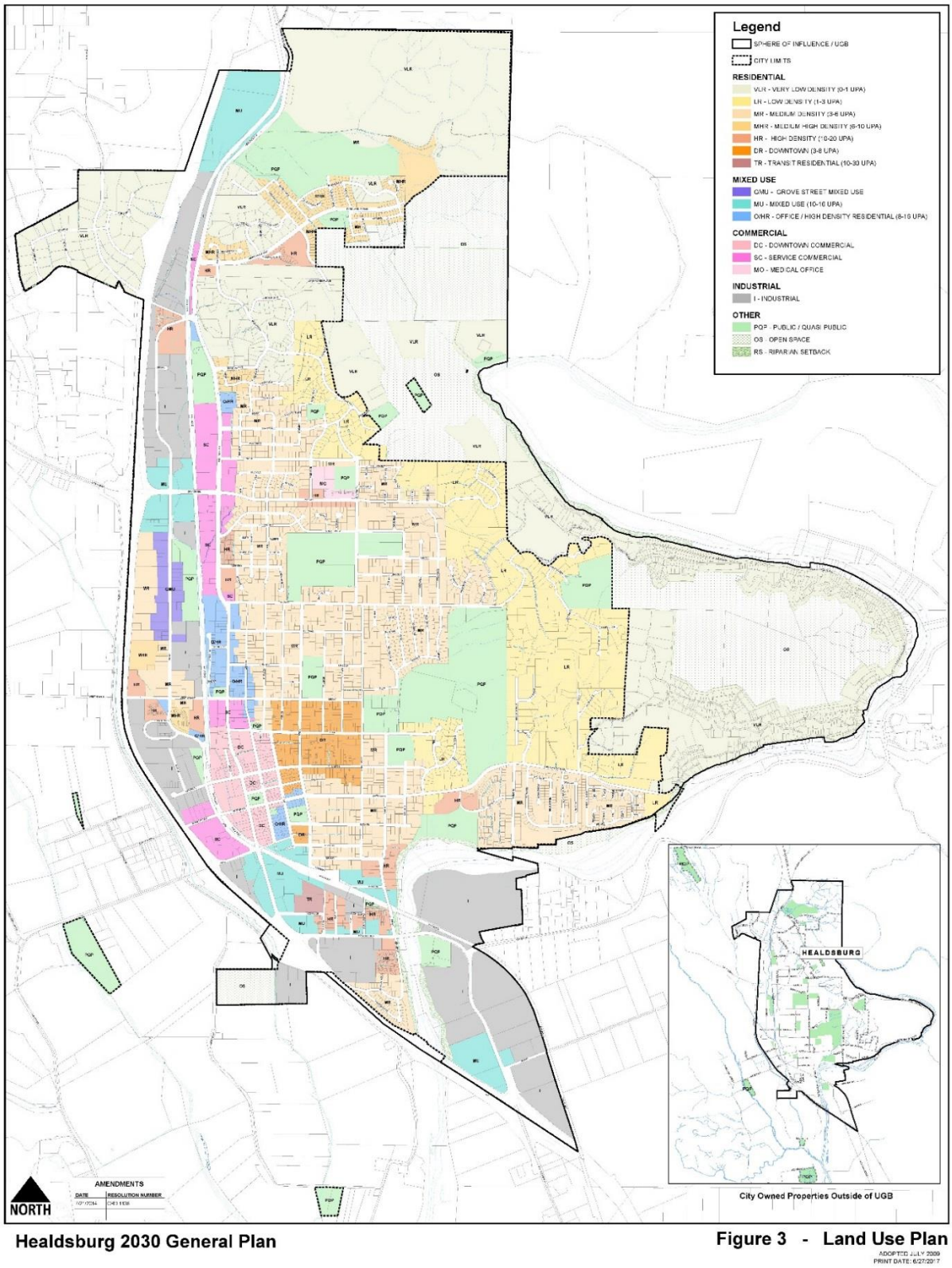

Figure 2.2: City of Healdsburg Land Use Plan

2.4.1 Future Growth

In the Bay Area, a long-range plan titled Plan Bay Area has been developed that looks ahead to 2040. Plan Bay Area is a state-mandated, integrated long-range transportation, land use, and housing plan that will support a growing economy, provide more housing and transportation choices, and reduce transportation-related pollution in the nine-county San Francisco Bay Area (Plan Bay Area 2018.). Two concepts directly affect growth in a community: the Regional Housing Need allocation (RHNA) and the Plan Bay Area Priority Development Areas (PDAs).

The California Department of Housing and Community Development (HCD) identifies the total housing need for the San Francisco Bay Area for eight-year periods (the current period being from 2014 to 2022). ABAG then develops a methodology to distribute the need to local governments. The RHNA for Healdsburg and the entirety of Sonoma County is illustrated is **Table 2-4**; housing allocations are divided into four different income categories.

Table 2-4: Regional Housing Need Allocation 2014–2022 by Income Category

	Very Low 0–50%	Low 51–80%	Moderate 81–120%	Above Moderate 120%+	Total
City of Healdsburg	31	24	26	76	157
Sonoma County Total	1,818	1,094	1,355	4,177	8,444
Bay Area Region Total	46,680	28,940	33,420	78,950	187,990

Source: ABAG 2013.

PDAs are areas where growth and development will be focused. Plan Bay Area identifies nearly 200 PDAs; these existing neighborhoods are served by public transit and have been identified as appropriate for additional compact development. There are no PDAs in Healdsburg.

Plan Bay Area concentrates growth in the "Big 3 Cities" of San Jose, San Francisco, and Oakland, as well as in east and west Bayside corridors along the region's core transit network. As illustrated in **Figure 2.3**, 83 percent of all growth will occur in four counties (Santa Clara, Alameda, San Francisco, and Contra Costa), while the remaining five counties will see modest growth over the next 24 years. Four percent of the Bay Area's growth will occur in Sonoma County.

The growth for Healdsburg set forth in Plan Bay Area is consistent with past growth patterns and current land use policies.

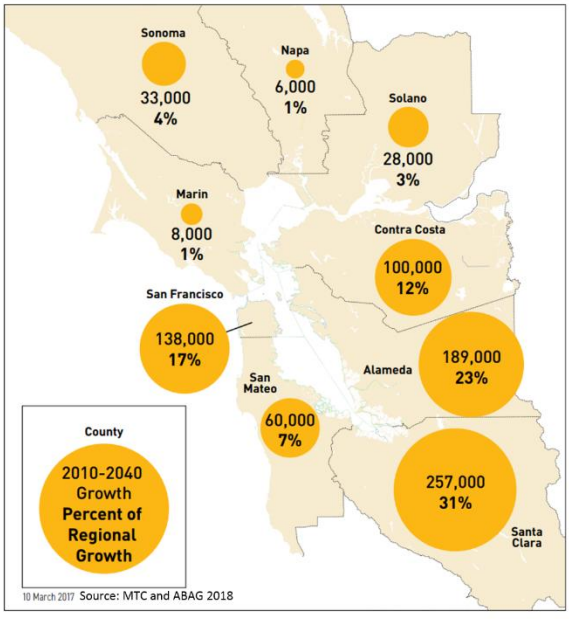

Figure 2.3: Household Growth by County
(Percent of Regional 2010-2040 Growth)

2.5 Changes in Development

The local hazard mitigation planning requirement for changes in development is as follows:

Regulation Checklist – 44 CFR 201.6 Local Mitigation Plans
Element D: Plan Review, Evaluation, and Implementation
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))

Since the 2011 LHMP, Healdsburg has experienced development and growth, but the general development trend that existed when the 2011 LHMP was developed is still relevant: The City will continue to focus inward with infill development and redevelopment of underutilized sites. New development will be compact and efficient to make the best use of remaining land. With this growth, an increased number of people are vulnerable to various hazards, but the recent development has not changed the city's landscape; therefore, no new hazard areas, such as floodplains, have been added to Healdsburg. Additionally, the City is implementing mitigation measures for new developments and their construction. For example, water mains that cross fault lines are equipped for emergency connection, and curbs under construction at the new roundabout as part of the Central Healdsburg Avenue Plan have porous concrete. As such, development that has occurred since the last plan has not significantly affected the vulnerabilities of Healdsburg.

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Section 3. Planning Process

The local hazard mitigation planning requirement to document the planning process is as follows:

Regulation Checklist – 44 CFR 201.6 Local Mitigation Plans
Element A: Planning Process
A1. Does the plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))

For the development of the LHMP, a planning process was created based on the various federal guidance documents and regulations. As shown in **Figure 3.1**, the LHMP planning process included organizing resources, assessing risk, developing the mitigation strategy, and developing the plan (including drafting, reviewing and revising, and adopting and submitting the plan). Documents that further illustrate the planning process are provided in **Appendix A**.

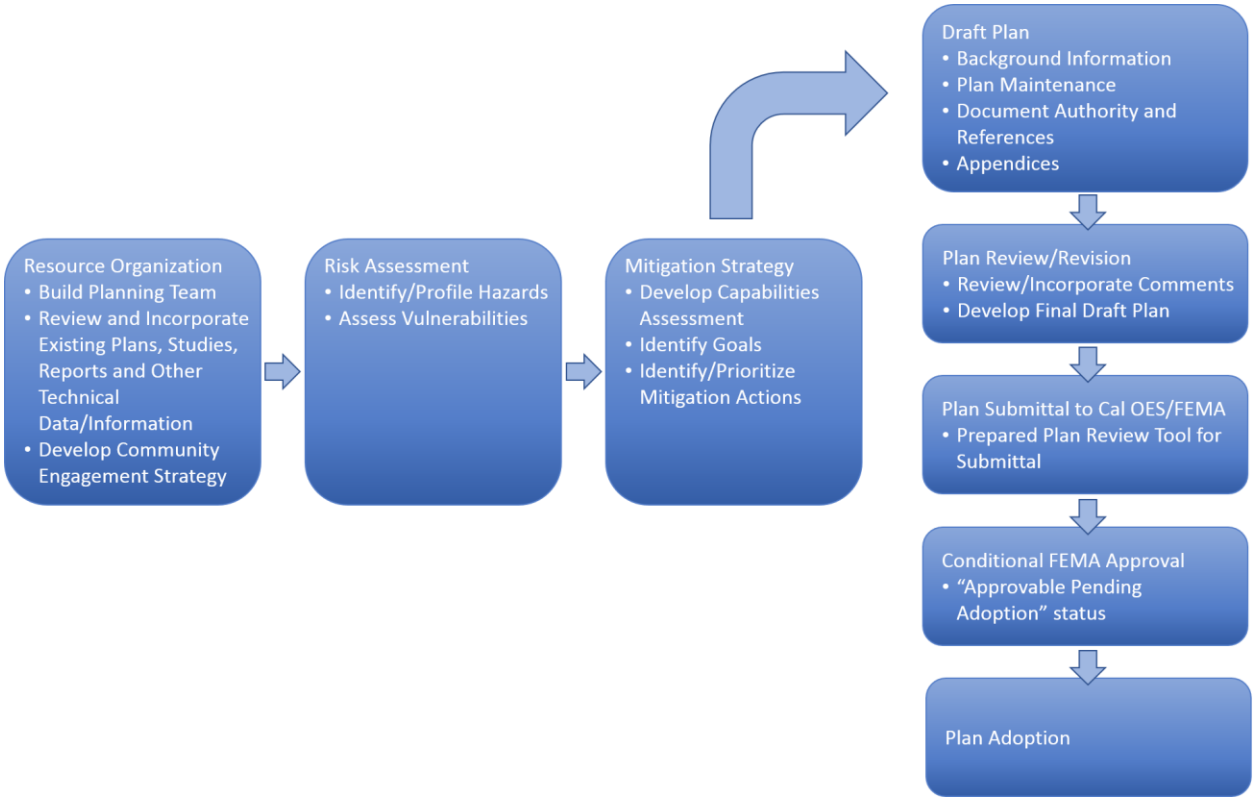

Figure 3.1: Hazard Mitigation Planning Process

3.1 Organize Resources

The planning process began by organizing resources, which included establishing a planning team and identifying stakeholders, collecting and analyzing relevant plans, and developing a community engagement strategy.

3.1.1 LHMP Planning Team

At the core of the LHMP planning process is the LHMP Planning Team, which served as the backbone of the LHMP planning process. Team members provided data for the plan, made key decisions to guide the development of the plan, and served as liaisons to their departments. The membership of the 2011 LHMP Planning Team was used as a starting point for the 2018 LHMP Planning Team. The 2018 LHMP Planning Team includes staff from a variety of City departments, as shown in **Table 3-1**.

Table 3-1: LHMP Planning Team

Planning Team Member	Title
Debra Nelson	Emergency Management Specialist, Planning Team Lead
Jason Boaz	Fire Chief
Rhea Borja	Public Information Officer
Kevin Burke	Police Chief
Linda Collister	Fire Marshall
Patrick Fuss	Principal Engineer, Water/Wastewater Utilities
Paul McQuaid	Electric Field Coordinator
Dirk Medema	Associate Civil Engineer, Public Works Department and Storm Water Manager
Shawn Sumpter	Administrative Specialist, Planning & Building Department
Matt Jenkins	Lieutenant, Police Department
Mark Themig	Community Services Director

The Planning Team met throughout the development of the 2018 LHMP. Meetings were conducted in person; follow-up activities were conducted on the phone or via email. The LHMP Planning Team met four times between November 2018 and March 2018, addressing the following items:

- **Meeting 1 – November 29, 2018:** Summarize the project purpose and process, identify hazards, introduce capability assessment, discuss community outreach strategies
- **Meeting 2 – January 18, 2018**: Introduce/review hazard assessment, revisit capability assessment, identify critical facilities
- **Meeting 3 – February 22, 2018:** Review updated hazard maps, discuss community workshop format and outreach, introduce and discuss the mitigation strategy
- **Meeting 4 – March 22, 2018:** Finalize mitigation strategy, finalize community workshop goals and structure, discuss plan maintenance processes

Meeting documentation, including agendas, PowerPoint presentations, sign-in sheets, and other relevant handouts, is provided in **Appendix A**.

3.1.2 Review and Incorporate Existing Information

The local hazard mitigation planning requirement for review and incorporation of existing information, and the requirement to revise the plan based on current priorities are as follows:

Regulation Checklist – 44 CFR 201.6 Local Mitigation Plans
Element A: Planning Process
A4. Does the plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))

Regulation Checklist – 44 CFR 201.6 Local Mitigation Plans
Element D: Plan Review, Evaluation, and Implementation
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))

The project consultants worked with the LHMP Planning Team to review and assess existing plans, studies, and data available from local, state, and federal sources. Key documents reviewed as part of the LHMP planning process and how they were incorporated are shown in **Table 3-2**; a complete list of resources is found in **Section 9**. Additionally, at the beginning of the plan update process, the 2011 LHMP was reviewed and recommendations for updates were provided. These are described in the subsection "LHMP Review and Recommendations" below.

Table 3-2: Existing Plans, Studies, Reports, and Other Technical Data/Information

Document/Data	Use
2013 California Multi-Hazard Mitigation Plan	Disaster declaration information and hazard descriptions
Healdsburg 2030 General Plan Background Report and Policy Documents, 2009	Hazard identification, historical hazard and location information
HMPs of neighboring communities (2017 Sonoma County HMP, 2016 Santa Rosa LHMP)	Historical hazard and location information
Foss Creek Flood Control Study (West Yost Associates)	Historic flooding mapping and event data
City of Healdsburg Geographic Information Systems (GIS) data	Mapping data for hazards and demographics

It is also important to note that in January 2018, the City of Healdsburg attended the Russian River Watershed Discovery Meeting, which is part of FEMA's Risk MAP Program. This meeting kicked off the Discovery process (which lasts years) so, there is no information/data to incorporate in this version of the plan, but future versions of the plan should incorporate relevant information from the Russian River Watershed Discovery process.

LHMP Review and Recommendations

This 2018 LHMP is the third iteration of the plan. The LHMP was originally developed as part of the 2005 ABAG Multi-Jurisdictional Hazard Mitigation Plan. An Annex specific to the City of Healdsburg was adopted in 2007, and a second version was developed in 2011. As a plan update and as the City's first stand-alone

plan, it was important to review the 2011 LHMP prior to developing this 2018 version of the plan. Areas identified for updates included:

- Hazards will be analyzed specifically for the City of Healdsburg.
- Vulnerability to specific hazards will be provided for individual critical facilities.
- A capability assessment will be added.
- Mitigation actions will be more focused.
- Hazard profiles will be in an updated format (hazard description, strength/magnitude, past occurrences, location, frequency/probability of future occurrence, and future condition considerations).
- Future condition considerations will be added to each hazard profile.

3.2 Community Engagement Strategy

The local hazard mitigation planning requirements for public involvement are as follows:

Regulation Checklist – 44 CFR 201.6 Local Mitigation Plans
Element A: Planning Process
A2. Does the plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))
A3. Does the plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))

The community engagement strategy included an initial media release, an online hazards questionnaire, a community workshop and availability of the draft plan for review and comment. Each aspect of the engagement strategy is described in more detail below, and associated documentation is included in **Appendix B**. The community engagement strategy was drafted at the commencement of the plan and was modified as needed throughout the plan development process.

One key modification was that, at the project's onset, the strategy focused on online outreach. Historically there had not been a lot of public involvement in the LHMP process, and the Planning Team anticipated that few, if any, members of the public would attend an in-person community workshop. However, following the devastating North Bay wildfires in October 2017, the Planning Team decided that it was vital to hold an in-person community workshop.

Media Release

A media release was distributed announcing the project. It described the purpose of the project and provided points of contact for anyone who wanted to participate in the planning process or wanted more information about the project. The media release was distributed by the City's Public Information Officer in September 2017. A copy of the media release was also posted to the City and the Fire Department Facebook pages. Screenshots of the media releases are included in **Appendix B**.

Stakeholder Outreach

The previous version of the LHMP was developed by ABAG and was a multi-jurisdictional plan that covered the entire San Francisco Bay Area. For the current iteration, while each jurisdiction is responsible for

developing their own plan, Sonoma County decided to lead a Task Force open to all interested parties within the County of Sonoma. As defined by the Task Force, "the Sonoma County Operational Area Task Force provides the opportunity for localities in the process of updating their LHMPs to maintain collaborative and cooperative relationships with neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development." The Sonoma County Operational Area Task Force kicked off in April 2016, with regular meetings occurring through October 2017; a total of nine meetings were held. At the Task Force meetings communities shared lessons learned and best practices, and discussed progress in their mitigation planning efforts. Additionally, a Task Force Dropbox was created which facilitated the sharing of resources between communities. Participants on the Task Force included representatives from the following communities and agencies:

- California Governor's Office of Emergency Services (Cal OES)
- City of Petaluma
- City of Rohnert Park
- City of Santa Rosa
- City of Sonoma
- Federated Indians of Graton Rancheria
- FEMA
- Kashia Band of Pomo Indians, Stewarts Point Rancheria
- Redwood Empire Schools Insurance Group
- Regional Climate Protection Authority
- Rincon Valley Union School District
- Sonoma County Fire and Emergency Services
- Sonoma County Permit and Resource Management Department
- Sonoma County Water Agency

The Healdsburg representative on the Task Force (Debra Nelson), is also the Planning Team Lead for this 2018 LHMP, allowing for continuity between efforts. While discussions about Healdsburg's mitigation planning process occurred with Sonoma County and communities throughout the County, no neighboring communities participated on Healdsburg's LHMP Planning Team.

Development of the 2018 LHMP was also discussed at the Sonoma County Emergency Coordinator's Forum. As described on the Sonoma County website, the Emergency Coordinator's Forum "is a working group hosted by Sonoma County Fire & Emergency Services and composed of representatives from each of the cities, various county departments, state agencies, special districts, utilities, and disaster response and recovery related agencies. The group meets quarterly to discuss and coordinate emergency management, preparedness, training and disaster recovery-related issues."

When the public review draft of the 2018 LHMP was ready, the following agencies and cities were notified of the plan's availability for review and comment: American Red Cross; California Department of Forestry and Fire Protection (CalFire); Cal OES; California Army National Guard; California Department of

Transportation (Caltrans); California Highway Patrol (CHP); Catholic Charities of Santa Rosa; Golden Gate Transportation District; Pacific Gas & Electric; Redwood Empire Food Bank; Redwood Empire Schools' Insurance Group; Rincon Valley and Windsor Fire Protection Districts; Santa Rosa Junior College; Sonoma State University; Sonoma Valley Fire & Rescue Authority; Sonoma-Marin Area Rail Transit (SMART); The Sea Ranch Association; US Coast Guard; the Cities of Cloverdale, Cotati, Petaluma, Rohnert Park, and Santa Rosa; and the County of Sonoma. A copy of the email announcing availability of the public review draft is found in **Appendix B**.

Hazard Questionnaire

A questionnaire was developed for the public to provide feedback on their concerns about natural and human-caused hazards. The online questionnaire was advertised on the City's website, Facebook, and Nextdoor. Hard copies were available at the community workshop for immediate completion. The hazard questionnaire was available in both English and Spanish. A copy of the questionnaire is included in **Appendix B**, as well as an analysis of the 95 responses received.

Key takeaways from the questionnaire responses are that:

- The LHMP Planning Team and the community are in agreement in terms of hazards of concern and hazards experienced. The community identified the following hazards as their top concerns: wildfire, drought, earthquake, climate change, and flooding/heavy rain. The community did not note any hazards of concern that the LHMP Planning Team had not discussed.
- 70.5 percent of community members have signed up to receive City community alerts.
- Community members stated that utility bills and mail, the City's website, social media, newspapers, and public meetings are the most effective ways to disseminate information. The City is providing information/outreach in the desired mediums. While newspapers are not as commonly used to provide information, the City regularly uses the other four mediums to reach community members.
- 99 percent of community members are implementing at least one mitigation method within their own household. The vast majority have implemented multiple mitigation actions across multiple hazards. It could be deduced that this level of awareness and personal responsibility indicates that public education and outreach is an effective approach to reducing risk in Healdsburg.
- 83.9 percent of community members believe that at a minimum, development should be restricted in severe hazard areas. This overwhelming support for some level of development restrictions is valuable for planning staff and City authorities. It is also valuable to keep in mind that this number might be temporarily inflated due to the recent wildfire events.

As these responses were in line with the LHMP Planning Team's current thinking, the responses did not alter the planning process. Rather, the responses reinforced that the LHMP Planning Team has the correct approach and priorities in mind.

Community Workshop

A community workshop was held on April 12, 2018. The workshop was open-house style and lasted for two hours, from 4 to 6 p.m. It was advertised that a short formal presentation would occur 15 minutes after the hour at 4:15 and 5:15 p.m. The second formal presentation did not occur, as only a few new

community members had arrived, but the project consultants summarized the presentation for the interested new attendees.

The community workshop included:

- Large-scale hazard maps for the public to view
- A map where community members were asked to write down their concerns and to identify location-specific concerns as well as general concerns
- Handouts on mitigation planning, mitigation and preparedness activities that can be completed by an individual, and complementary planning efforts being undertaken by the City
- A Spin-the-Wheel game, where members of the public received preparedness prizes for answering questions about hazard mitigation and preparedness
- Hard copies of the hazard questionnaire, as well as flyers advertising the questionnaire with the link to the online version

LHMP Planning Team members attended the community workshop to answer questions and interact with the public. Additionally, both the Fire Chief and the Police Chief attended the workshop (their attendance was advertised) to discuss the 2018 LHMP, but also to address any concerns about emergency management in general. While the focus of the workshop was on mitigation, it was assumed that due to the recent fires there would be a heightened focus on wildfire and response and recovery activities.

As described above, the Planning Team initially viewed online public outreach as the best approach. After the North Bay wildfires, the team decided an in-person community workshop was needed to provide an opportunity to highlight what the City it is doing to reduce risk. The workshop also provided community members with a chance to gather, be heard, and learn. Documentation of outreach for the workshop and of the workshop itself is provided in **Appendix B**.

Public Review Draft Plan

At the beginning of June, the Public Review Draft Plan was posted to the City's website. Availability of the draft was advertised on the home page of the City's website as well as on Facebook and Nextdoor. Also, as previously described, various neighboring communities, and local and regional agencies were directly notified when the Public Review Draft became available. Documentation of the availability of the Public Review Draft is included in **Appendix B**.

One comment was received on the Public Review Draft. The comment was from the Sonoma County Water Agency and provided advice on security information for the plan itself; this advice was incorporated.

3.3 Assess Risks

In accordance with FEMA requirements, this step of the LHMP planning process identified and prioritized the natural hazards affecting Healdsburg and assessed the vulnerability from the identified hazards. Results from this phase in the LHMP planning process formed the foundation for the subsequent identification of appropriate mitigation actions for reducing risk and losses in the city. This component of the LHMP planning process is detailed in **Sections 4** and **5**.

3.3.1 Identify/Profile Hazards

Based on a review of past hazards as well as a review of the existing plans, reports, and other technical studies/data/information, the Planning Team determined whether the hazards from the previous plan were still valid and identified new hazards that could affect Healdsburg. The Planning Team decided to profile the following hazards: drought, earthquake (including liquefaction), flooding (including dam failure), landslide, and wildfire (including high winds). Additionally, it was decided that discussions of future conditions would be incorporated into each hazard profile. Further details about the hazard identification process are found in **Section 4.1**; each hazard is profiled in **Section 4.2**.

3.3.2 Assess Vulnerabilities

Hazard profiling exposes the unique characteristics of individual hazards and begins the process of determining which areas in Healdsburg are vulnerable to specific hazard events. The vulnerability assessment included a GIS overlaying method for all geographically defined hazards. Using this methodology, an analysis identified the critical facilities, population, and residential buildings that might be impacted the hazards. Detailed information on each hazard vulnerability assessment is provided in **Section 5**.

3.4 Develop Mitigation Strategy

The LHMP is the explicit strategy that provides the blueprint for hazard mitigation planning to better protect people and property in the city from the effects of future natural hazard events. Developing the mitigation strategy involved developing a capabilities assessment, identifying goals, and finally identifying and prioritizing mitigation actions. This step of the LHMP planning process is detailed in **Sections 6** and **7**.

3.4.1 Develop Capabilities Assessment

A capabilities assessment is a comprehensive review of all the various mitigation capabilities and tools currently available to the City of Healdsburg to implement the mitigation actions prescribed in the LHMP. The LHMP Planning Team identified legal and regulatory, human and technical, and financial capabilities, as detailed in **Section 6**.

3.4.2 Identify Goals

Mitigation goals are general guidelines that explain what the community wants to achieve in terms of hazard loss and prevention. The LHMP Planning Team began by reviewing the goal from the existing LHMP and decided that, with a minor tweak, the goal would still be relevant and appropriate for the 2018 LHMP.

3.4.3 Identify Mitigation Actions

The LHMP Planning Team and the project consultants worked together to identify and develop the mitigation action plan. The mitigation action plan is the City's road map for the next five years, illustrating the priority mitigation actions the City would like to implement in the near future. **Section 7** details the approach to review of the existing mitigation actions, identification and prioritization of new mitigation actions, and creation of the implementation strategy.

3.5 Develop the Plan

All information, data, and associated narratives from the previous tasks were incorporated into the 2018 LHMP. There will be four versions of the plan:

- The first draft will be an **administrative draft**, distributed to the LHMP Planning Team for their review and comment.
- Comments received from the LHMP Planning Team will be incorporated into the plan and a **public review draft** will be developed. This second draft will be available for public review and comment.
- All comments received by the public will be compiled and addressed; the 2018 LHMP will be revised as appropriate. This third version of the plan is the **courtesy review draft,** which will be sent to Cal OES and FEMA for their review and comment.
- The final version of the plan will have addressed any comments received by Cal OES and FEMA. This **final 2018 LHMP** will be presented to the City Council for adoption.

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Section 4. Hazard Assessment

The local hazard mitigation planning requirements for hazard profiles are as follows:

Regulation Checklist – 44 CFR 201.6 Local Mitigation Plans
Element B: Hazard Identification and Risk Assessment
B1. Does the plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))
B2. Does the plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))

The hazard assessment identifies and describes the hazards that threaten Healdsburg.

4.1 Hazard Identification

To aid in the process of identifying hazards, the LHMP Planning Team considered the hazards included in the previous version of the City's LHMP, looked at associated HMPs, reviewed other relevant planning documents, and considered hazard history to determine the natural hazards with the potential to affect the city. **Table 4-1** provides a crosswalk of hazards considered and the final determination by the LHMP Planning Team.

Table 4-1: Hazard History and Hazards in Various Planning Documents

Hazard	State of CA HMP (2013)	Sonoma County HMP (2016)	Healdsburg General Plan (2030)	2011 Healdsburg HMP Annex	Disaster Declaration* (# of events)	Include in 2018 Healdsburg LHMP?
Avalanche	X					No (no history)
Coastal Flooding, Erosion, and Sea Level Rise	X					No (city is landlocked)
Dam Failure	X		X	X		Yes (as a sub-hazard to flood)
Drought	X				X (1)	Yes
Earthquake (including liquefaction)	X	X	X	X		Yes
Extreme Heat	X					(in Future Conditions)
Flood	X	X	X	X	X (16[a])	Yes
Freeze	X				X (2[b])	No

Table 4-1: Hazard History and Hazards in Various Planning Documents

Hazard	State of CA HMP (2013)	Sonoma County HMP (2016)	Healdsburg General Plan (2030)	2011 Healdsburg HMP Annex	Disaster Declaration* (# of events)	Include in 2018 Healdsburg LHMP?
Landslide	X	X	X	X		Yes
Levee Failure	X					No (no levees)
Tsunami	X					No (city is landlocked)
Volcano	X					No (not a priority concern)
Wildfire	X	X	X	X	X (5[c])	Yes (including high winds)

Future Condition Considerations will be discussed for each hazard.

* 1950–Present, Declarations for Sonoma County not just Healdsburg

[a.] Flood: 13 federally declared flood disasters, 3 additional incidents that were not federally declared

[b.] Freeze: 1 federally declared freeze disaster, 1 additional incident that was not federally declared

[c.] Wildfire: 2 federally declared wildfire disasters, 3 additional incidents that were not federally declared

Based on the above analysis, the Planning Team determined that all of the hazards identified in the 2011 LHMP should be included in the 2018 LHMP, with some now defined as sub-hazards rather than stand-alone hazards. In addition, it was decided that the hazard of drought should be added, high winds should be added as a sub-hazard to wildfire, and future conditions should be discussed in the 2018 LHMP. Future condition considerations will be discussed for each hazard profiled.

As such, the following five hazards are profiled in the 2018 LHMP:

- Drought
- Earthquake (including liquefaction)
- Flooding (including dam failure)
- Landslide
- Wildfire (including high winds)

4.2 Hazard Profiles

For each hazard, a profile has been established describing the hazard in general, as well as details specific to Healdsburg. The hazard profiles discuss the following topics: hazard description, strength/magnitude, past occurrences, location, frequency/probability of future occurrence, and future condition considerations.

The hazards are discussed in alphabetical order; the order does not signify the level of risk. Hazard maps are included within the hazard profiles, but larger and higher resolution versions of these maps can be found in **Appendix C**.

4.2.1 Drought

Hazard Description

A drought is a long-term water shortage caused by an extended period with little to no precipitation that can lead to a decline in available water supplies. Droughts may cause increases in water rates or additional restrictions on water use. In severe cases, communities may not have enough available water to meet basic needs. Drought conditions can significantly harm agricultural operations, particularly in areas that grow water-intensive crops. Planted landscapes may become drought-stressed, causing them to become weak or die from lack of water. If drought conditions are severe enough, the lack of water may pose a human health risk.

Droughts also have several indirect impacts. The lack of precipitation can cause soil to harden and become less permeable so that when precipitation does eventually occur, the soil cannot absorb water as easily, potentially leading to increased flooding. Drier soil may become decompressed, increasing its susceptibility to sliding and eroding. Droughts may dry out wildland vegetation, potentially increasing the risk of fire. Water-stressed plants may also be more vulnerable to disease or pests.

Unlike most other hazards, droughts develop over a long period of time. It often takes multiple dry years to cause drought conditions, and these conditions may persist for years. They are usually a region-wide hazard, and at times may extend statewide or cover multiple states. However, the specific impacts of a drought can depend on local conditions, including water supply systems, soil types, and land uses. As a result, two communities under similar drought conditions may experience different impacts. Droughts may also have a significant impact on communities not directly in the affected area. For example, if a community relies on imported water that travels a great distance, the community may be substantially impacted if a drought occurs at the source of the imported water, even if precipitation levels in the community itself are normal. Similarly, communities may be facing local drought conditions, but impacts may be minor if the community's water comes from a distant unaffected area.

Strength/Magnitude

There are multiple ways to measure the severity of different drought conditions. The US Drought Monitor Classification Scheme, shown in **Table 4-2**, combines many of these systems into a single index. D1 is the least intense level and D4 the most intense. Drought is defined as a moisture deficit bad enough to have social, environmental, or economic effects. D0 areas are not in drought but are experiencing abnormally dry conditions that could turn into drought, or are recovering from drought but are not yet back to normal.

Table 4-2: US Drought Monitor Classification Scheme

Category	Description	Possible Impacts
D0	Abnormally dry	Slower growth of crops and pastures compared to normal activities.
D1	Moderate drought	Some damage to crops and pastures. Streams, reservoirs, or wells low. Some water shortages may be developing or imminent.
D2	Severe drought	Likely crop and pasture losses. Water shortages are common, leading to restrictions.
D3	Extreme drought	Major crop and pasture losses. Widespread water shortages.
D4	Exceptional drought	Exceptional and widespread crop and pasture losses. Emergency shortages develop.

Source: US Drought Monitor, 2018a

Past Occurrences

Droughts are a common feature of the climate in much of California, and many of the state's native plants and animals have evolved strategies to survive during drought conditions. The state also has an extensive water supply network that helps to reduce the impacts of droughts with the assistance of large storage reservoirs and pipes that can move water from regions with available supplies to drought-affected areas, although this system primarily benefits the urban areas of California.

Historic droughts in California occurred from 1976 to 1977, 1986 to 1992, and 2007 to 2009. During the statewide drought of 1976 to 1977, four Bay Area counties (Contra Costa, Napa, San Mateo, and Marin) were among those where a state disaster was declared. Marin, Solano, and Sonoma counties were affected in the 1986–92 drought, which caused $1.7 billion in crop losses nationwide (Cal OES 2013, as cited by ABAG 2017).

The most recent drought in California lasted from 2011 to 2017 and was declared a state of emergency by Governor Jerry Brown on January 17, 2014. Locally, Sonoma County declared an emergency for drought, the Proclamation of Local Emergency Due to Drought Conditions. The proclamation was first adopted in February 2014, and the County extended the emergency proclamation through the end of 2015. This proclamation was in response to an intensification of the state's ongoing drought in 2014, and was guided by mandatory state emergency conservation regulations issued to all water providers in California. The proclamation applied to the entire Sonoma County Operational Area, including all special districts and incorporated cities (including Healdsburg). In January 2014, Healdsburg became the first city to pass mandatory water conservation measures, which expired in January 2017. Because of the drought, water storage for the county remained below average conditions. In April 2015, water supply in Lake Mendocino was only 56 percent of the maximum water supply. Similarly, water supply at Lake Sonoma was at 87 percent of maximum water supply (Sonoma County 2015).

The US Drought Monitor placed nearly all of Sonoma County in the most severe category, D4 (Exceptional Drought), for most of the latter half of 2014, from late July through early December. **Figure 4.1** offers snapshots of US Drought Monitor classifications for Sonoma County at the start of California's rainy season in October and the end of the rainy season in March for each year since 2012. The progression demonstrates how the area affected by the more severe categories spread and receded over the course of the drought. Higher than average rainfall and snowpack in 2017 alleviated the most extreme drought conditions, but it will take years for local water systems to fully recover.

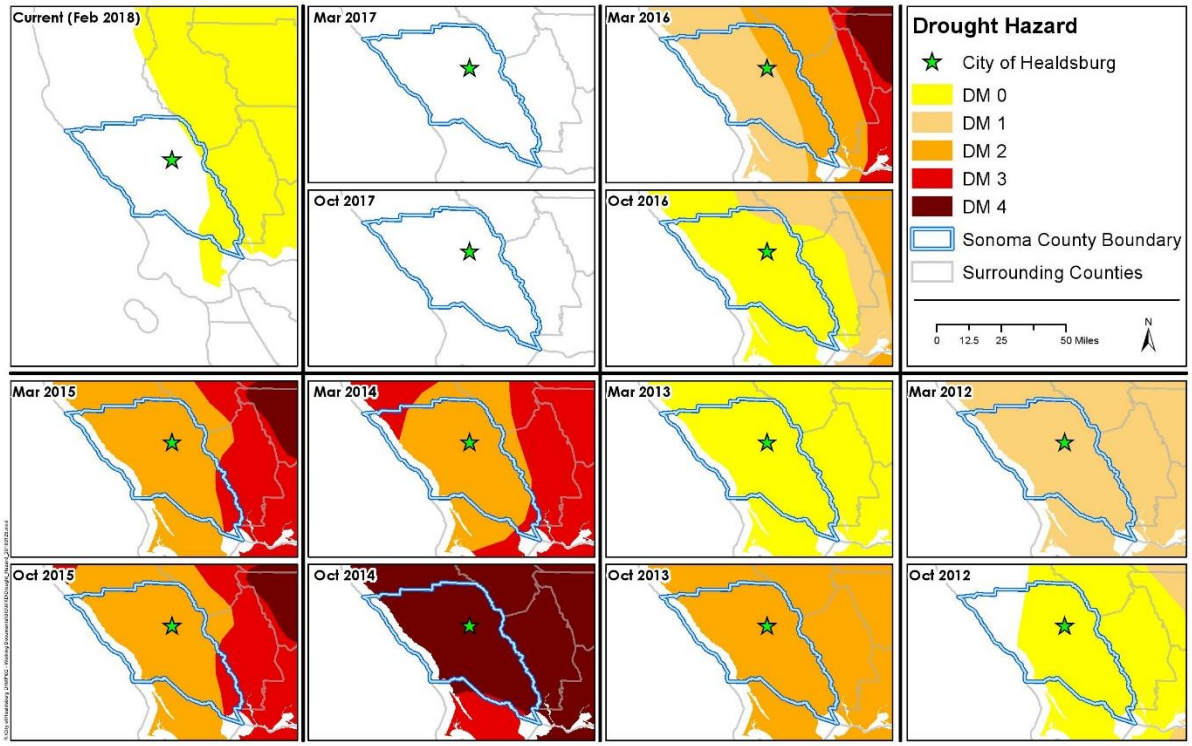


Figure 4.1: Drought History for Sonoma County 2012–2018

(See Appendix C for a larger and higher resolution map)

Location

Droughts are regional by nature, so occurrences of drought that occur in Healdsburg will likely affect the entire city. No one part of the city is at more or less risk of drought conditions, although some areas may be impacted more than others depending on individual water needs and accessibility.

Frequency/Probability of Future Occurrence

As noted above, droughts are a regular feature in California. They are almost certain to continue to occur in the future, with varying severity and duration. Healdsburg sources water locally from three well fields: two located along the Russian River and one located on Dry Creek (Healdsburg 2015). Because drought is an expected occurrence in California and Sonoma County, it is highly likely Healdsburg will have future periods of drought.

Since the US Drought Monitor began producing data in 2000, there have been 186 weeks when at least half of Sonoma County was classified as experiencing severe to exceptional drought based on US Drought Monitor categories, or about 20 percent of the time. A more established drought classification system, the Palmer Drought Severity Index, shows that California's North Coast Drainage climate division (which includes Healdsburg) has experienced periods of severe or extreme drought on six occasions since 1970, or every eight years on average. Such frequencies are likely to increase in the future, as discussed below.

Future Condition Considerations

The climate of California has been drier and warmer than in previous decades, and this trend is expected to continue in the state as a whole, according to the most recent climate data. It is likely that drought conditions will become more frequent and more severe as a result. These drier conditions will also alter

the timing of water supply availability, potentially impacting Healdsburg if local water sources are affected. A reduction in the overall regional water supply due to reduced precipitation would only exacerbate the local effects of drought. A reduction in snowpack in the mountainous regions of California would also limit options for the City to supplement local water supply with external sources. Ongoing drought not only would reduce local water supply but would also stress regional supplies and constrict the availability of statewide water sources.

4.2.2 Earthquake

Hazard Description

The category of seismic hazards includes three different but related hazard types—fault rupture, ground shaking, and liquefaction—all of which are consequences of earthquakes. Earthquakes themselves are caused by the movement of large pieces of the earth's crust, called tectonic plates. As the tectonic plates move against each other, they can become stuck together, causing stress between the plates to build up until it eventually overcomes the friction holding them together. When this happens, the stress is released and the plates suddenly slip past each other, creating the shaking that is called an earthquake.

Earthquakes occur along boundaries called fault lines. These fault lines may be the actual border between plates, but they may also be borders between two sections of a single plate, created by the repeated process of accumulated and released stress. California sits on the boundary between the Pacific and North American tectonic plates. The motion between these plates occurs primarily on the faults of the Eastern California Shear Zone and the San Andreas fault system, which includes the Healdsburg-Rodgers Creek fault that passes through the eastern and northern areas of the city, as well as the San Andreas fault, 19 miles to the west, and the Maacama fault, 4 miles to the east. Fault rupture is the actual movement of the ground's surface along a fault line when an earthquake occurs. This movement may be vertical, horizontal, or both, depending on the type of fault. Damage from fault rupture is limited to the area of the fault boundary itself, although depending on the amount of movement along the fault, the damage may be severe. Some earthquakes, known as "blind thrust earthquakes," occur without causing visible surface rupture, although they may still cause substantial damage. The 1994 Northridge Earthquake, one of the most damaging in California history, was a blind thrust earthquake.

Ground Shaking

Ground shaking is generally the most damaging of seismic hazards and is the specific hazard most commonly associated with earthquakes. The severity of ground shaking is affected by local geology, but in general it will be most severe closest to the site of the earthquake and decrease with distance. Ground shaking may occur in an up-and-down, side-to-side, or rolling motion, depending on the type of seismic waves produced by the earthquake.

Liquefaction

Liquefaction occurs when loosely packed sand or silt is saturated with water and then shaken hard enough for it to temporarily behave like a fluid. This causes the soil to lose its strength, which may in turn damage structures built on or in it in a variety of ways. Liquefaction risk depends primarily on the height of the groundwater table and the composition of the soil.

Strength/Magnitude

Ground shaking is measured using either the moment magnitude scale (MMS, denoted as Mw or simply M) or the Modified Mercalli Intensity (MMI) Scale. The MMS is a replacement for the Richter scale, which is still often referred to but is no longer actively used, as the Richter scale is not reliable when measuring large earthquakes (USGS 2014). The weakest earthquakes measured by the MMS start at 1.0, with the numbers increasing with the strength of the earthquake. The strongest recorded earthquake, which struck Chile in 1960, measured 9.5 on the MMS (USGS 2015). Like the Richter scale, the MMS is a logarithmic scale, meaning the difference in strength between two earthquakes is much larger than the difference in their measurements. For example, a M6.0 earthquake is 1,000 times stronger than a M4.0 earthquake and about 1.4 times as strong as a M5.9 event.

The MMI Scale is based on the damage caused by the earthquake and how it is perceived, rather than an actual measurement. When comparing multiple earthquakes, one event may have a higher Mercalli rating than another even if it released less energy and thus was measured lower on the MMS. The MMI scale ranges from I (instrumental, rarely felt by people) to XII (catastrophic, total damage and lines of sight are distorted). **Table 4-3** shows a general comparison between the MMS and the MMI Scale. Note that there is some overlap toward the higher end of the Mercalli ratings, with certain intensities produced by multiple ranges of magnitude measurements.

Table 4-3: Comparison of MMS and MMI Scale

Magnitude (MMS)		Modified Mercalli Intensity (MMI) Scale	
		Intensity	Description
1.0 to 3.0		I	Not felt except by very few persons under especially favorable conditions.
3.0 to 3.9		II	Weak: Felt only by a few persons at rest, especially on upper floors of buildings.
		III	Weak: Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
4.0 to 4.9		IV	Light: Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
		V	Moderate: Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
5.0 to 5.9		VI	Strong: Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
	6.0 to 6.9	VII	Very Strong: Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
7.0 and greater		VIII	Severe: Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
		IX	Violent: Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.

Table 4-3: Comparison of MMS and MMI Scale

Magnitude (MMS)	Modified Mercalli Intensity (MMI) Scale	
	Intensity	Description
	X	Extreme: Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
	XI	Extreme: Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
	XII	Extreme: Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Source: USGS 2018a

Past Occurrences

Earthquakes in California are a frequent occurrence, and smaller earthquakes often do not cause damage or disruption. There have been a few significant earthquakes in the region, though several happened prior to 1900 when documentation was less reliable. **Table 4-4** lists significant earthquakes that have occurred since 1868 in the Healdsburg region.

Table 4-4: Earthquakes Felt in Healdsburg

Earthquake Name	Year	Fault	Location	Damage in Healdsburg	Magnitude	MMI Scale – Healdsburg
Hayward	1868	Southern Hayward	East Bay	Moderate	Unknown	V–VI
Winters	1892	Unknown	Central Valley	Minor to moderate	Unknown	V
Santa Rosa	1893	Unknown	8 miles east of Santa Rosa	Minor	Unknown	V
Mare Island	1898	Rodgers Creek	Mare Island	Moderate	M6.3	V–VI
Great San Francisco	1906	San Andreas	Near San Francisco	Extensive	M7.9	VII–IX
Santa Rosa	1969	Rodgers Creek	Northern Santa Rosa	Minor	M5.6 and M5.7	VI
Loma Prieta	1989	Near San Andreas	Near Santa Cruz	Slight	M7.1	V
South Napa	2014	West Napa Fault	Near Napa	None	M6.0	IV

Source: USGS 2018c

According to the City's General Plan, the only reported case of liquefaction in Healdsburg was during the 1906 San Francisco earthquake, when there was evidence of lateral spreading and sand boils along the banks of the Russian River.

Location

The city is in a seismically active region, and all of Healdsburg is at risk of one or more seismic hazards. **Table 4-5** shows faults in proximity to Healdsburg, along with their distance from the city and maximum moment magnitude.

Table 4-5: Fault Parameters

Fault	Distance and Direction from Healdsburg	Maximum Moment Magnitude
Healdsburg-Rodgers Creek	Crosses portions of Healdsburg	7.0
Maacama	4.5 miles north	6.9
San Andreas	19 miles west	7.9
Hunting Creek	29 miles northeast	6.9
West Napa	28 miles southeast	6.5
Concord-Green Valley	40 miles east	6.9
Cordelia	43 miles southeast	6.7
Hayward	46 miles southeast	7.1
San Gregorio	52 miles south	7.3

Source: Healdsburg, City of, 2009

Scenario-specific shakemaps for the Rodgers Creek, Maacama, and San Andreas faults are illustrated in **Figures 4.2** through **4.4**. These maps illustrate the expected level of ground shaking based on a specific event. Although it has not been mapped as part of California's Alquist-Priolo Earthquake Fault Zoning Act (which regulates areas at risk of fault rupture), a stepover from the Rodgers Creek fault extends through the city. Sometimes identified as the Healdsburg fault, it follows the hills on the city's eastern boundary before passing through the Saggio Hills Planning Area.

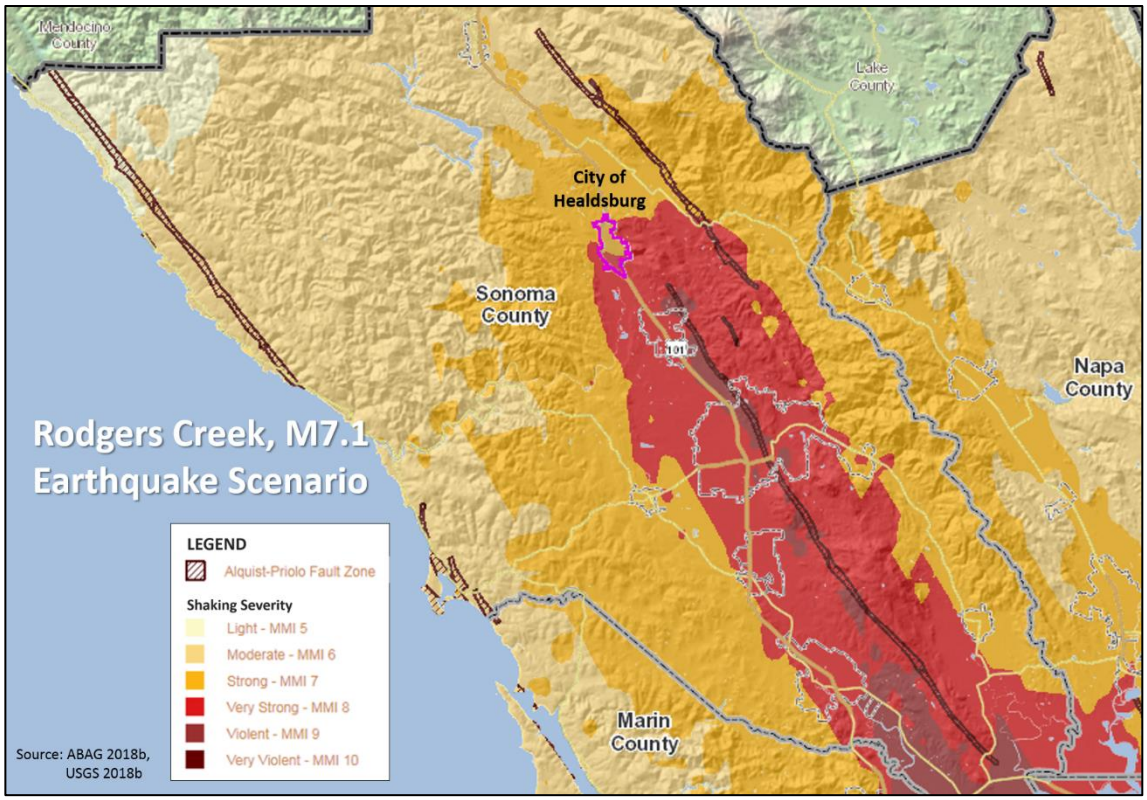


Figure 4.2: Rodgers Creek Fault Shakemap

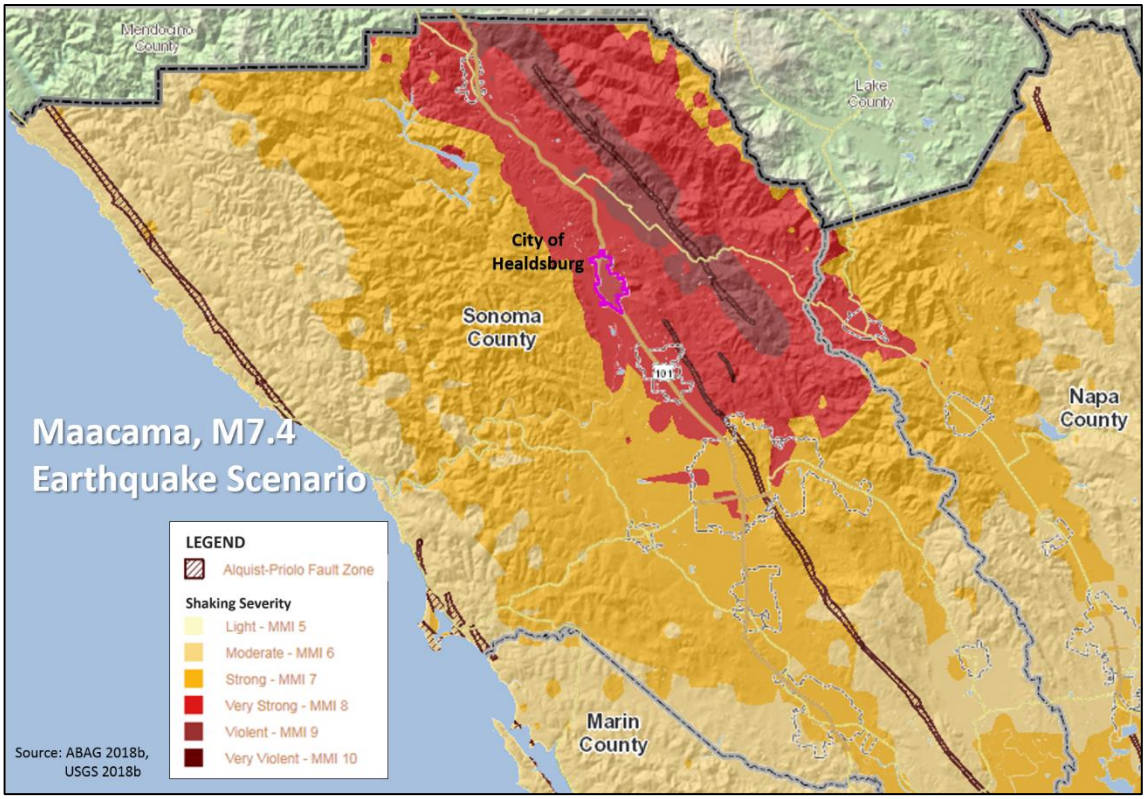


Figure 4.3: Maacama Fault Shakemap

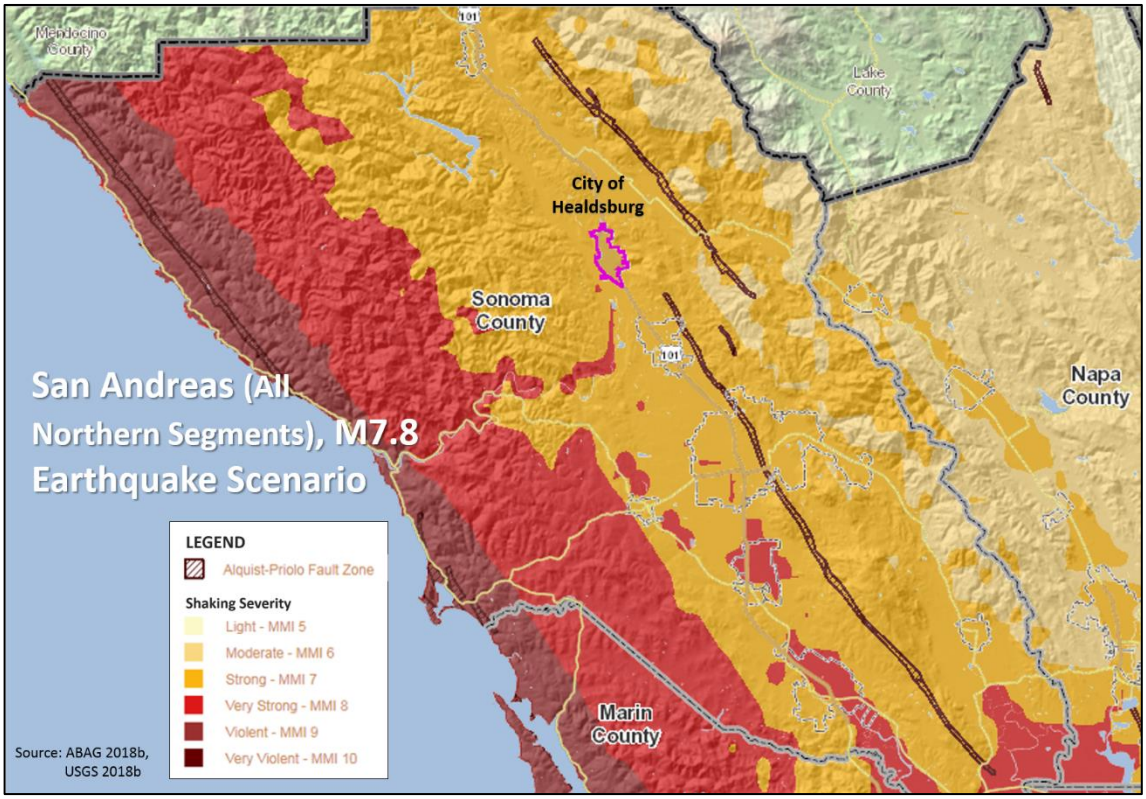


Figure 4.4: San Andreas (All Northern Segments) Fault Shakemap

Figure 4.5 shows faults that have been active within the last 1.6 million years, including those in Healdsburg and the surrounding county, as well as the epicenters of earthquakes since 1973 that measured at least M3.5. The map indicates a cluster of earthquakes near The Geysers, a geothermal field about 14 miles northeast of Healdsburg. These earthquakes are frequent but relatively weak, associated with human actions at the Calpine Corporation's power plant as opposed to fault activity. Geologists do not believe that the field is capable of producing a strong, destructive earthquake (USGS 2018d)

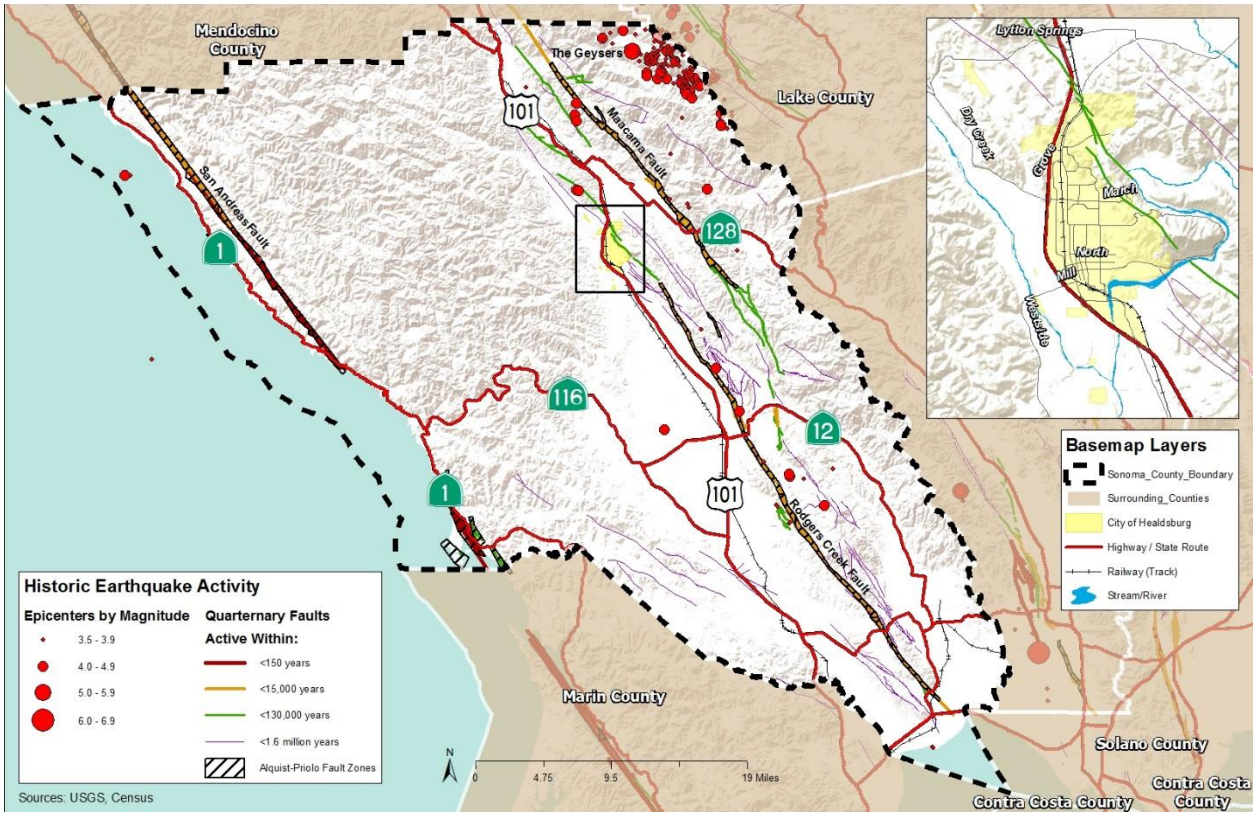


Figure 4.5: Historic Earthquake Activity in Sonoma County

(See Appendix C for a larger and higher resolution map)

Healdsburg's seismic risk comes primarily from regional faults in the area. US Geological Survey (USGS) studies show that these faults are capable of producing earthquakes with a peak ground acceleration equivalent to a g-force of 0.65 or greater throughout much of Sonoma County, including the entirety of Healdsburg. Two MMI categories of ground shaking are present in Healdsburg, Category IX described as violent shaking and, Category X described as extreme shaking. **Figure 4.6** shows which areas are susceptible to different levels of ground shaking.

Different from the scenario-specific shakemaps above, **Figure 4.6** illustrates the overall shaking potential or the overall susceptibility. This map takes into account potential shaking on all major faults and incorporates that information into a single map, with the goal of illustrating the maximum level of shaking anticipated from any earthquake event. As described by the California Geological Survey (CGS), earthquake shaking potential is calculated considering historic earthquakes, slip rates on major faults and deformation throughout the region, and the potential for amplification of seismic waves by near-surface geologic materials. The complete analysis is called a Probabilistic Seismic Hazard Analysis. The resulting

earthquake shaking potential is used in developing building code design values, estimating future earthquake losses, and prioritizing earthquake retrofit (Branum, Chen, Peterson & Wills 2016).

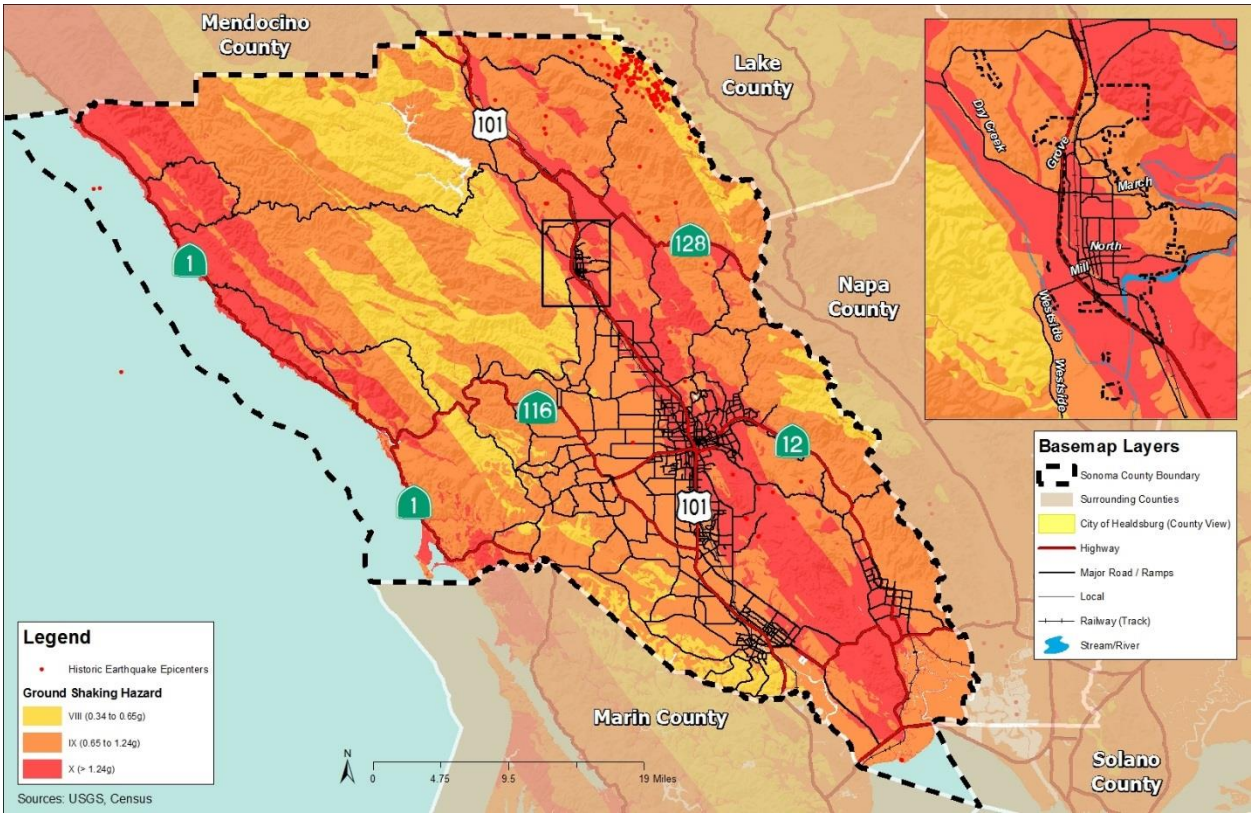


Figure 4.6: Susceptibility to Ground Shaking in Sonoma County
(See Appendix C for a larger and higher resolution map)

Most of Healdsburg has a very low to moderate susceptibility to liquefaction, although there are areas of high susceptibility along the city's southern edge that includes portions of downtown west of Center Street and residential subdivisions on the north bank of the Russian River. **Figure 4.7** shows liquefaction hazard areas in the city.

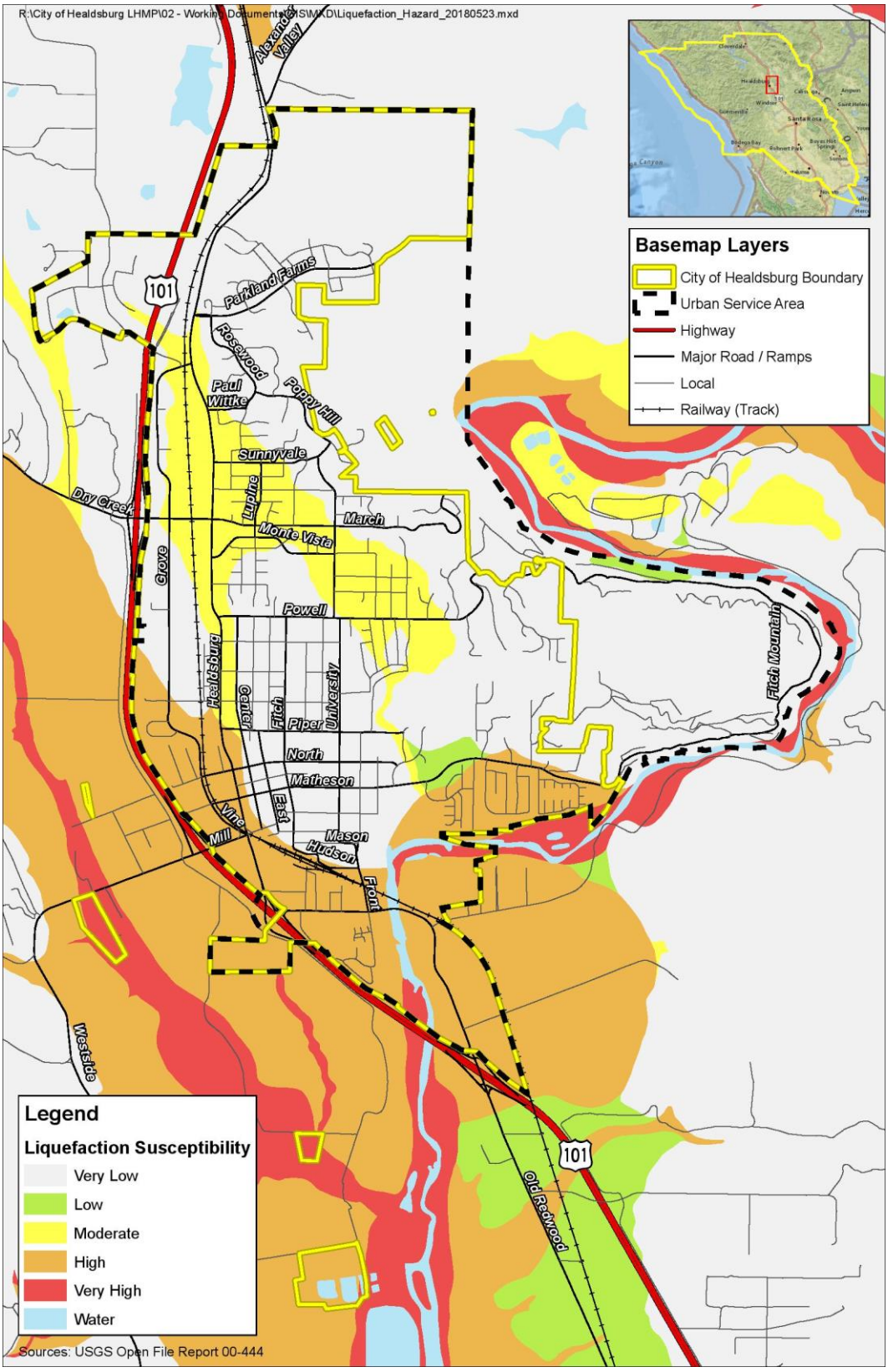


Figure 4.7: Liquefaction Susceptibility in Healdsburg
(See Appendix C for a larger and higher resolution map)

Frequency/Probability of Future Occurrence

Seismologists do not know when a large earthquake will hit the region again but do know that one will occur. The city's location on and near numerous faults, including several capable of causing significant earthquakes, means that Healdsburg will continue to face threats from earthquakes and related hazards.

The third Uniform California Earthquake Rupture Forecast (UCERF3), developed in 2014 by the Working Group on California Earthquake Probabilities and led by the USGS, provides estimates of the magnitude, location, and likelihood of fault rupture for more than 2,600 fault segments throughout the state, including two segments of the Rodgers Creek fault that passes through Healdsburg. The forecast for these segments indicates a 5.5 to 6.9 percent chance that a M6.7 earthquake will occur within the next 30 years. **Table 4-6** lists faults in Sonoma County included in UCERF3, showing the range of probabilities for earthquakes of varying magnitude occurring on a fault segment within the next 30 years.

Figure 4.8 illustrates the probability forecasts of the three faults of greatest concern (Rodgers Creek, Maacama, and San Andreas-Northern Coast) for M≥6.7, M≥7.5 and M≥8.0 earthquakes. A single probability is not provided for an entire fault; rather, the probability varies depending on the location on the fault in question. To illustrate the range in probabilities for each fault, three points on each fault have been chosen, points that represent the lowest and highest probabilities as well as a mid-range probability.

Table 4-6: UCERF3 30-Year Earthquake Probabilities by Fault

	M6.7			M7.0			M7.5		
Fault	**Min.**	**Max.**	**Avg.**	**Min.**	**Max.**	**Avg.**	**Min.**	**Max.**	**Avg.**
Bennett Valley	0.3%	0.4%	0.3%	0.2%	0.3%	0.2%	0.1%	0.2%	0.1%
Hayward	13.2%	13.6%	13.3%	11.2%	11.4%	11.2%	3.6%	3.6%	3.6%
Maacama	0.5%	14.3%	8.8%	0.4%	12.2%	7.7%	0.2%	1.7%	1.4%
Rodgers Creek-Healdsburg	2.2%	13.9%	9.9%	2.1%	11.4%	8.2%	0.9%	3.6%	2.8%
San Andreas (North Coast)	6.3%	7.1%	6.7%	6.2%	7.0%	6.5%	6.1%	6.7%	6.3%

Source: WGCEP 2018

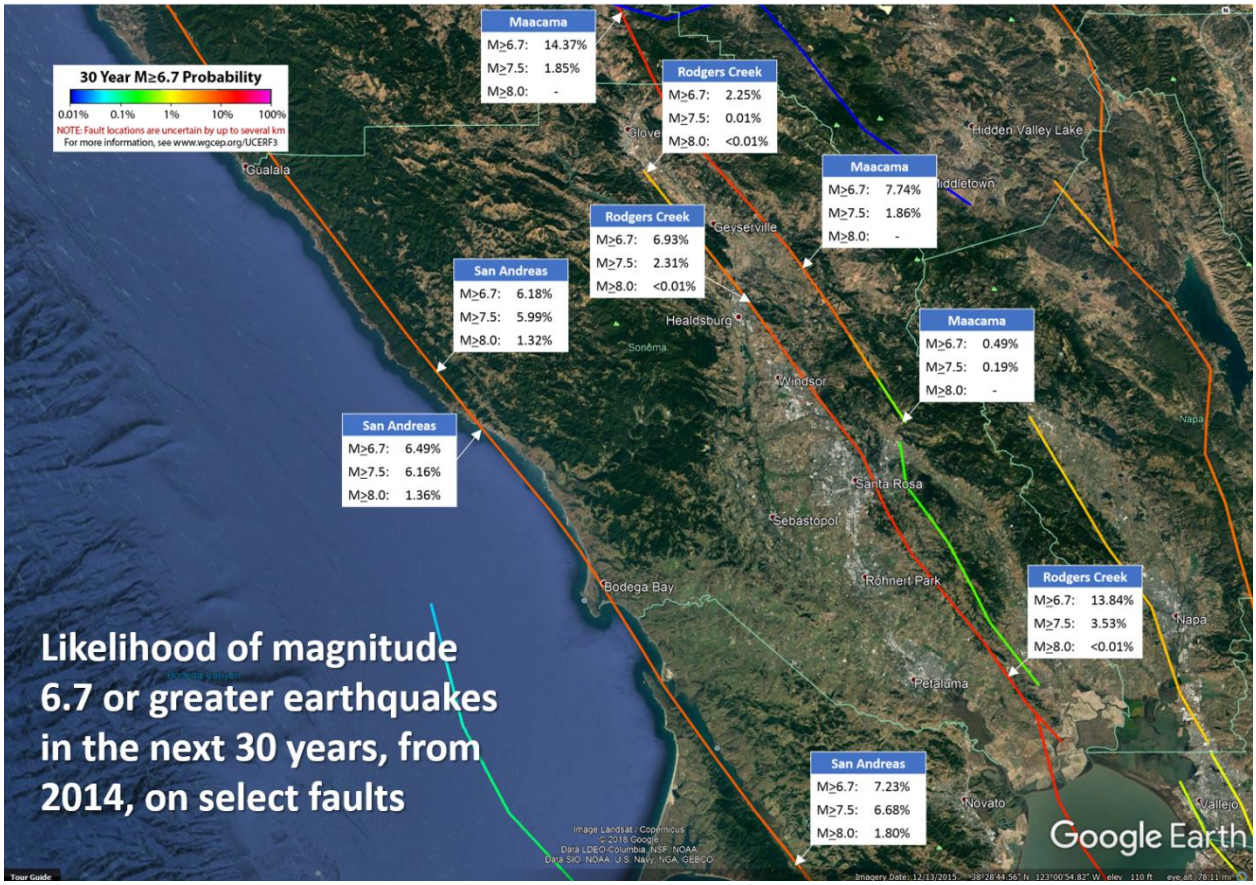


Figure 4.8: UCERF3 30-Year M6.7 Earthquake Probabilities
(Source: WGCEP 2018)

Faults not identified in the forecast are still capable of causing significant earthquakes. Depending on the magnitude and location of the earthquake, Healdsburg could be affected by earthquakes originating in all parts of the Bay Area.

Future Condition Considerations

The likelihood, size, and severity of seismic events are not expected to be directly impacted by any changes in future climate conditions. It is possible that anticipated changes to precipitation levels and storm intensity may affect groundwater aquifer levels, which could expand or contract areas of potential liquefaction in the Planning Area.

4.2.3 Flooding

Hazard Description

Flooding occurs when normally dry land is partially or completely inundated and can occur for a number of reasons. The water levels in bodies such as streams, rivers, lakes, and reservoirs can exceed the water body's banks due to heavy rainfall or snowmelt, causing water to overflow into nearby areas. Heavy precipitation can overwhelm the ability of soil to absorb water or of local storm drains to carry it away, causing water to build up on the surface. Flooding may also occur from infrastructure failure, such as a burst water tank or dam failure.

Dam failure occurs when a dam structure or its foundation is damaged to such a degree that the dam partially or completely loses its ability to hold back water. When this happens, some or all of the water impounded by the dam is suddenly released, causing a very fast-moving flood downstream of the dam. Like other flash floods, dam failures can cause widespread injury or loss of life, extensive property damage, and displacement of a large number of people in the flood's path. If the failed dam is part of a water supply network, a dam failure may also cause local and regional disruption to water service if there is no sufficient alternative supply.

Dams can fail for a number of reasons. Seismic or geologic hazards, such as earthquake shaking or a landslide, may damage the dam or its foundations, causing it to weaken to the point of failure. During intense rainfalls, the dam itself or the surrounding rock can erode sufficiently to cause a failure. Additionally, the dam itself may be poorly sited, designed, or maintained, and so may collapse independent of any other hazard event. At times, these factors can work together, such as if a design flaw in a dam causes the floodwaters from an intense rainfall to erode parts of the dam and lead to a failure.

Regardless of the type of flood, a flood event can damage buildings and infrastructure either by debris carried along in the water or by the pressure of the water itself. Floods can weaken foundations and wash away soils, increasing the risk of damage or destruction. According to California's Multi-Hazard Mitigation Plan, floods are the second most common disaster type in California, second only to fires (CNRA and Cal OES 2012).

Strength/Magnitude

Flood severity is often described in years, such as a 100-year event. This does not mean that such an event will occur just once every 100 years. Rather, the term indicates a 1-in-100 probability, or that there is a 1 percent risk of such an event in any given year. Similarly, a 500-year flood indicates the risk of such an event is 1-in-500, or 0.2 percent, in any given year.

The magnitude of a flood may also be expressed in terms of the water's depth. A 2017 flood control study prepared for the City of Healdsburg by West Yost Associates estimated flood depths along Foss Creek, the city's primary source of flood risk. Using historic rainfall totals logged by the National Oceanic and Atmospheric Administration, along with locally collected hydrologic and hydraulic modeling, the study generated a flooding scenario that would result from a storm with a 1 percent chance of occurring in any given year. Based on existing conditions in the city, the report estimated that such a flood would produce 1.0 to 4.3 feet of flooding at eight locations, with an average depth of 2.3 feet.

Past Occurrences

A December 2014 flood originating from Foss Creek was Healdsburg's most significant event. Following a series of storms, more than 8 inches of rain fell in a 24-hour period on December 10 and 11, flooding about 78 acres in the downtown area. The City identified 178 residential buildings and 143 commercial buildings that were affected, with roughly two dozen businesses suffering interior water damage. Total damages were estimated at $1.5 million.

Sonoma County has experienced significant flooding on the Russian River on at least six occasions since 1955. Of these, only the two most severe events caused flooding in Healdsburg. In both cases, inundated areas were centered on the bend in the river upstream of the Healdsburg Avenue bridge near Badger Park. These floods are detailed in the 2017 Sonoma County HMP:

> The largest flood in recent history occurred between February 14 and 18, 1986, when a peak discharge of 102,000 cubic feet per second was recorded and the flood reached a gauge height of 48.6 feet at Guerneville. Heavy rains [fell] from December 26, 2005, to January 3, 2006. The Russian River rose above flood stage at all USGS gaging stations in Sonoma County. … At Guerneville, the river crested at 41.6 feet. The rainfall measured in the City of Santa Rosa during this storm was near record-setting at 17.6 inches. The President declared this flood a major disaster, and more than 100 roadways were blocked due to flooding or landslides.

Areas that flooded during the February 1986, December 2005–January 2006, and December 2014 events are shown in **Figure 4.9**.

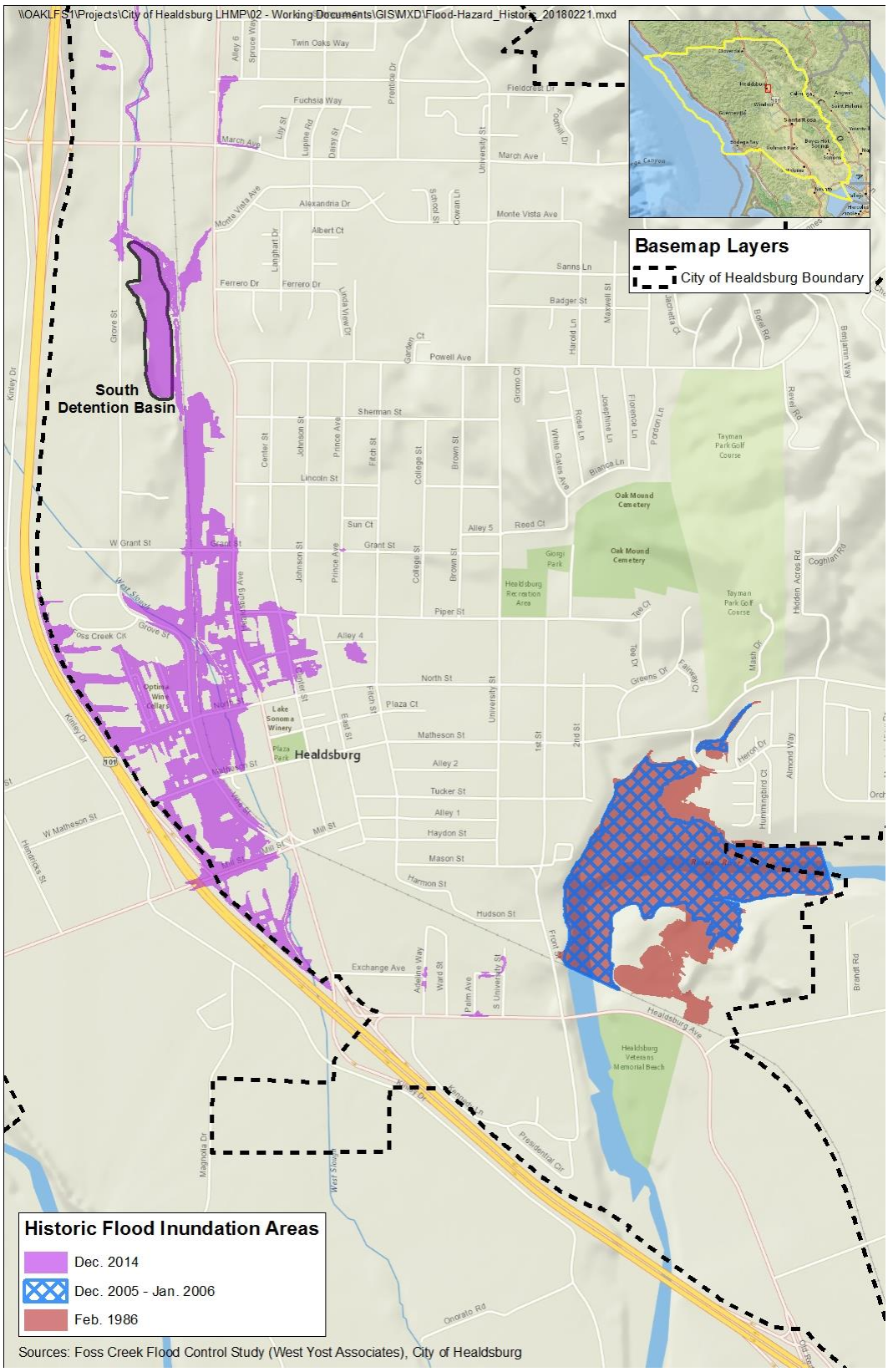


Figure 4.9: Historic Flooding in Healdsburg
(See Appendix C for a larger and higher resolution map)

The city has never experienced flooding caused by a dam failure, nor have there been any significant dam failures elsewhere in Sonoma County. The near-catastrophic failure of the spillway of the Oroville Dam in Butte County, about 100 miles northeast of Healdsburg, in 2017 posed no direct threat to the city but serves as a reminder of the ongoing risk presented by dams.

Location

The Russian River and Foss Creek are the dominant flooding hazards for Healdsburg, with Foss Creek causing most of the flooding in the city.

FEMA produces Flood Insurance Rate Map (FIRM) panels that identify which areas would be affected by flood events with a 1 percent and 0.2 percent chance of happening in any given year. FEMA revised its flood maps for the Healdsburg area in 2006. In addition, Healdsburg's Public Works Department submitted an application for a Letter of Map Revision that modified the floodway for Foss Creek from where it crosses Grove Street to where it crosses US Highway 101; these revisions became effective in 2010. **Figure 4.10** shows the location of flood hazard zones based on current FEMA data.

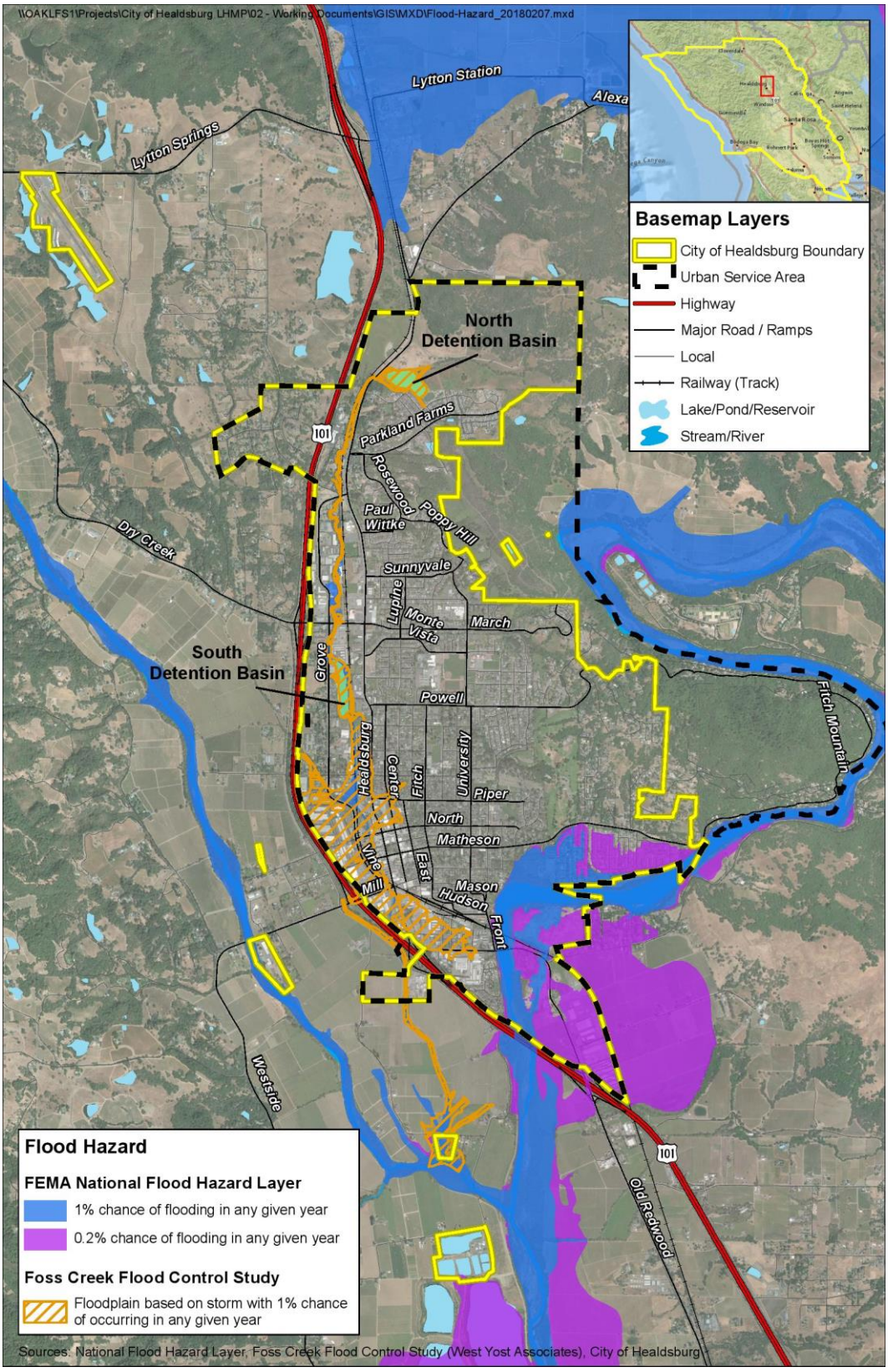


Figure 4.10: Flood Hazard Zones for Healdsburg
(See Appendix C for a larger and higher resolution map)

Russian River

The Russian River extends 110 miles and drains approximately 1,500 square miles in Mendocino and Sonoma counties into the Pacific Ocean. The river defines part of the eastern boundary of Healdsburg's Urban Service Area. After rounding Fitch Mountain, the river crosses the city's southern tip. FEMA's flood maps show much of this area has at least a 0.2 percent annual chance of flooding, with a 1 percent annual chance for parts of Badger Park and the Rio Vista Estates subdivision. All or portions of approximately 100 homes and a few nonresidential properties within the city limits are included in the river's 1 percent annual chance flood hazard zone. To maintain participation in the National Flood Insurance Program (NFIP), the City updated its floodplain regulations to bring the City's floodplain management ordinance into conformance with the current federal regulations and adopted the new flood hazard map.

Foss Creek

The other important surface water in the city is Foss Creek, which has its origins at the northeastern-most corner of the city's Urban Service Area and empties into the Russian River. Most of the area within the city limits and over half of the Urban Service Area falls within the drainage area of Foss Creek. A portion of the Urban Service Area to the north of the city limits drains to Alexander Valley, and the balance of the Urban Service Area drains to the Russian River. Foss Creek runs north–south through town, roughly paralleling the Northwestern Pacific Railroad tracks, and flows first through a detention basin near the northern city limits (75 acre-feet capacity) and to a second detention basin (off-stream) south of Dry Creek Road (49 acre-feet capacity), then runs south in channels and conduits, leaving the city through double concrete boxes under US Highway 101 near Exchange Avenue and Healdsburg Avenue. The northern detention basin, located north of the Parkland Farms subdivision, was sized to accommodate anticipated development in the Foss Creek watershed portion of the city's northern Planning Area. The detention basin accepts increases in storm runoff from development and detains the peak storm flows, thereby reducing downstream flooding. The detention basin is designed with upper and lower sections so that the lower area nearest the creek has 3:1 banks, fills first, and functions as a riparian habitat and wetland. During a peak storm, an infrequent event, the upper portion of the detention basin fills as stormwater backs in from the lower area. This area is designed with a gradual 6:1 slope and rectangular shape to be available for secondary use as a recreational area. The detention capacity for the basin was calculated for housing densities higher than have actually been approved, resulting in a substantial factor of safety. Therefore, no other major flood control or off-site storm drain improvements are anticipated to be required for further development in the northern Planning Area. This was the basis of the flood map amendment the City filed with FEMA, reflecting a significant reduction in the flood hazard areas for Foss Creek as a result of the detention basins' construction.

The 2014 flood, however, inundated areas outside the revised hazard areas shown on FEMA flood maps, even as the detention basins functioned as intended. The Foss Creek Flood Control Study by West Yost Associates found the storm that produced the flood was less than a 1 percent annual chance event, with approximately a 1-in-67 chance of occurring in any given year. The study further estimated that a rainstorm with a 1-in-100 annual probability would flood much of southwestern Healdsburg and the downtown area, as shown in **Figure 4.10**. All this suggests that the hazard posed by Foss Creek may not be limited to the Special Flood Hazard Area shown on FIRM panels, and properties that do not fall within the regulatory 1 percent annual chance floodplain may still be at risk of flooding.

Dam Failure Inundation

Flood control for the lower Russian River is provided primarily by Warm Springs Dam. It is located on Dry Creek, a tributary of the Russian River, approximately 10 miles northwest of the city. Lake Sonoma was created by the dam and has a storage capacity of 381,000 acre-feet and a total surface area of 3,600 acres. Warm Springs Dam is located on a medium-sized fault but was designed to absorb the maximum expected displacement and ground shaking from any fault in the region. Failure of this dam could inundate most of the city, to an elevation of 230 feet.

Coyote Dam is an earthen dam on the East Fork of the Russian River above Ukiah (north and upstream of the city, in Mendocino County) and is part of a system that provides water to Mendocino, Sonoma, and Marin counties. The dam provides storage capacity of 122,500 acre-feet at Lake Mendocino. Failure of this dam could inundate the southern portion of the city with water traveling down the Russian River.

Frequency/Probability of Future Occurrence

Areas illustrated in blue in **Figure 4.10** have a 1 percent chance of flooding in any given year. There is a 0.2 percent chance that a flood will occur in any given year in the floodplain areas shown in purple. Some flooding may occur annually but it may not be as severe as a 1 percent annual chance event, and it may not occur within the identified 1 percent annual chance floodplain. Significant, widespread flooding is most likely to occur when heavy rains fall over already saturated ground.

The risk of flooding can increase significantly in areas that have been burned by wildfire. Fires alter terrain and ground conditions, eliminating vegetation that can absorb rainfall. Flooding is also often more severe, as ash and debris left from the fire can contribute to mudflows. It can take up to five years before vegetation is restored. See the Wildfire section (**Section 4.2.5**) for information on areas at risk of wildfire.

The lack of any previous dam failure events in Sonoma County makes it difficult to make a precise prediction about future probability. A 2018 independent forensic report on the Oroville Dam incident identified systemic failures in dam safety regulations and industry practices, and suggested that dam owners may be overconfident in their assessments (IFT 2018). Still, with only two actual failures among California's 1,500 dams in the last 90 years and none since 1963, future occurrences can still be regarded as extremely unlikely.

Future Condition Considerations

There is some evidence that frequent intense storms, known as atmospheric river events, could increase in the coming decades. Statewide, some studies suggest that more years will have an increased number of atmospheric river events and that the largest of these atmospheric river events will be more intense than they have been historically (Dettinger 2011). In general, Northern California is expected to see more frequent atmospheric river events, potentially up to twice as many by 2100 as the region currently does, while Southern California is expected to see the same number of atmospheric river events but with each individual storm an average of 10 to 20 percent more intense. However, the specific impacts on the Healdsburg region are not yet known (Oskin 2014).

As noted in the Drought section, dry conditions cause soil to harden, making it less absorbent to precipitation and increasing the risk of flooding, particularly at the beginning of the rainy season. Since drought conditions are expected to increase also, there is a greater risk of flooding from drought-induced changes in soil characteristics. These impacts may already be felt; in July 2015, Lieutenant Governor Gavin

Newsom, acting temporarily as governor, issued a disaster proclamation for large parts of Southern California due to flooding and related hazards as a result of severe storms. In the proclamation, Newsom noted the drought's impact of drying out soil and increasing the risk of flash floods (Office of the Governor 2015).

4.2.4 Landslide

Hazard Description

Landslides occur when the soils of a slope, such as a hillside or mountain, become unstable. When this happens, the soils slide down toward the base of the slope, damaging or destroying structures built on the moving soil or in its path. While landslides are often thought of as fast-moving events, some landslides may happen slowly over a long period of time.

The types of materials that compose a slope and the steepness of the slope help determine the overall risk that a landslide may occur. Soil stability and time also contribute to the risk of rockfall, which is of particular risk along roadways and trails where a path or highway has been cut into a hillside, exaggerating the angle of repose and increasing the likelihood of rockfalls.

Landslides may be triggered by other hazard events. The shaking of an earthquake or the loss of soil stability as a result of earthquake-induced liquefaction can cause the soil to slide. Alternatively, precipitation can result in saturated soil and a loss of stability, or flowing water may erode the base of a slope. The risk of a landslide is often exacerbated in areas recently burned by wildfire, as the fire burns vegetation that can absorb water and hold back soil. Without the vegetation to stabilize a slope and prevent runoff, sediment and debris are more susceptible to sliding.

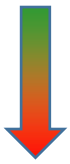
Landslide hazards in Healdsburg are common, and generally occur as a result of heavy rainfall. Large earthquakes and improper grading or drainage practices can also cause landslides.

Within Healdsburg, many of the swales or ravines that occupy the steep hill slopes may be capable of generating debris flows. Debris flows are most likely to originate on slopes underlain by sandstone or Glen Ellen sediments. Areas underlain by mudstone of the Great Valley Sequence are generally characterized by earthflows or slumps and are considered less likely to generate debris flows (Healdsburg 2009).

Strength/Magnitude

As defined in a CGS Special Report for Sonoma County, five categories of stability, based on terrain and geology, have been established to help the County understand landslide susceptibility. The slope categories are shown in **Table 4-7**.

Table 4-7: Categories of Stability

Risk	Category	Description
Most stable/lowest risk  **Least stable/highest risk**	A	Areas of greatest relative stability due to low slope inclination—predominantly less than 15%.
	Bf	Locally level areas within hilly terrain; may be underlain or bounded by unstable or potentially unstable rock materials.
	B	Areas of relatively stable rock and soil units, on slopes greater than 15%, containing few landslides.
	C	Areas of relatively unstable rock and soil units, on slopes greater than 15%, containing abundant landslides.
	Landslide	Areas of lowest relative slope stability. Failure and downslope movement of rock and soil have occurred or may have occurred.

Source: Huffman, Armstrong 1980

Notable landslide events are often described in terms of the volume of soil that moved or the depth of debris. Landslides that occurred in the Bay Area during the 1997–98 El Niño rainstorms, for example, ranged from 25 cubic meters to 13 million cubic meters (Godt 1999).

Past Occurrences

The Healdsburg General Plan Background Report identified 36 smaller landslides in Healdsburg along the northwestern to southeastern stretch of the city, and a larger landslide in the central portion of the eastern city boundary. These landslides are mainly slow-moving or earthflow landslides that are confined to the soil mantle and shallow, weathered bedrock. They represent identified, ongoing hazard areas as opposed to the location of specific events that caused damage.

The most notable example of damaging landslides in Sonoma County occurred during the 1997–98 El Niño rainstorms. Approximately 300 landslides were documented in 10 Bay Area counties. In Sonoma County, the USGS recorded seven major landslides that caused a total of $21 million in damages (Godt 1999). While not among the most damaging, two of the seven were centered on Fitch Mountain near Healdsburg (Ramsey & Godt 1999). In one case, a small slide on the north side of the mountain liquefied at the toe—the lower margin of displaced soil—and moved down onto North Fitch Mountain Road near two homes (DOC 2018). The worst of the Sonoma County landslides occurred in the unincorporated community of Rio Nido near Guerneville, where debris flows on January 6–7, 1998, forced the evacuation of 140 homes, three of which were destroyed and dozens more damaged.

During the week of March 21, 2011, heavy rainfall caused a landslide near Burgundy Road in the portion of northern Healdsburg west of US Highway 101. The slide damaged the city's water system, which in turn damaged the road and adjacent properties. The City Council declared a local emergency on September 19, 2011, and paid $500,000 to regrade the hill, install reinforcements and erosion control measures, and repair water and sewer mains and the road (Healdsburg, City of 2013).

More recently, the December 11, 2014, rainstorm that flooded downtown Healdsburg also caused part of a hillside to fail at a vineyard on West Dry Creek Road about 5 miles northwest of the city. The debris flow caused a large amount of soil to reach a tributary that feeds Dry Creek (Callahan 2016).

Location

The area most susceptible to landslides trends from the northwestern part of Healdsburg to the southeastern part, along the hills that define the city's eastern edge. Much of this area also has mapped landslide deposits, which identifies higher risk of future landslides. The population in this area is less dense, but the area contains enough housing to pose a risk to life and property.

In addition to Burgundy Road and North Fitch Mountain Road locations, there is an active slide in the Parkland Farms area.

The Healdsburg General Plan Background Report maps areas of landslide risk based on CGS's slope categorization. Virtually all the hillside areas are mapped as Zone C, areas with moderate to high landslide risk. **Figure 4.11** shows the location of slope hazard zones in the city.

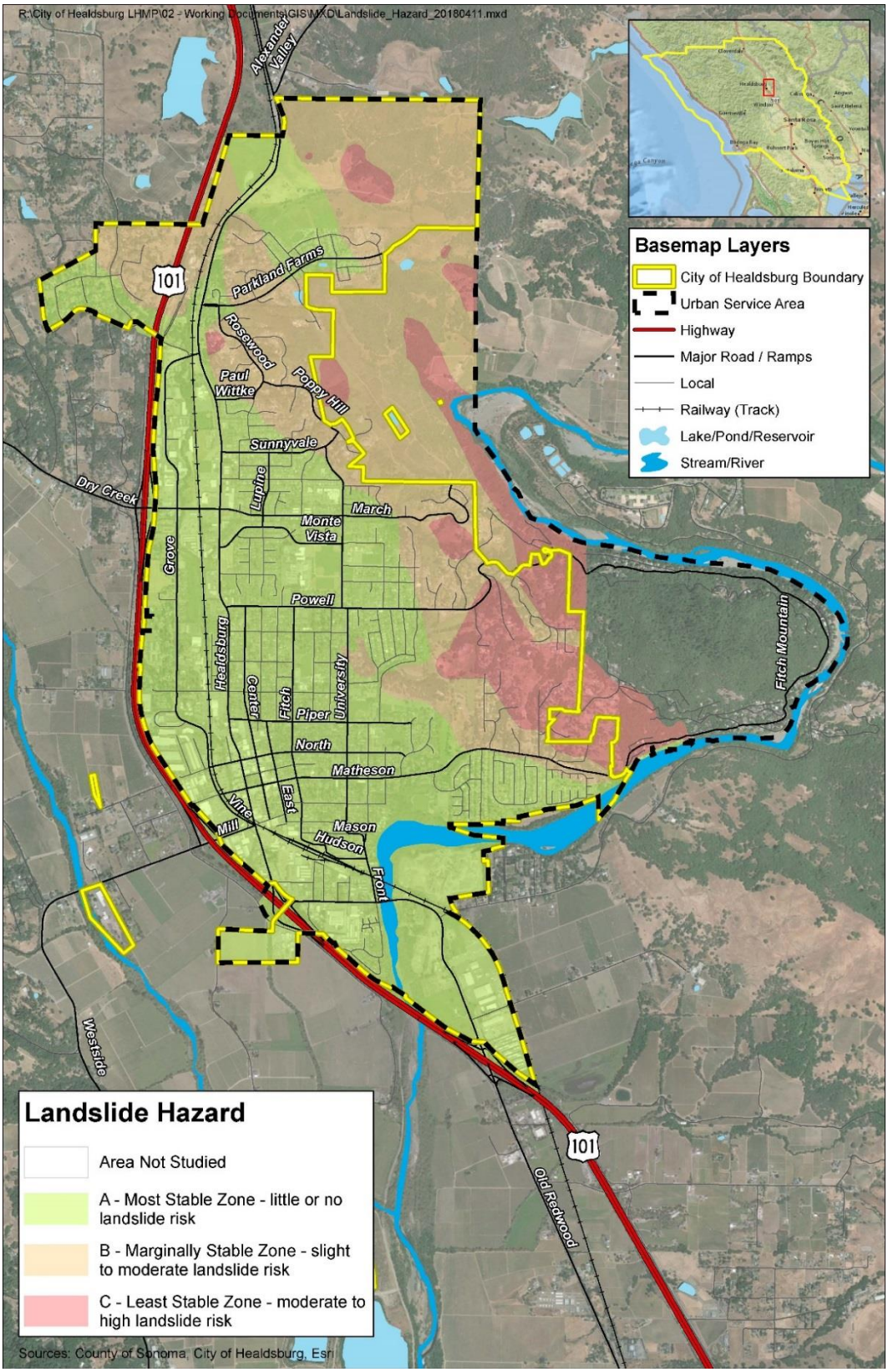


Figure 4.11: Healdsburg Landslide Hazard Zones
(See Appendix C for a larger and higher resolution map)

Frequency/Probability of Future Occurrence

Because of Healdsburg's topography, future landslides will most likely occur during periods of heavy rain. Just two damaging landslides have occurred within Healdsburg's Urban Service Area in the last 20 years, both during the same winter storms. Road closures due to mud flows may occur more frequently, particularly during El Niño years, which have occurred in 7 of the last 20 winter seasons. The probability of a geologic hazard occurring in any given area is unknown, although landslide risks are likely to remain highest in the areas identified as having a high susceptibility. The geologic conditions in the county that have been responsible for past landslide events are not expected to change.

Future Condition Considerations

The expected increase in the frequency and/or intensity of storms that will affect California could make moisture-related landslides more common. The increase in average temperature and periods of drought may also cause soil to become less cohesive, making soil more unstable and potentially increasing landslide risk.

4.2.5 Wildfire

Hazard Description

The term *wildfire* refers to any conflagration that starts in a rural, sparsely populated or largely undeveloped area. In many parts of the world, wildfires form part of the ecosystem and often burn at a safe distance from areas of human settlement. Under dry conditions and when fanned by strong winds, however, fires can spread into heavily populated areas, causing major damage to property. Buildings may be set alight by radiant heat, contact with the flames, or flying embers. Smoke can also cause property damage and health concerns, and indirect losses can result from business interruption.

A complex interplay of natural anthropogenic factors influences the extent and magnitude of wildfires. Most wildfires are sparked by human activity and expand due to factors such as the type and dryness of vegetation, slope, wind, and other climatic components such as temperatures and precipitation. Wind plays a significant factor in the spread of fire, and the strong, dry Santa Ana and foehn winds significantly increase the risk and severity of wildfire (Sonoma County 2017). Recent issues with Sudden Oak Death, a forest disease caused by a fungus-like organism that has been responsible for the death of thousands of oaks and tanoaks in California's coastal areas, has increased the amount of dead and dry vegetation that can serve as tinder for a wildfire. Drought also can increase the likelihood and magnitude of wildfires. The complicated nature of wildfire spread makes it difficult to predict; even if hazard zones can be clearly identified, fires can cause significant losses in unexpected locations under unique circumstances.

Strength/Magnitude

CalFire gauges wildfires in terms of the number of acres burned. On average, wildfires in Sonoma County since the 1960s have burned about 13,000 acres each, and as much as 76,000 acres. The median fire is the 2000 Berryessa Fire, which burned 5,731 acres.

Past Occurrences

Wildfires have occurred regularly in the Bay Area region, with documented fires going back to the 1960s. ABAG (2015) reports large wildfires as having occurred in 1961, 1962, 1964, 1965, 1970, 1981, 1985, 1988, 1991, and 2008.

The 2017 fire season was the worst in the California's history and included major, highly destructive fires in Sonoma and Napa counties. These included the Pocket Fire to the north of Healdsburg and the Tubbs Fire to the south and east. The Tubbs Fire is the most destructive wildfire in modern state history, claiming 36,432 acres of land, 5,300 structures, and 22 lives. Within hours of its ignition, the fire swept out of the mountainous areas north of Santa Rosa and into densely populated city neighborhoods. The Pocket Fire burned 17,357 acres of mostly undeveloped land in the Geyserville area, destroying only a few structures. These fires burned in concert with the Nuns and Atlas fires farther to the south, all of which started on October 8 and 9, 2017, spurred by high winds and recent drought conditions that caused the fires to spread quickly and unpredictably (Cal Fire 2018). While none of these fires reached Healdsburg, the Tubbs and Pocket fire perimeters both were less than 6 miles from the city's border. On October 11, 2017, city officials advised residents of Fitch Mountain and along Bailhache and Rio Lindo avenues to be prepared to evacuate if necessary. No official evacuation orders were issued, but some residents did leave their homes as a precaution. The Healdsburg Community Center served as an emergency shelter for those displaced by the fires, registering 195 evacuees by the second day (Avants 2017).

Prior to the Sonoma and Napa County fires, the 1991 fire in the Oakland-Berkeley Hills was the largest urban wildland fire in the Bay Area and resulted in $1.7 billion in losses. In the fire, 3,354 single-family dwellings and 456 apartments were destroyed, while 25 people were killed and 150 people were injured (ABAG 2017).

Hundreds of fires have burned in Sonoma County since the 1960s, including those listed in **Table 4-8** and shown in **Figure 4.12**. Historically, major fires have not significantly impacted Healdsburg, but they could in the future.

Table 4-8: Historic Sonoma County Fires

Year	Name	Acres Burned	Structures Burned
1964	Hanley	52,700	108
1964	Nuns Canyon	10,400	27
1965	Knight's Valley	6,000	0
1965	Pocket Ranch	4,000	0
1965	Austin Creek	7,000	0
1972	Bradford	1,760	4
1978	Creighton Ridge	11,405	64
1988	Cloverdale	1,833	100
1988	Geysers	9,000	7
1996	Porter Creek	300	0
1996	Cavedale	2,100	0
1999	Geyser Road	1,300	0
2000	Berryessa	5,731	15
2004	Geysers	12,000	6
2008	85	322	0
2008	Pine	989	0
2013	McCabe	3,505	1
2015	Valley	76,067	1,955

Table 4-8: Historic Sonoma County Fires

Year	Name	Acres Burned	Structures Burned
2017	Tubbs	36,807	5,643
2017	Nuns	54,382	1,355

Source: CalFire, 2018b (Fire Season Summaries)

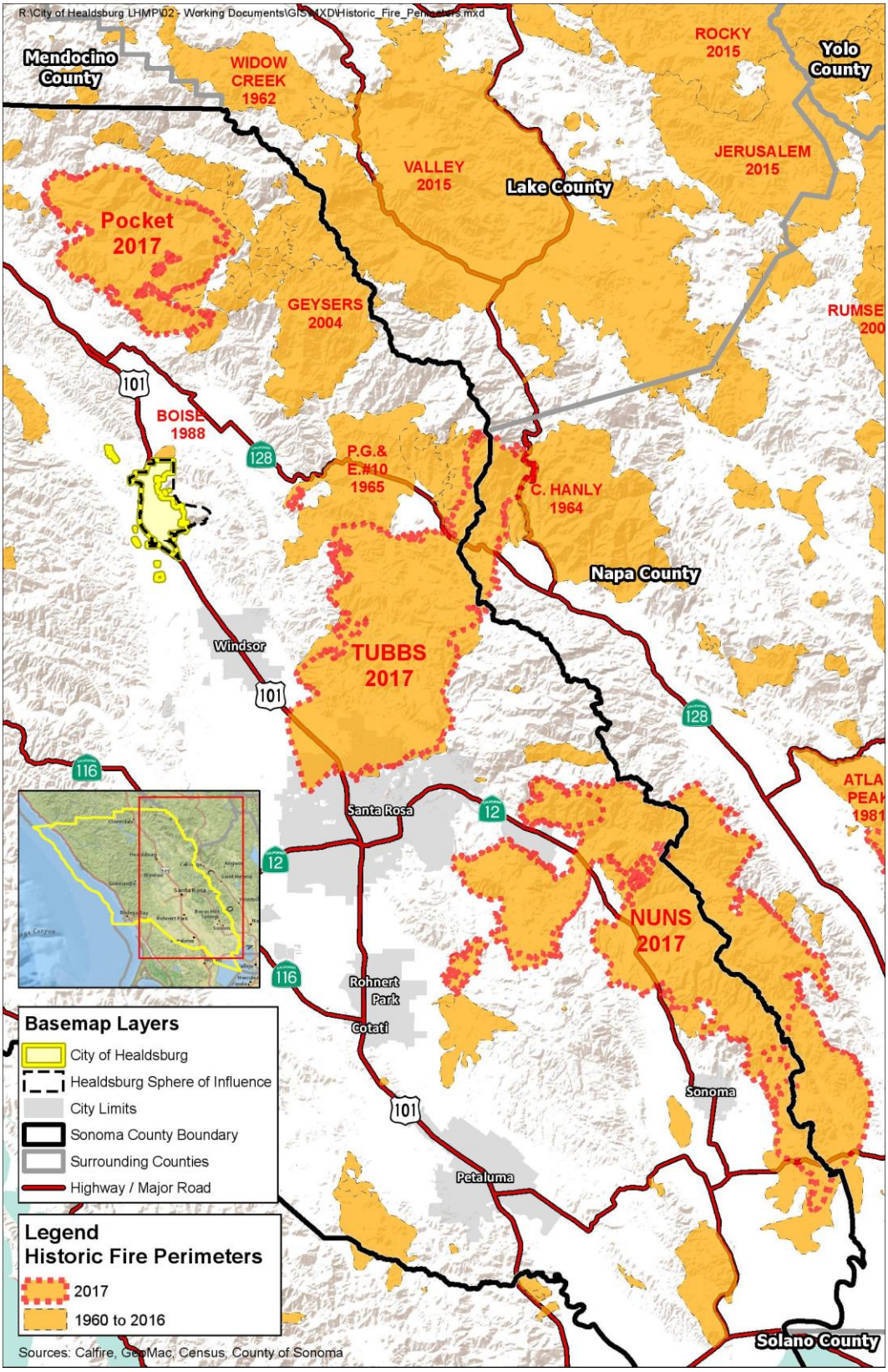


Figure 4-12: Historic Fire Perimeters in the Healdsburg Vicinity
(See Appendix C for a larger and higher resolution map)

Location

Fire-prone areas in California are divided into three categories: Federal Responsibility Areas (FRAs), State Responsibility Areas (SRAs), and Local Responsibility Areas (LRAs). FRAs are lands where federal agencies are responsible for preventing and fighting fires, and include lands protected by the US Forest Service, the US Department of Agriculture, and the Department of the Interior (including the National Park Service, the Bureau of Land Management, and the Bureau of Indian Affairs). SRAs are areas where CalFire is responsible for fire prevention and firefighting, while local agencies have responsibilities in the LRAs. The LRA for the Healdsburg region is shown in **Figure 4.13**.

CalFire is required by state law to map areas of significant fire hazards based on fuels, terrain, weather, and other relevant factors. These zones, referred to as Fire Hazard Severity Zones (FHSZ), influence how people construct buildings and protect property to reduce risk associated with wildland fires. Determining fire hazard severity has two key components: probability of burning and expected fire behavior. The factors considered in determining hazard are how often an area will burn, and when it does burn, what characteristics might lead to buildings being ignited? Based on these factors, each area is categorized as a Moderate, High, or Very High FHSZ. The classification system is intended to provide a broad-stroke understanding of level of wildfire hazard across the state and may not always reflect hazard from highly localized and fine-grained factors.

Figure 4.13 shows the FHSZs for both the SRA and LRA in the Healdsburg area. The area around Healdsburg is generally classified as either moderate or high fire hazard, with the high fire hazard areas on the eastern side encompassing much of Fitch Mountain and the wooded and brush-covered ridges. Although these are the areas of greatest concern, the rest of the city could be affected by the spread of fire into urban areas, high winds and mountainous terrain that make firefighting difficult, and the resulting particulate matter causing health concerns in the region. Areas of wildland-urban interface (WUI) are particularly vulnerable because fire can easily spread from the wildland area to the urban, putting property and lives at risk.

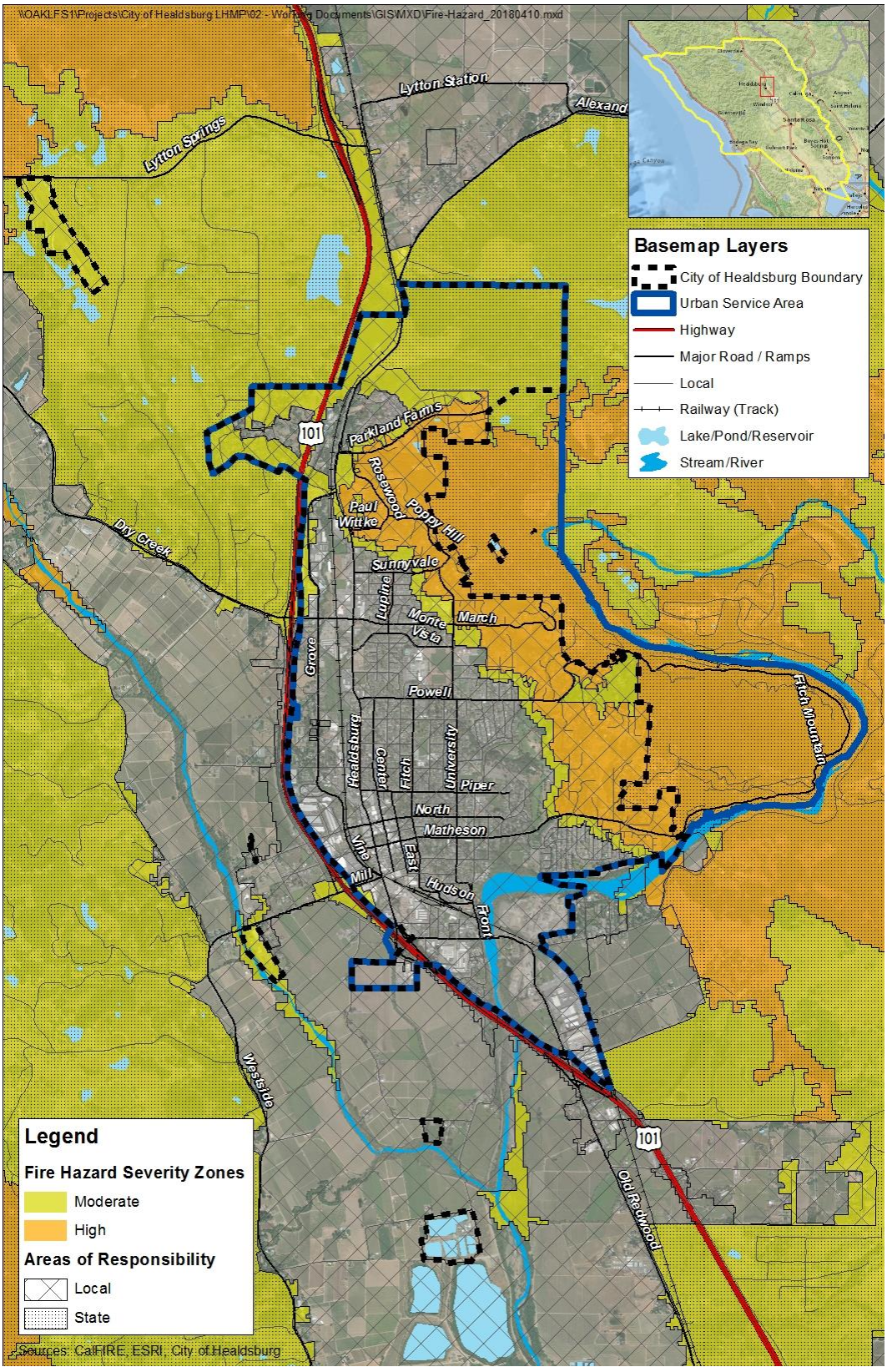


Figure 4.13: Healdsburg Fire Hazard Severity Zones and Areas of Responsibility
(See Appendix C for a larger and higher resolution map)

Frequency/Probability of Future Occurrence

Fires are a common feature in California and the Healdsburg area. In the last 25 years, one in every three fire seasons has involved a major wildfire in Sonoma County. In addition, development in rural and suburban areas along Healdsburg's WUI is expected to increase with population growth, which increases the risk of wildfire damage. Increased development in the area can also lead to more fires caused by human activity, including faulty or downed utility lines. It is therefore assumed that wildfires will continue to occur and pose a risk to people and assets in Healdsburg, and possibly increase in frequency and magnitude.

Future Condition Considerations

Future fire risk modeling analyzes two primary variables: fuel availability and flammability. In California, the change in fire risk is a result of two climate factors. First, fire risk can increase due to a densely forested ecosystem as a result of higher temperatures, less snowpack, and earlier springs. Second, fire risk can decrease when formerly dry climates experience substantial vegetation growth after a year of above average precipitation. This type of ecosystem will be dominated by grass and low-density shrubs, resulting in a potential for reduced risk due to decreased availability of fuel.

Although the northern Bay Area will not be impacted by future climate conditions as severely as other parts of California, as precipitation lessens and average temperatures warm, wildfires will have an easier time igniting and spreading. This has already become apparent in the recent trend of larger and more frequent fires that have occurred in the western region, most likely due to hotter, longer, and drier summers. An anticipated increase in droughts will reduce moisture in vegetation, making it easier to ignite, and reduce the water available for combatting fires when they occur.

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Section 5. Vulnerability Assessment

The vulnerability assessment provides an explicit representation of what a community stands to lose in a disaster. This is useful for City staff and other decision-makers who will need to balance the costs of mitigation against the potential harm to residents and damage to property. The assessment provides comparable measurements of community exposure to natural hazard and helps determine which hazards and/or what areas of the City to focus on or prioritize when improving resiliency. Based on possible assets at risk, hazard mitigation resources can be directed where need be, in part, through a vulnerability assessment and information found in the hazard profiles in **Section 4.2**.

The vulnerability assessment is developed using quantitative and qualitative information for each hazard. Through an exposure analysis, quantitative data is developed for each hazard. An exposure analysis quantifies the assets at risk to particular hazards. Qualitative data has been developed and presented in this section for hazards without measurable data. Rather than quantities of assets at risk, qualitative data provides a description of how the hazard could affect the region.

5.1 Methodology

A vulnerability assessment was conducted for each of the hazards profiled in **Section 4.2**. Vulnerability can be quantified in instances where there is a known hazard area, such as a mapped floodplain or high fire hazard area. Geospatial analysis can be conducted if a natural hazard has a particular spatial footprint that can be overlaid against the locations of people, residential buildings, and critical facilities. In Healdsburg, earthquake, flooding, liquefaction (as a sub-hazard to earthquake), landslide, and wildfire have known geographic extents and corresponding spatial information about each hazard.

The hazard of drought is the only hazard in this plan that is not associated with a specific mapped area. The vulnerability and potential impacts from profiled hazards that do not have specific mapped areas or the data to support additional vulnerability analyses are discussed in more general terms.

Critical facilities are described as assets that are essential for people and a community to function, including public utilities such as lift stations. The LHMP Planning Team compiled a list of 45 critical facilities as shown in **Table 5-1** and **Figure 5.1**.

A critical facility spatial database was developed to translate critical facilities information into georeferenced points.[1] Critical facility points were overlaid with the spatial hazard layers to develop a list of "at-risk" critical facilities. The City critical facilities that intersect with natural hazards are referred to as facilities with hazard "exposure." The exposure analysis for individual critical facilities is illustrated in **Table 5-2** (results summarized by hazard are provided in the subsequent section).

[1] 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.

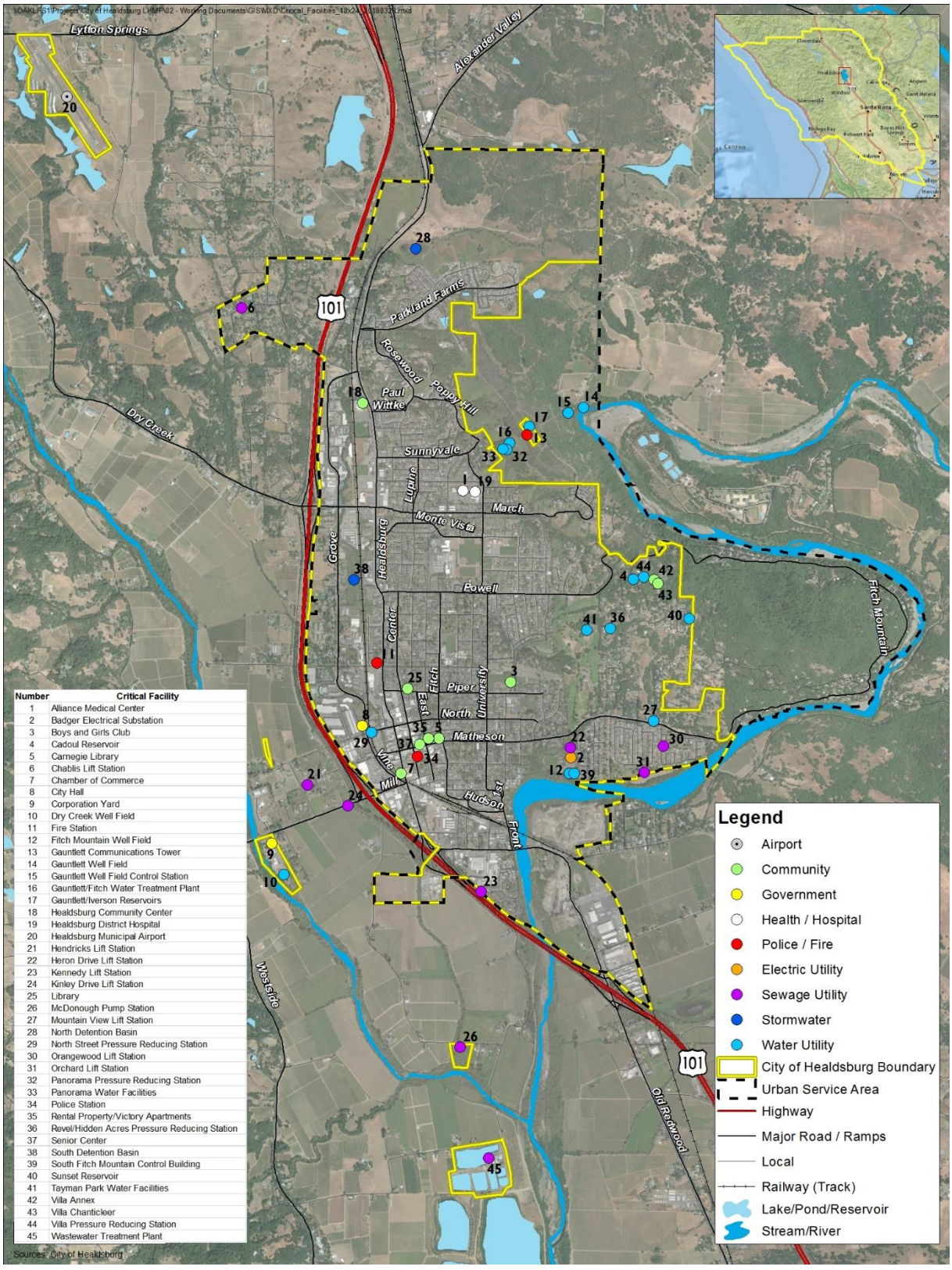
Population data is derived from the US Census Bureau's 2012-2016 5-Year American Community Survey (2012-2016 ACS), utilizing census block groups. Residential building data is derived from City of Healdsburg and Sonoma County GIS files detailing land use designations, zoning, building footprints, and tax information. Then, a combination of spatial overlay and proportional analysis was used to determine the number of people and residential buildings in areas where hazards are likely to occur. Maps illustrating the population density and residential building density data used are found in **Appendix C**.

Table 5-1: Healdsburg Critical Facilities by Type

Critical Facility	Type
Healdsburg Municipal Airport	Airport
Boys and Girls Club	Community
Carnegie Library	Community
Chamber of Commerce	Community
Healdsburg Community Center	Community
Library	Community
Rental Property/Victory Apartments	Community
Senior Center	Community
Villa Annex	Community
Villa Chanticleer	Community
Badger Electrical Substation	Electrical
City Hall	Government
Corporation Yard	Government
Alliance Medical Center	Health/Hospital
Healdsburg District Hospital	Health/Hospital
Fire Station	Police/Fire
Gauntlett Communications Tower	Police/Fire
Police Station	Police/Fire
Chablis Lift Station	Sewage Utility
Hendricks Lift Station	Sewage Utility
Heron Drive Lift Station	Sewage Utility
Kennedy Lift Station	Sewage Utility
Kinley Drive Lift Station	Sewage Utility
Magnolia Drive Lift Station	Sewage Utility
Orangewood Lift Station	Sewage Utility
Orchard Lift Station	Sewage Utility
Wastewater Treatment Plant	Sewage Utility
North Detention Basin	Stormwater
South Detention Basin	Stormwater
Cadoul Reservoir	Water Utility
Dry Creek Well Field	Water Utility
Fitch Mountain Well Field	Water Utility
Gauntlett Well Field	Water Utility
Gauntlett Well Field Control Station	Water Utility
Gauntlett/Fitch Water Treatment Plant	Water Utility

Table 5-1: Healdsburg Critical Facilities by Type

Critical Facility	Type
Gauntlett/Iverson Reservoirs	Water Utility
McDonough Pump Station	Water Utility
North Street Pressure Reducing Station	Water Utility
Panorama Pressure Reducing Station	Water Utility
Panorama Water Facilities	Water Utility
Revel/Hidden Acres Pressure Reducing Station	Water Utility
South Fitch Mountain Control Building	Water Utility
Sunset Reservoir	Water Utility
Tayman Park Water Facilities	Water Utility
Villa Pressure Reducing Station	Water Utility



Number	Critical Facility
1	Alliance Medical Center
2	Badger Electrical Substation
3	Boys and Girls Club
4	Cadoul Reservoir
5	Carnegie Library
6	Chablis Lift Station
7	Chamber of Commerce
8	City Hall
9	Corporation Yard
10	Dry Creek Well Field
11	Fire Station
12	Fitch Mountain Well Field
13	Gauntlett Communications Tower
14	Gauntlett Well Field
15	Gauntlett Well Field Control Station
16	Gauntlett/Fitch Water Treatment Plant
17	Gauntlett/Iverson Reservoirs
18	Healdsburg Community Center
19	Healdsburg District Hospital
20	Healdsburg Municipal Airport
21	Hendricks Lift Station
22	Heron Drive Lift Station
23	Kennedy Lift Station
24	Kinley Drive Lift Station
25	Library
26	McDonough Pump Station
27	Mountain View Lift Station
28	North Detention Basin
29	North Street Pressure Reducing Station
30	Orangewood Lift Station
31	Orchard Lift Station
32	Panorama Pressure Reducing Station
33	Panorama Water Facilities
34	Police Station
35	Rental Property/Victory Apartments
36	Revel/Hidden Acres Pressure Reducing Station
37	Senior Center
38	South Detention Basin
39	South Fitch Mountain Control Building
40	Sunset Reservoir
41	Tayman Park Water Facilities
42	Villa Annex
43	Villa Chanticleer
44	Villa Pressure Reducing Station
45	Wastewater Treatment Plant

Figure 5.1: City of Healdsburg Critical Facilities

(See Appendix C for a larger and higher resolution map)

Table 5-2: Exposure Analysis Results for Critical Facilities in Healdsburg

Map #	Critical Facility	Type	EQ: IX, Violent	EQ: X, Extreme	LQ: Mod	LQ: High	LQ: Very High	Flood: 1%	Flood: 0.2%	LS: Slight to Mod	LS: Mod to High	Wildfire: Mod	Wildfire: High
1	Alliance Medical Center	Health/Hospital	X		X							X	
2	Badger Electrical Substation	Electrical		X		X		X					
3	Boys and Girls Club	Community		X									
4	Cadoul Reservoir	Water Utility	X							X			X
5	Carnegie Library	Community		X									
6	Chablis Lift Station	Sewage Utility	X									X	
7	Chamber of Commerce	Community		X		X							
8	City Hall	Government		X		X							
9	Corporation Yard	Government		X			X					X	
10	Dry Creek Well Field	Water Utility		X			X					X	
11	Fire Station	Police/Fire		X	X								
12	Fitch Mountain Well Field	Water Utility		X		X		X					
13	Gauntlett Communications Tower	Police/Fire	X							X			X
14	Gauntlett Well Field	Water Utility		X				X			X		X
15	Gauntlett Well Field Control Station	Water Utility	X								X		X
16	Gauntlett/Fitch Water Treatment Plant	Water Utility	X							X			X
17	Gauntlett/Iverson Reservoirs	Water Utility	X							X			X
18	Healdsburg Community Center	Community	X		X							X	
19	Healdsburg District Hospital	Health/Hospital	X									X	
20	Healdsburg Municipal Airport	Airport	X									X	
21	Hendricks Lift Station	Sewage Utility		X		X							
22	Heron Drive Lift Station	Sewage Utility		X		X		X					
23	Kennedy Lift Station	Sewage Utility		X		X							
24	Kinley Drive Lift Station	Sewage Utility		X		X							
25	Library	Community		X									
26	Magnolia Drive Lift Station	Sewage Utility		X			X	X					

Table 5-2: Exposure Analysis Results for Critical Facilities in Healdsburg

Map #	Critical Facility	Type	EQ: IX, Violent	EQ: X, Extreme	LQ: Mod	LQ: High	LQ: Very High	Flood: 1%	Flood: 0.2%	LS: Slight to Mod	LS: Mod to High	Wildfire: Mod	Wildfire: High
27	McDonough Pump Station	Water Utility	X			X				X			X
28	North Detention Basin	Stormwater	X									X	
29	North Street Pressure Reducing Station	Water Utility		X		X							
30	Orangewood Lift Station	Sewage Utility		X		X			X				X
31	Orchard Lift Station	Sewage Utility		X		X		X					
32	Panorama Pressure Reducing Station	Water Utility	X							X			X
33	Panorama Water Facilities	Water Utility	X							X			X
34	Police Station	Police/Fire		X									
35	Rental Property/Victory Apartments	Community		X									
36	Revel/Hidden Acres Pressure Reducing Station	Water Utility	X								X		X
37	Senior Center	Community		X									
38	South Detention Basin	Stormwater		X				X					
39	South Fitch Mountain Control Building	Water Utility		X		X		X					
40	Sunset Reservoir	Water Utility	X							X			X
41	Tayman Park Water Facilities	Water Utility	X								X	X	
42	Villa Annex	Community	X								X	X	
43	Villa Chanticleer	Community	X								X		X
44	Villa Pressure Reducing Station	Water Utility	X								X	X	
45	Wastewater Treatment Plant	Sewage Utility		X		X							

EQ – Earthquake
LQ – Liquefaction
LS – Landslide
*Note: No critical facilities located in Alquist-Priolo Fault Rupture Zones or Very High Fire Hazard Zones

5.2 Hazard-Specific Vulnerability

The local hazard mitigation planning requirement to describe hazard impact and overall vulnerability is as follows:

Regulation Checklist – 44 CFR 201.6 Local Mitigation Plans
Element B: Hazard Identification and Risk Assessment
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))

This section summarizes the possible impacts and quantifies, where data permits, the city's vulnerability to each of the hazards identified in **Section 4.0**. **Tables 5-3** through **5-17** illustrate the total exposure analysis by hazard. The exposure analysis details the number and percentage of critical facilities, residential units, and population. For residential units, the total value and total square footage of exposed units is also included.

5.2.1 Drought

Drought should not be viewed as merely a physical phenomenon or natural event. Its impacts on society result from the interplay between a natural event (less precipitation than expected) and the demand humans place on the water supply.

Due to the lack of defined geographical boundaries, the vulnerability assessment for drought differs from other natural hazards discussed earlier. The impacts of drought can be categorized as economic, environmental, or social. The incidence of forest and range fires increases substantially during extended droughts, which in turn places humans and critical facilities at higher levels of risk.

Drought vulnerability is primarily measured by its potential impact to sectors of the city's economy and natural resources. Healdsburg is known as a wine and culinary epicenter. Fortunately, as discussed in a recent report to the City Council, Healdsburg's economy is relatively balanced and the city does not depend on tourism to support its economy (Eyler 2018). According to the report, "Over 57 percent of jobs are not related to wineries" (Holley 2018). While the city's economy may be impacted by the presence of a drought, the impact will not be as severe as assumptions based on conventional wisdom.

Potential impacts to the economy include the following:

- Decreased municipal and industrial water supply
- Loss of recreation/tourism

Drought may lead to significant direct costs, due to such factors as increased pumping because of lower groundwater levels, investment in infrastructure to compensate for reduced yields and developing alternative water sources. Social impacts mainly involve public safety, health, conflicts between water users, reduced quality of life, and inequities in the distribution of impacts and disaster relief.

5.2.2 Earthquake

Major impacts from earthquakes are primarily casualties and damage to infrastructure occurring from ground movement along a particular fault. The degree of infrastructure damage depends on the magnitude; focal depth; distance from fault; duration of shaking; type of surface deposits; presence of high groundwater; topography; and the design, type, and quality of infrastructure construction.

Healdsburg is not located within an Alquist-Priolo Earthquake Fault Zone. However, the city is in a seismically active region, and all of Healdsburg is at risk of one or more seismic hazards. All of Healdsburg, including all critical facilities, residential building units, and population, fall within areas with the potential for either a violent or extreme level of ground shaking. **Tables 5-3** through **5-5** illustrate the summary of impacts from an earthquake on the city.

Liquefaction is a secondary hazard that can occur from earthquakes. Liquefaction susceptibility is five categories: very low, low, moderate, high, and very high. For this exposure analysis, the focus was on the top three most vulnerable categories. **Tables 5-6** through **5-8** summarize impacts from liquefaction in the categories of moderate, high, and very high susceptibility on Healdsburg.

Earthquakes pose numerous risks to critical facilities and infrastructure. Risks, or the harm or losses, that are likely to result from exposure to earthquakes and liquefaction include:

- Fire from broken gas lines and power lines
- Flooding from broken dams
- Casualties (fatalities and injuries) from falling debris or secondary hazards
- Utility outages
- Economic losses for repair and replacement of critical facilities, roads, buildings, etc.
- Indirect economic losses, such as income lost during the downtime that results from damage to private property or public infrastructure
- Roads or railroads that are blocked or damaged can prevent access throughout the area and can isolate residents and emergency service providers needing to reach vulnerable populations or to make repairs

Table 5-3: Earthquake Exposure Analysis Summary – Critical Facilities

Category	Number: Violent Shaking	Percentage of Total	Number: Extreme Shaking	Percentage of Total
Airport	1	100.00%	0	0.00%
Community	3	33.33%	6	66.67%
Electrical	0	0.00%	1	100.00%
Government	0	0.00%	2	100.00%
Health/Hospital	2	100.00%	0	0.00%
Police/Fire	1	33.33%	2	66.67%
Sewage Utility	1	11.11%	8	88.89%
Stormwater	1	50.00%	1	50.00%
Water Utility	11	68.75%	5	31.25%
TOTAL	**20**	**44.44%**	**25**	**55.56%**

Table 5-4: Earthquake Exposure Analysis Summary – Residential Structures

Structure	Number	Percentage of Total	Total Value	Total Square Feet
Healdsburg				
IX, Violent Shaking				
Single-Family Dwellings	959	29.0%	$372,772,653	2,361,645
Planned Unit Development	125	50.8%	$27,652,905	194,927
Multi-Family Dwellings	21	7.2%	$54,678,786	62,471
Mixed Use	4	6.7%	$4,680,414	5,977
Other	103	17.2%	$40,797,735	172,986
TOTAL	**1,212**	**26.9%**	**$500,582,493**	**2,798,005**
X, Extreme Shaking				
Single-Family Dwellings	2345	71.0%	$619,709,680	4,724,882
Planned Unit Development	121	49.2%	$22,825,757	242,793
Multi-Family Dwellings	269	92.8%	$409,807,901	613,509
Mixed Use	56	93.3%	$74,412,832	205,372
Other	495	82.8%	$173,847,422	887,457
TOTAL	**3,286**	**73.1%**	**$1,300,603,592**	**6,674,013**
Unincorporated County within Healdsburg Urban Service Area				
IX, Violent Shaking				
Single-Family Dwellings	256	76.4%	$59,298,803	383,387
Multi-Family Dwellings	5	83.3%	$1,998,779	4,166
Other	41	83.7%	$18,992,092	66,562
TOTAL	**302**	**77.4%**	**$80,289,674**	**454,115**
X, Extreme Shaking				
Single-Family Dwellings	79	23.6%	$11,155,994	112,929
Multi-Family Dwellings	1	16.7%	$602,187	1,653
Other	8	16.3%	$1,708,319	9,557
TOTAL	**88**	**22.6%**	**$13,466,500**	**124,139**

Table 5-5: Earthquake Exposure Analysis Summary – Population

Jurisdiction	Number: IX, Violent Shaking	Percentage of Total	Number: X, Extreme Shaking	Percentage of Total
City of Healdsburg	2,199	21.5%	8,037	78.5%
Unincorporated County within Healdsburg Urban Service Area	769	97.8%	17	2.2%

Note: Estimates based on assumption of equal distribution of population across Census Block Groups

Table 5-6: Liquefaction Exposure Analysis Summary – Critical Facilities

Category	Number: Moderate	Percentage of Total	Number: High	Percentage of Total	Number: Very High	Percentage of Total
Airport	0	0.00%	0	0.00%	0	0.00%
Community	1	11.11%	1	11.11%	0	0.00%
Electrical	0	0.00%	1	100.00%	0	0.00%
Government	0	0.00%	1	50.00%	1	50.00%
Health/Hospital	1	50.00%	0	0.00%	0	0.00%
Police/Fire	1	33.33%	0	0.00%	0	0.00%
Sewage Utility	0	0.00%	7	77.78%	1	11.11%
Stormwater	0	0.00%	0	0.00%	0	0.00%
Water Utility	0	0.00%	4	25.00%	1	6.25%
TOTAL	**3**	**6.67%**	**14**	**31.11%**	**3**	**6.67**

Table 5-7: Liquefaction Exposure Analysis Summary – Residential Structures

Structure	Number	Percentage of Total	Total Value	Total Square Feet
Healdsburg				
Moderate				
Single-Family Dwellings	747	22.6%	$156,499,001	1,656,650
Planned Unit Development	5	2.0%	$873,695	8,121
Multi-Family Dwellings	61	21.0%	$85,572,079	141,598
Mixed Use	21	35.0%	$7,362,421	55,055
Other	72	12.0%	$23,551,094	126,767
TOTAL	**906**	**20.1%**	**$273,858,290**	**1,988,190***
High				
Single-Family Dwellings	456	13.8%	$89,858,475	969,745
Planned Unit Development	94	38.2%	$17,849,987	181,479
Multi-Family Dwellings	42	14.5%	$155,865,081	103,463
Mixed Use	18	30.0%	$7,696,953	49,196
Other	90	15.1%	$14,483,741	171,463
TOTAL	**700**	**15.6%**	**$285,754,237**	**1,475,346**
Unincorporated County within Healdsburg Urban Service Area				
Moderate				
Single-Family Dwellings	0	0.0%	$ -	0
Multi-Family Dwellings	0	0.0%	$ -	0
Other	0	0.0%	$ -	0
TOTAL	**0**	**0.0%**	**$ -**	**0**
High				
Single-Family Dwellings	0	0.0%	$ -	0
Multi-Family Dwellings	0	0.0%	$ -	0

Table 5-7: Liquefaction Exposure Analysis Summary – Residential Structures

Structure	Number	Percentage of Total	Total Value	Total Square Feet
Other	0	0.0%	$ -	0
TOTAL	**0**	**0.0%**	**$ -**	**0**

* Numbers may not add up due to rounding

Table 5-8: Liquefaction Exposure Analysis Summary – Population

Jurisdiction	Number: Moderate	Percentage of Total	Number: High	Percentage of Total	Number: Very High	Percentage of Total
City of Healdsburg	2,241	21.9%	1,474	14.4%	61	0.6%
Unincorporated County within Healdsburg Urban Service Area	0	0.0%	0	0.0%	0	0.0%

Note: Estimates based on assumption of equal distribution of population across Census Block Groups

5.2.3 Flooding

Flooding occurs on a semi-regular basis, both within the FEMA-identified floodplains and in other localized areas. For this exposure analysis, the flood zones from FEMA's Digital FIRM were used in coordination with City asset data. Per the exposure analysis, 20 percent of the city's critical facilities, about 8 percent of residential structures, and about 9 percent of the city's population are in a flood zone (residential structures and population from the unincorporated county within Healdsburg's Urban Service Area are also illustrated). **Tables 5-9** through **5-11** illustrate the summary of impacts from flooding on Healdsburg for two floodplains: the 1% annual chance and 0.2% annual chance.

Flooding poses numerous risks to critical facilities and infrastructure. Risks, or the harm or losses, that are likely to result from exposure to flooding include:

- Roads or railroads that are blocked or damaged can prevent access throughout the area and can isolate residents and emergency service providers needing to reach vulnerable populations or to make repairs
- Bridges washed out or blocked by floods or debris from floods can cause isolation
- Creek or river floodwaters can back up drainage systems, causing localized flooding
- Floodwaters can get into drinking water supplies, causing contamination
- Sewer systems can back up, causing waste to spill into homes, neighborhoods, rivers, and streams
- Underground utilities can be damaged

Table 5-9: Flood Exposure Analysis Summary – Critical Facilities

Category	Number: 1% Flood	Percentage of Total	Number: 0.2% Flood	Percentage of Total
Airport	0	0.00%	0	0.00%
Community	0	0.00%	0	0.00%
Electrical	1	100.00%	0	0.00%
Government	0	0.00%	0	0.00%
Health/Hospital	0	0.00%	0	0.00%
Police/Fire	0	0.00%	0	0.00%
Sewage Utility	3	33.33%	1	11.11%
Stormwater	1	50.00%	0	0.00%
Water Utility	3	18.75%	0	0.00%
TOTAL	**8**	**17.78%**	**1**	**2.22%**

Table 5-10: Flood Exposure Analysis Summary – Residential Structures

Structure	Number	Percentage of Total	Total Value	Total Square Feet
Healdsburg				
1% Annual Chance of Flood				
Single-Family Dwellings	11	0.3%	$2,372,473	27,403
Planned Unit Development	78	31.7%	$15,750,636	139,060
Multi-Family Dwellings	8	2.8%	$14,826,473	49,736
Mixed Use	0	0.0%	$ -	0
Other	0	0.0%	$ -	0
TOTAL	**97**	**2.2%**	**$32,949,582**	**216,199**
0.2% Annual Chance of Flood				
Single-Family Dwellings	252	7.6%	$46,571,682	559,938
Planned Unit Development	25	10.2%	$4,041,283	47,241
Multi-Family Dwellings	0	0.0%	$ -	0
Mixed Use	0	0.0%	$ -	0
Other	1	0.2%	$24,246	532
TOTAL	**278**	**6.2%**	**$50,637,211**	**607,711**
Unincorporated County within Healdsburg Urban Service Area				
1% Annual Chance of Flood				
Single-Family Dwellings	12	3.6%	$1,427,067	14,849
Multi-Family Dwellings	1	16.7%	$194,556	1,218
Other	2	4.1%	$194,461	2,525
TOTAL	**15**	**3.8%**	**$1,816,084**	**18,592**
0.2% Annual Chance of Flood				
Single-Family Dwellings	2	0.6%	$330,343	2,512
Multi-Family Dwellings	0	0.0%	$ -	0

Table 5-10: Flood Exposure Analysis Summary – Residential Structures

Structure	Number	Percentage of Total	Total Value	Total Square Feet
Other	0	0.0%	$ -	0
TOTAL	**2**	**0.5%**	**$330,343**	**2,512**

Table 5-11: Flood Exposure Analysis Summary – Population

Community Name	Number: 1% Flood	Percentage of Total	Number: 0.2% Flood	Percentage of Total
City of Healdsburg	473	4.6%	470	4.6%
Unincorporated County within Healdsburg Urban Service Area	5	0.7%	0	0.0%

Note: Estimates based on assumption of equal distribution of population across Census Block Groups

National Flood Insurance Program

The local hazard mitigation planning requirement to address NFIP structures and NFIP participation are as follows:

Regulation Checklist – 44 CFR 201.6 Local Mitigation Plans
Element B: Hazard Identification and Risk Assessment
B4. Does the plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))

Regulation Checklist – 44 CFR 201.6 Local Mitigation Plans
Element C: Mitigation Strategy
C2. Does the plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))

The NFIP, managed by FEMA, enables homeowners, business owners, and renters in participating communities to purchase federally backed flood insurance. Participating communities agree to adopt and enforce floodplain management ordinances to reduce future flood damage (Benefits.gov. 2018).

The City of Healdsburg has participated in the NFIP since 1980; the City's participation is illustrated in **Table 5-12**. The current effective map date is from 2008. Since then, the Healdsburg Public Works Department submitted an application for a Letter of Map Revision that modified the floodway for Foss Creek from where it crosses Grove Street to where it crosses US Highway 101; the revisions became effective in 2010.

Table 5-12: National Flood Insurance Participation Summary

City of Healdsburg		
Date Jointed/Initial FIRM Identified	March 4, 1980	
Current Effective Map Date	December 2, 2008	
Community Rating System	Not a Participant	
Repetitive Losses (RL)	**Number**	**Total Payout**
Number of RL Properties	10	$430,086.06
Number of Severe RL Properties	0	$0
NFIP Compliance		
• City continues to require all new development and substantial property improvement to comply with the City Municipal Code and FEMA regulations that regulate development in the designated 100-year floodplain and encourages buffer/setback area from waterways. • City implements the NFIP requirements pursuant to Chapter 17.28 of the Healdsburg Municipal Code.		

Note: Number of repetitive and severe repetitive loss properties is as of November 2017

Repetitive loss (RL) properties are insured properties that have incurred two or more flood losses greater than $1,000 within any 10-year period. A subset of these properties is designated severe repetitive loss (SRL) properties; these are insured properties that have incurred four or more flood-related losses of at least $5,000 each, or at least two separate claims with the cumulative amount of the building payments exceeding the value of the structures on the property. At least two claims under each of these scenarios must have occurred within any 10-year period. As illustrated above, Healdsburg has RL properties, but no SRL properties.

5.2.4 Landslide

The landslide risk in Healdsburg is largely in the more hilly northern and eastern parts of the community. Because of Healdsburg's topography, landslides will most likely occur during periods of heavy rain. Landslide hazard zones have been divided into three categories: A, B, and C. Category A is the Most Stable Zone, B is the Marginally Stable Zone, and C is the Least Stable Zone. For this exposure analysis, the top two categories were the focus. Per the analysis, about 30 percent of the city's critical facilities, 25 percent of residential structures, and 17 percent of the population are in a slight to high landslide zone (residential structures and population from the unincorporated county within Healdsburg's Urban Service Area are also illustrated). **Tables 5-13** through **5-15** summarize the impacts from landslide in the categories of marginally and least stable zones in Healdsburg.

Landslide poses numerous risks to critical facilities and infrastructure. Risks, or the harm or losses, that are likely to result from exposure to landslide include:

- Blocked and/or damaged roads
- Casualties (fatalities and injuries)
- Damage to utility distribution lines
- Economic losses for repair and replacement of critical facilities, roads, buildings, etc.

- Damaged vegetation (debris flows often uproot trees and wipe out vegetation in their path)
- Impacts to river ecosystems (soil, debris, and rocks sliding downhill can end up in rivers and affect their natural flow)

Table 5-13: Landslide Exposure Analysis Summary – Critical Facilities

Category	Number: Slight to Moderate	Percentage of Total	Number: Moderate to High	Percentage of Total
Airport	0	0.00%	0	0.00%
Community	0	0.00%	2	22.22%
Electrical	0	0.00%	0	0.00%
Government	0	0.00%	0	0.00%
Health/Hospital	0	0.00%	0	0.00%
Police/Fire	1	33.33%	0	0.00%
Sewage Utility	0	0.00%	0	0.00%
Stormwater	0	0.00%	0	0.00%
Water Utility	7	43.75%	5	31.25%
TOTAL	**8**	**17.78%**	**7**	**15.56%**

Table 5-14: Landslide Exposure Analysis Summary – Residential Structures

Structure	Number	Percentage of Total	Total Value	Total Square Feet
Healdsburg				
Slight to Moderate				
Single-Family Dwellings	538	16.3%	$220,003,726	1,386,871
Planned Unit Development	55	22.4%	$13,291,303	91,503
Multi-Family Dwellings	10	3.4%	$45,443,800	37,986
Mixed Use	0	0.0%	$ -	0
Other	87	14.5%	$31,501,407	136,828
TOTAL	**690**	**15.3%**	**$310,240,236**	**1,653,187***
Moderate to High				
Single-Family Dwellings	129	3.9%	$57,575,384	333,694
Planned Unit Development	0	0.0%	$ -	0
Multi-Family Dwellings	0	0.0%	$ -	0
Mixed Use	0	0.0%	$ -	0
Other	3	0.5%	$2,271,086	9,421
TOTAL	**132**	**2.9%**	**$59,846,470**	**343,115**
Unincorporated County within Healdsburg Urban Service Area				
Slight to Moderate				
Single-Family Dwellings	8	2.4%	$2,379,092	14,605
Multi-Family Dwellings	0	0.0%	$ -	0
Other	4	8.2%	$4,546,297	16,269

Table 5-14: Landslide Exposure Analysis Summary – Residential Structures

Structure	Number	Percentage of Total	Total Value	Total Square Feet
TOTAL	**12**	**3.1%**	**$ 6,925,389**	**30,875***
Moderate to High				
Single-Family Dwellings	66	19.7%	$20,808,409	132,818
Multi-Family Dwellings	0	0.0%	$ -	0
Other	9	18.4%	$8,718,493	17,278
TOTAL	**75**	**19.2%**	**$29,526,902**	**150,096**

* Numbers may not add up due to rounding

Table 5-15: Landslide Exposure Analysis Summary – Population

Jurisdiction	Number: Slight to Moderate	Percentage of Total	Number: Moderate to High	Percentage of Total
City of Healdsburg	1,419	13.9%	296	2.9%
Unincorporated County within Healdsburg Urban Service Area	594	75.6%	130	16.6%

Note: Estimates based on assumption of equal distribution of population across Census Block Groups

5.2.5 Wildfire

Risk to residents and property from wildfire is of significant concern. Wildfire danger is a major threat across the forested, fuel-rich area. High fuel loads in the wooded areas, along with geographical and topographical features, create the potential for both natural- and human-caused fires that can result in loss of life and property damage. These factors, combined with natural weather conditions common to the area, including periods of drought, low relative humidity, and significant winds, can result in frequent and sometimes catastrophic fires. Any fire, once ignited, has the potential to quickly become large and out of control.

Wildfire severity is categorized into three zones: moderate, high, and very high. Healdsburg has no areas located in the very high severity zone; therefore, this exposure analysis focuses on the moderate and high FHSZs. Per the analysis, over 50 percent of the city's critical facilities, about 30 percent of residential structures, and almost 25 percent of the population are in a wildfire severity zone (residential structures and population from the unincorporated county within Healdsburg's Urban Service Area are also illustrated). **Tables 5-16** through **5-18** summarize the impacts from wildfire in Healdsburg.

Wildfire poses numerous risks to critical facilities and infrastructure. Risks, or the harm or losses, that are likely to result from exposure to wildfire include:

- Casualties (fatalities and injuries)
- Utility outages
- Economic losses for repair and replacement of critical facilities, roads, buildings, etc.

- Indirect economic losses, such as income lost during the downtime that results from damage to private property or public infrastructure
- Loss of natural and cultural resources
- Smoke and air pollution
- Creation of more favorable conditions for other hazards such as flooding, landslides, and erosion during the subsequent rainy season

Table 5-16: Wildfire Vulnerability Summary – Critical Facilities

Category	Number: Moderate	Percentage of Total	Number: High	Percentage of Total
Airport	1	100.00%	0	0.00%
Community	2	22.22%	1	11.11%
Electrical	0	0.00%	0	0.00%
Government	1	50.00%	0	0.00%
Health/Hospital	2	100.00%	0	0.00%
Police/Fire	0	0.00%	1	33.33%
Sewage Utility	1	11.11%	1	11.11%
Stormwater	1	50.00%	0	0.00%
Water Utility	3	18.75%	10	62.50%
TOTAL	**11**	**24.44%**	**13**	**28.89%**

Note: No critical facilities are located in the Very High FHSZ.

Table 5-17: Wildfire Vulnerability Summary – Residential Structures

Structure	Number	Percentage of Total	Total Value	Total Square Feet
Healdsburg				
Moderate				
Single-Family Dwellings	422	12.8%	$123,910,712	975,314
Planned Unit Development	13	5.3%	$1,857,761	21,151
Multi-Family Dwellings	13	4.5%	$17,880,785	30,023
Mixed Use	0	0.0%	$ -	0
Other	47	7.9%	$17,199,652	77,460
TOTAL	**495**	**11.0%**	**$160,848,910**	**1,103,948**
High				
Single-Family Dwellings	702	21.2%	$244,644,001	1,716,866
Planned Unit Development	116	47.2%	$26,656,166	181,189
Multi-Family Dwellings	10	3.4%	$4,544,380	37,986
Mixed Use	0	0.0%	$ -	0
Other	60	10.0%	$12,788,863	93,396
TOTAL	**888**	**19.7%**	**$288,633,410**	**2,029,436**

Table 5-17: Wildfire Vulnerability Summary – Residential Structures

Structure	Number	Percentage of Total	Total Value	Total Square Feet
Unincorporated County within Healdsburg Urban Service Area				
Moderate				
Single-Family Dwellings	1	0.3%	$514,080	1,247
Multi-Family Dwellings	0	0.0%	$ -	0
Other	0	0.0%	$ -	0
TOTAL	**1**	**0.3%**	**$514,080**	**1,247**
High				
Single-Family Dwellings	334	99.7%	$57,523,620	495,069
Multi-Family Dwellings	6	100.0%	$1,300,483	5,818
Other	49	100.0%	$12,323,578	76,120
TOTAL	**389**	**99.7%**	**$71,147,681**	**577,007**

Table 5-18: Wildfire Vulnerability Summary – Population

Jurisdiction	Number: Moderate	Percentage of Total	Number: to High	Percentage of Total
City of Healdsburg	1,042	10.2%	1,303	12.7%
Unincorporated County within Healdsburg Urban Service Area	62	7.8%	716	91.0%

Note: Estimates based on assumption of equal distribution of population across Census Block Groups

Section 6. Capability Assessment

The local hazard mitigation planning requirement to document existing capabilities is as follows:

Regulation Checklist – 44 CFR 201.6 Local Mitigation Plans
Element C. Mitigation Strategy
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))

The capability assessment identifies and evaluates the legal and regulatory, human and technical, and financial resources available to accomplish mitigation. Completing the capability assessment is a helpful exercise to clearly illustrate the capabilities that currently exist, which helps to assess and prioritize potential mitigation actions. Mitigation actions should push to expand on a community's resiliency, but the actions need to be grounded in something achievable; the capability assessment is necessary to evaluate the feasibility of proposed mitigation actions based on local capabilities. Conducting the capability assessment will also help identify gaps in capabilities and resources and will provide an opportunity to start discussing how current capabilities can be improved and expanded.

6.1 Regulatory Mitigation Capabilities

The City of Healdsburg has several plans and programs in place that guide the City's mitigation of development in hazard-prone areas. **Table 6-1** lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in Healdsburg.

Table 6-1: Legal/Regulatory Capabilities

Legal/Regulatory Tool (Ordinances, Codes, Plans)	Yes/No	Comments
General Plan	Yes	Addressed hazards and affects development in hazard areas.
Comprehensive/Master Plan	No	
Capital Improvements Plan	Yes	Addressed hazards and affects development in hazard areas.
Zoning Ordinance	Yes	Addressed hazards and affects development in hazard areas.
Subdivision Ordinance	Yes	Addressed hazards and affects development in hazard areas.
Floodplain Ordinance	Yes	Addressed hazards and affects development in hazard areas.
Growth Management Ordinance	Yes	
Building Code	Yes	Version: CBC 2016 Addressed hazards and affects development in hazard areas.

Table 6-1: Legal/Regulatory Capabilities

Legal/Regulatory Tool (Ordinances, Codes, Plans)	Yes/No	Comments
Fire Department ISO Rating	Yes	Rating: 2 (due for evaluation)
Erosion or Sediment Control Program	Yes	Addressed hazards and affects development in hazard areas.
Transportation Plan	Yes	
Community Wildfire Protection Plan (CWPP)	No	The County has a CWPP, and Fitch Mountain is working on a CWPP.
Storm Water Management Program	Yes	Addressed hazards and affects development in hazard areas.
Site Plan Review Requirements	Yes	Addressed hazards and affects development in hazard areas.
Capital Improvements Plan	Yes	Addressed hazards and affects development in hazard areas.
Economic Development Plan	No	
Local Emergency Operation Plan	Yes	Adopted in 2007.
Flood Insurance Study or other engineering study for streams	Yes	Addressed hazards and affects development in hazard areas.
Elevation Certificates	Yes	Addressed hazards and affects development in hazard areas.
Fitch Mountain Management Plan	Yes	November 2017, annually update with fire risk projects/abatement plans.
Vegetation Management Ordinance	Yes	Done annually by resolution. Documents from fire department, follows Government Code.
Are there gaps in your capabilities/resources? How can your legal/regulatory capabilities be expanded and improved to further reduce risk?		
• There should be a Fire Resource and Assessment Program (FRAP) for the Healdsburg Ridge Open Space Preserve. The ridge borders city residential areas. • Develop an economic development plan. Assessment done in 2006. • No CWPP for City of Healdsburg (Fitch Mountain is working on CWPP).		

6.2 Human/Technical Capabilities

Table 6-2 identifies the City personnel responsible for or who have skills for activities related to mitigation.

Table 6-2: Human/Technical Capabilities

Human/Technical Resources	Yes/No	Department/Position & Comments
Planning Commission	Yes	
Mitigation Planning Committee	Yes	Framework for LHMP Planning Team to continue meeting on regular basis will be outlined in plan maintenance section
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Yes	Parks, Public Works, California Conservation Corps: tree maintenance, stormwater inlet cleaning (understaffed), Foss Creek cleaning

Table 6-2: Human/Technical Capabilities

Human/Technical Resources	Yes/No	Department/Position & Comments
Mutual aid agreements	Yes	With communities around Healdsburg, with their public works departments
Hazard data and information	Yes	Planning and Building, Public Works, IT
Grant writing	Yes	Fire, Public Works Within Public Works, have staff with the ability, but not staff dedicated to grant writing
HAZUS analysis	No	
Planner/Engineer with knowledge of land development/land management practices	Yes	Planning and Building
Engineer/Professional trained in construction practices related to building and/or infrastructure	Yes	Planning and Building
Planner/Engineer/Scientist with an understanding of natural hazards	Yes	Planning and Building
Personnel skilled in GIS	Yes	Planning and Building, Public Works, IT
Full-time building official	Yes	Planning and Building
Floodplain Manager	Yes	Public Works
Emergency Manager	Yes	Fire
Public Information Officer	Yes	City Manager's Office, as well as Public Safety Officials
GIS Data (hazard areas, critical facilities, building footprints, land use, links to assessor's data)	Yes	Planning and Building
Warning Systems/Services (Reverse 911, cable override, outdoor warning signals)	Yes	Nixle, subscription based Access to wireless alert system (limited)
Fire Marshal	Yes	Fire Department
Predevelopment Meetings	Yes	Twice weekly meetings for new development on any scale, with all departments that will be reviewing plans in attendance

Table 6-2: Human/Technical Capabilities

Human/Technical Resources	Yes/No	Department/Position & Comments
Are there gaps in your capabilities/resources? How can your human/technical capabilities be expanded and improved to further reduce risk?		
• Staff member to focus on grant writing and management. Currently handled by people in various departments as needed, subject-driven. Lots of opportunities passed up because they don't have time and ability to apply and manage. • Flood modeling for Foss Creek, which is primary source of flood threat within the city. Gauge in place but monitoring may need enhancement. Currently practice is for staff to walk to bridge and visually monitor. • Train or hire a staff member with knowledge of HAZUS. • Desire for another fire inspector, firefighter, division chief. • Hire back a utility conservation analyst. • Recent additions: – Public Works is hiring a new inspector. Currently in selection process. – Building Department has increased from equivalent of 1.5 inspectors to 3.		

6.3 Fiscal Capabilities

This section identifies the financial tools or resources that the City could potentially use to help fund mitigation activities. These include City-specific capabilities (**Table 6-3**), as well as state and federal resources (**Table 6-4**). It is important to note that funding can also be sourced from participating agencies/organizations that collaborate with the County in the implementation of mitigation actions.

Table 6-3: Financial Capabilities

Financial Resources	Accessible/ Eligible to Use (Y/N)	Purpose and Comments
Capital improvements project funding	Yes	
Authority to levy taxes for specific purposes	Yes	Subject to Prop 218
Fees for water, sewer, gas, or electric services	Yes	
Impact fees for new development	Yes	Includes fire impact fees
Stormwater utility fee	Yes	Really minimal, subject to new state law classifying stormwater as Utility for Prop 218 purposes
Incur debt through general obligation bonds	Yes	Currently paying off bonds (and good credit rating)
Incur debt through special tax bonds	Yes	
Other federal funding programs	Yes	
State funding programs	Yes	
Are there gaps in your capabilities/resources? How can your fiscal capabilities be expanded and improved to further reduce risk?		
• Unless it's an emergency situation, new expenditures require approval from City Council.		

6.3.1 State and Federal Funding Resources

Table 6-4 lists potential funding programs and resources provided by state and federal agencies/programs the City can tap into for hazard mitigation activities. Please note that the information listed below is not exhaustive.

Table 6-4: Potential Funding Programs/Grants from State and Federal Agencies

Agency	Potential Programs/Grants
Department of Homeland Security – Federal Emergency Management Agency	• Homeland Security Grant Program (HSGP) • Emergency Management Performance Grants (EMPG) Program • Transit Security Grant Program • Assistance to Firefighters Grant (AFG) Program • HMGP (gain eligibility by having a FEMA-approved HMP) • PDM Grant Program (gain eligibility by having a FEMA-approved HMP) • Flood Mitigation Assistance (FMA) Program (gain eligibility by having a FEMA-approved HMP)
US Department of Housing and Urban Development	Community Development Block Grant (CDBG) Program
US Department of the Interior	• Coastal Impact Assistance Program • USGS Research and Data Collection • WaterSMART Grants
US Department of Defense – US Air Force	Training Requirements Funding
US Department of Health and Human Services	Grants for Public Health Emergency Preparedness
US Department of Commerce	Coastal Resilience Networks
California Governor's Office of Emergency Services	• Regional Catastrophic Preparedness Grant Program • Interoperable Emergency Communications Center Grant Program • Proposition 1B Grant • Citizens Corps Program • Metropolitan Medical Response System Program • Earthquake and Tsunami Grants Program
California Department of Housing and Community Development	Disaster Recovery Initiative (DRI)
California Department of Forestry and Fire Protection	Western States WUI Fire Assistance Grant
California Department of Water Resources	Integrated Regional Water Management (IRWM) Grant Programs
State Water Resources Control Board	Storm Water Grant Program (SWGP) – Proposition 1
California Coastal Conservancy	Proposition 1 Grants
California Department of Fish and Wildlife	Watershed Restoration Grant Program

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Section 7. Mitigation Strategy

The intent of the mitigation strategy is to provide the City of Healdsburg with the tools that will serve as guiding principles for future hazard mitigation policy and project administration. The development of the mitigation strategy includes the creation of a mitigation action plan, which involves a prioritization process for selected mitigation actions. The mitigation action plan represents the key outcomes of the LHMP planning process.

7.1 Hazard Mitigation Goals

The local hazard mitigation planning requirement to establish goals is as follows:

Regulation Checklist – 44 CFR 201.6 Local Mitigation Plans
Element C: Mitigation Strategy
C3. Does the plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))

Goals are broad policy statements representing the City's desire for long-term hazard mitigation results. The LHMP Planning Team first looked at the goal in the current LHMP, which is a general goal that addresses all hazards covered in the plan. The group considered developing more goals and having hazard-specific goals, but the LHMP Planning Team determined that the preference was a single general goal. The Planning Team also noted that the goal from the current LHMP does not contradict the Guiding Principles in the current General Plan.

The LHMP Planning Team decided to keep the mitigation goal from the current plan with one minor change; the reference to "region" was changed to "community."

To maintain and enhance a disaster-resistant community by reducing the potential for loss of life, property damage, and environmental degradation from natural disasters, while accelerating economic recovery from those disasters.

7.2 Review of the 2011 Mitigation Action Plan

The local hazard mitigation planning requirement for reviewing the previous LHMP's mitigation action plan is as follows:

Regulation Checklist – 44 CFR 201.6 Local Mitigation Plans
Element D: Plan Review, Evaluation, and Implementation
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))

During the 2018 LHMP planning process, the 2011 mitigation action plan was reviewed to determine which mitigation actions had been completed, deleted, deferred, or are ongoing. Mitigation actions are activities, measures, and/or projects that help achieve the goals of a mitigation plan. The results of this review, shown in **Table 7-1**, illustrate the progress in the City's local mitigation efforts over the five-year

period, under the guidance of the 2011 LHMP. Recent mitigation activities that were not specifically called out in the 2011 LHMP have also been included in the table to create a more comprehensive list of the City's mitigation efforts.

Table 7-1: Status of 2011 LHMP Mitigation Actions and Other Recent Mitigation

Status (Current, Ongoing, Completed, or No Action)	Project/Program Name	Description	Responsible Agency	Year(s)
Completed and Current (program has been initiated, but is ongoing)	Equip water mains crossing fault lines for emergency connection	Include "areas subject to high ground shaking, earthquake-induced ground failure, and surface fault rupture" in the list of criteria used for determining a replacement schedule for pipelines. Where active faults are found based on geologic investigations, public water mains will include additional valves and fire hydrants placed on each side of the fault, which in the event of pipeline rupture will allow the rupture to be isolated limiting water loss and damage. Temporary water lines can then be run overland to "shunt" water between fire hydrants and thereby maintain service for domestic water and fire protection. Design of sewer mains will include a manhole on each side of the fault, which in the event of pipeline rupture, would allow the pipelines nearest to the break to be plugged from inside the manholes and prevent or minimize the spread of environment damage, and also allow installing a temporary "bypass" between these manholes using portable pumps so that sewer service can continue during the emergency.	Public Works Department	Start date unknown, from at least 2009–Ongoing
Complete (federally funded, addressed seismic retrofitting)	Retrofit or replace critical lifeline infrastructure. Healdsburg Bridge seismic retrofits	The City is currently in the process of rehabilitating the 90-year-old Healdsburg Avenue Bridge over the Russian River. This rehabilitation will include protection against scour resulting from high flood flows and seismic activities. In addition to mitigation of these hazards, the functioning of the bridge is critical for evacuation in case of severe flooding, dam failure, or any disaster that might close US Highway 101 over the Russian River.	Public Works Department	2014–15

Table 7-1: Status of 2011 LHMP Mitigation Actions and Other Recent Mitigation

Status (Current, Ongoing, Completed, or No Action)	Project/Program Name	Description	Responsible Agency	Year(s)
No Action (City does not have ability to enforce, but access to information has improved. More information available on website since 2011, but no active outreach to real estate agents)	Work more effectively with real estate agents regarding hazard disclosures	Assist in ensuring adequate hazard disclosure by working with real estate agents to improve enforcement of real estate disclosure requirements for residential properties with regard to seven official natural hazard zones: (1) Special Flood Hazard Areas (designated by FEMA), (2) Areas of Potential Flooding from dam failure inundation, (3) Very High Fire Hazard Severity Zones, (4) Wildland Fire Zones, (5) Earthquake Fault Zones (designated under the Alquist-Priolo Earthquake Fault Zoning Act), and the (6) Liquefaction and (7) Landslide Hazard Zones (designated under the Seismic Hazard Mapping Act).	Planning and Building Department	N/A
No Action	Develop, adopt, and enforce a repair and reconstruction ordinance	Develop and enforce a repair and reconstruction ordinance to ensure that damaged buildings are repaired in an appropriate and timely manner and retrofitted concurrently. This repair and reconstruction ordinance should apply to all public and private buildings, and also apply to repair of all damage, regardless of cause. See http://quake.abag.ca.gov/ recovery/inforepair-ord.html.	Planning and Building Department	N/A
Unknown	Develop a plan for short-term and intermediate-term sheltering of your employees	Maintain cots, food, and water at the Fire Station.	Fire Department (with assistance from Police Department)	N/A
Unknown	Encourage health care facilities to develop disaster mitigation plans	Encourage ancillary facilities, medical offices, pharmacies, free or specialty clinics, etc. facility operators to develop disaster mitigation plans.	Fire Department	N/A
Completed	North Detention Basin	Detention basin with 75 acre-foot capacity in the north area, sized to accommodate anticipated development in the Foss Creek watershed portion of the City's north Planning Area. The detention basin accepts increases in storm runoff from development and detains the peak storm flows, thereby reducing downstream flooding.	Department of Public Utilities	Prior to 1997

Table 7-1: Status of 2011 LHMP Mitigation Actions and Other Recent Mitigation

Status (Current, Ongoing, Completed, or No Action)	Project/Program Name	Description	Responsible Agency	Year(s)
Current	Construction of a Healdsburg Fire Department substation	This new substation will be an alternate station should the main station be impacted by flooding. Regarding the area of geology and soils, the environmental impact report for the project identified five mitigation measures to be implemented during the construction process.	Planning and Building Department	2007–current
Completed and Current (program has been initiated, but is ongoing)	Lawn Conversion program – cash for grass	Lawns that are removed and replaced and maintained with low-water-use plantings, permeable landscape surfaces (mulch, decorated rock, stone pavers, or similar), gardens, trees, shrubs, and/or decorative outdoor landscape elements are eligible for a one-time cash rebate.	Department of Public Utilities	2014–ongoing
Completed and Current (program has been initiated, but is ongoing)	Energy efficiency rebates	Energy efficiency rebates for items such as: • Heat pumps • Air conditioners and evaporative coolers • Duct sealing and weatherization • AC and heat pump tune-ups • Replacement of appliances: electric water heater, dishwasher, and clothes washer	Department of Public Utilities	2014–ongoing
Completed and Current (program has been initiated, but is ongoing)	Water conservation workshops	The City has offered a variety of water conservation workshops, such as: • Welcome to Greywater 101 • 2010 Urban Water Management Plan • Home-scale Greywater • Inspect and Evaluate Your Irrigation System • State Mandated Water Restrictions and You • Basics of Drought Tolerant Landscaping • Setting a Landscape Water Budget • Practical Solutions to Create a Water-Wise Home Series: – Water Conservation 101 – Indoor Solutions – Harvest the Rain and Slow the Flow	Department of Public Utilities	2015–ongoing

Table 7-1: Status of 2011 LHMP Mitigation Actions and Other Recent Mitigation

Status (Current, Ongoing, Completed, or No Action)	Project/Program Name	Description	Responsible Agency	Year(s)
Completed and Current (program has been initiated, but is ongoing)	Free water-saving items	Free water-saving items: • 1.5 gallons per minute (gpm) dual spray swivel kitchen sink aerator • 1.0 gpm bubble spray bathroom aerator • 1.0 gpm bubble spray bathroom aerator with one-touch on/off • 1.5 gpm chrome showerhead • Soap and soak shower valves • Toilet leak detection dye tablets • Toilet tank displacement bag • Educational water-saving wheel • Educational energy- and water-saving activity booklet for kids	Department of Public Utilities	2014–ongoing
Completed and Current (program has been initiated, but is ongoing)	Free energy audits	City offers free energy audits to residential and commercial electric customers.	Department of Public Utilities	Start date unknown–Ongoing
Completed and Current (program has been initiated, but is ongoing)	Weed Abatement & Chipper Program	The Fire Department conducts annual inspections. Residents are asked to abate high weeds, trim up limbs at least 6 feet off the ground, and remove ladder fuels. The City also has a chipper program, which offers three hours of free chipper service to City residents.	Fire Department	Ongoing
Current	Russian River Watershed Association Storm Water Resource Plan (SWRP)	An active participant in the development of the SWRP, one of 11 local entities represented. The main goals of the SWRP are to identify and prioritize stormwater and dry weather runoff capture projects and other multi-benefit projects that advance stormwater goals in the Russian River watershed. (Healdsburg submitted 17 projects during the planning process, 13 projects made the list of prioritized projects (51 total "prioritized" projects), including 12 of Top 20 ranked projects.)	Public Works Department	2017–18

7.3 2018 Mitigation Actions

With the results of the hazard risk assessment finalized, the mitigation goal established, and capabilities assessed, the City then set out to identify mitigation actions that would reduce the impacts of the focused natural hazards.

FEMA identifies four categories of mitigation actions. Understanding these categories helps communities to realize the full breadth of mitigation and develop a comprehensive mitigation strategy. FEMA's four hazard mitigation categories are described below.

- **Local Plans and Regulations:** Government administrative or regulatory actions (authorities, policies, or codes) or processes that influence the way land and buildings are developed and built.
- **Structure and Infrastructure Projects:** Actions that involve modifying or removing existing buildings or infrastructure to protect them from a hazard. Mitigation projects intended to lessen the impact of a hazard by using structures to modify the environment.
- **Natural Systems Protection:** Actions that, in addition to minimizing hazard damage/losses, also preserve or restore the functions of natural systems.
- **Education and Awareness Programs:** Actions to inform and educate citizens, elected/public officials, and property owners about potential risks from hazards and potential ways to mitigate them.

7.3.1 Identification and Prioritization of Mitigation Actions

The local hazard mitigation planning requirements to develop a mitigation action plan, and the requirement to revise the plan based upon current priorities are as follows:

Regulation Checklist – 44 CFR 201.6 Local Mitigation Plans
Element C: Mitigation Strategy
C4. Does the plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))
C5. Does the plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))

Regulation Checklist – 44 CFR 201.6 Local Mitigation Plans
Element D: Plan Review, Evaluation, and Implementation
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))

The project consultants worked with the LHMP Planning Team to review and assess existing plans and studies.

Development of the mitigation action plan occurred in three general steps:

1. Establish a list of potential mitigation actions.
2. Discuss the pros and cons of each potential mitigation action.
3. Identify the priority mitigation actions and provide additional details for each.

The LHMP Planning Team began the process of developing the mitigation action plan by identifying a list of potential mitigation actions. Potential actions are actions that are feasible and will benefit the City, but may not be priority actions for the five-year planning period.

As shown in **Table 7-2**, for each potential mitigation action, the following information is listed: description, hazard(s) addressed, mitigation category, and type of development affected by the action.

Table 7-2: Potential Mitigation Actions

No.	Description	Hazard	Mitigation Category	New or Existing Construction Affected?
1	Integrate the hazard analysis and mitigation strategy into the General Plan's Safety Element.	All	Local Plans and Regulations	Not Applicable
2	Have a booth at the annual Safety Fair to provide outreach and education about what residents can do in their own homes. Coordinate this effort with social media outreach.	All	Education and Awareness	Existing Construction
3	Make energy efficiency a priority through building code improvements, retrofitting City facilities with energy-efficient lighting, and urging employees to conserve energy and save money.	Climate Change	Local Plans and Regulations	Existing Construction
4	Restore and protect the ability of natural ecosystems to capture and store carbon.	Climate Change	Natural Systems Protection	New and Existing Construction
5	Develop a water conservation outreach program that focuses on recycled water.	Drought	Education and Awareness	Not Applicable
6	Install earthquake sensors that can automatically open vehicle bay doors at Police and Fire stations.	Earthquake	Structure and Infrastructure	Not Applicable
7	Seismically retrofit or upgrade seismically deficient government facilities and pre-identified shelter facilities.	Earthquake	Structure and Infrastructure	Existing Construction
8	Develop and implement plans to increase building owners' general knowledge of and appreciation for the value of seismic upgrading of their buildings' structural and nonstructural elements.	Earthquake	Local Plans and Regulations, Education and Awareness	Existing Construction
9	Develop an outreach program to talk to the public about earthquake risk and mitigation activities that can be completed in homes, schools, and businesses.	Earthquake	Education and Awareness	Existing Construction
10	Remove storm drains from backyards and relocate to streets. This is also an opportunity to increase stormwater capacity; ensure that relocation of storm drains also increases overall capacity.	Flooding	Structure and Infrastructure	Existing Construction
11	Reinforce roads/bridges from flooding through protection activities, including elevating the roads/bridges and installing/widening culverts beneath the roads/bridges or upgrading storm drains.	Flooding	Structure and Infrastructure	Existing Construction

Table 7-2: Potential Mitigation Actions

No.	Description	Hazard	Mitigation Category	New or Existing Construction Affected?
12	Acquire, relocate, or elevate residential structures, in particular those that have been identified as Repetitive Loss properties, within the 100-year floodplain.	Flooding	Structure and Infrastructure	Existing Construction
13	Acquire, relocate, or elevate critical facilities within the 100-year floodplain (such as the Fire Station).	Flooding	Structure and Infrastructure	Existing Construction
14	Encourage the use of Low Impact Development (LID) Best Management Practices (BMPs) to reduce stormwater runoff and increase groundwater recharge.	Flooding	Structure and Infrastructure, Natural Systems Protection	New and Existing Construction
15	Develop a Healdsburg-specific outreach strategy to utilize the materials being developed through the Russian River Watershed Association as part of the Storm Water Resource Plan (SWRP) currently in development.	Flooding	Education and Awareness	Not Applicable
16	Raise utilities or other mechanical devices above expected flood levels.	Flooding	Structure and Infrastructure	Existing Construction
17	Establish standards for all utilities regarding tree pruning around lines.	High Winds	Local Plans and Regulations	Not Applicable
18	Underground power lines whenever they are relocated, such as during efforts to move power lines that travel through back yards.	High Winds	Structure and Infrastructure	Existing Construction
19	Implement landslide stabilization and/or protection measures into the North Fitch Mountain Slide Repair. Stabilization measures include grading the unstable portion of the slope to a lower gradient, construction of rock buttresses and retaining walls, and drainage improvements. Protection measures include containment and/or diversion of the moving debris, such as walls, berms, ditches, and catchment basins.	Landslide	Structure and Infrastructure, Natural Systems Protection	New and Existing Construction
20	Implement post-fire debris flow hillslope and channel treatments, such as seeding, mulching, check dams, and debris racks, as needed.	Post-Fire Debris Flow	Natural Systems Protection	New and Existing Construction

Table 7-2: Potential Mitigation Actions

No.	Description	Hazard	Mitigation Category	New or Existing Construction Affected?
21	Encourage the use of non-combustible materials (e.g., stone, brick, and stucco) in new construction and the use of fire-resistant roofing and materials in remodels, upgrades, and new construction.	Wildfire	Local Plans and Regulations	New and Existing Construction
22	Implement an outreach program that educates residents on mitigation actions they can take at their homes such as removing dead or dry leaves and combustibles from roofs, decks, eaves, porches, and yards; and creating a defensible spaces or buffer zones around their houses.	Wildfire	Education and Awareness	Existing Construction
23	Install a storage tank for the Sunset pressure zone to increase the capacity and flow for fighting fires in this vulnerable area.	Wildfire	Structure and Infrastructure	New and Existing Construction
24	When replacing water lines, put in laterals for sprinklers to residential buildings (already included for commercial, industrial, and new construction, but not for existing residential buildings).	Wildfire	Structure and Infrastructure	Existing Construction
25	Implement storm water runoff reduction projects to reduce the impacts of flooding.	Flooding	Structure and Infrastructure	New and Existing Construction

After the list of potential mitigation actions was developed, the LHMP Planning Team was asked to consider the pros and cons of each action. Then, through a group discussion, the list of actions was narrowed down to a set of priority mitigation actions. While considering the pros and cons of the actions and during the priority action discussion, the group was asked to consider the following questions:

- **Does the action:** Solve the problem? Address multiple hazards? Offer benefits that equal or exceed costs (is there a cost benefit)? Implement a goal, policy, or project identified in the General Plan or Capital Improvement Plan?
- **Can the action:** Be implemented with existing funds? Be implemented by existing state or federal grant programs? Be completed within the five-year life cycle of the HMP?
- **Will the action:** Be implemented with currently available technologies? Be accepted by the community? Be supported by community leaders (is there political support)? Adversely affect segments of the population or neighborhoods? Require a change in local ordinances or zoning laws? Result in positive or neutral impact on the environment? Comply with all local, state, and federal environmental laws and regulations?
- **Is there:** Sufficient staffing to undertake the project? Existing authority to undertake the project? An example of a similar project being successful? A champion for the project?

To further support the prioritization process, the Planning Team considered HMA program requirements (**Table 7-3**), as these projects have the greatest chance of leading to enhanced project scoping and the lowest probability of HMA funding delays.

The format of this approach to prioritization differs from the previous plan, but similar concepts are covered. The previous plan based prioritization on economic cost-benefit analysis, technical and administrative feasibility, political acceptability, social appropriateness, legality, and the action not being harmful to the environment or the community's heritage. All of these criteria are addressed in the questions above and the HMA Program Requirements below.

Mitigation actions not selected as priority actions may be considered at a later date for implementation if the priority actions have been completed or deferred, as additional funding sources become available, or if the goals and objectives of the LHMP shift.

Table 7-3: Priority Mitigation Action Criteria (HMA Program Requirements)

Requirement	Description
Mitigation Planning	Links the existing mitigation plan, particularly the vulnerability analysis and capability assessment, to project scoping.
Technical Feasibility and Effectiveness	Conforms with accepted engineering practices, established codes, standards, modeling techniques, or best practices. Effective mitigation measures funded under HMA should provide a long-term or permanent solution.
Floodplain Management and Protection of Wetlands	Conforms to 44 CFR Part 9, which incorporates the requirements of Executive Order (EO) 11988 (Floodplain Management) and EO 11990 (Protection of Wetlands).
Environmental Planning and Historic Review and Compliance	Complies with all environmental and historic preservation (EHP) laws and with 44 CFR Part 10.
Cost Effectiveness	Is cost-effective or in the interest of the National Flood Insurance Fund.
Cost Review	Is reasonable in costs compared to the probable benefits.

Table 7-3: Priority Mitigation Action Criteria (HMA Program Requirements)

Requirement	Description
General Program Requirements	Is an eligible activity, including: property acquisition and structure demolition; property demolition and structure relocation; structure elevation; mitigation reconstruction; dry floodproofing of historic residential structures; dry floodproofing of nonresidential structures; minor localized flood reduction projects; structural retrofitting of existing buildings; nonstructural retrofitting of existing buildings and facilities; infrastructure retrofit; soil stabilization; wildfire mitigation; post-disaster code enforcement.

Source: FEMA 2015

Once priority actions were chosen, additional details were included for each action: the facility to be mitigated (if known and/or applicable), potential funding source, department or agency lead, and time frame. The final prioritized list of actions is the 2018 Mitigation Action Plan, as shown in **Table 7-4**.

Table 7-4: 2018 Mitigation Action Plan

No.	Description	Hazard	Mitigation Category	New or Existing Construction Affected? Facility to Be Mitigated (if known and/or applicable)	Potential Funding Source	Department or Agency Lead	Time Frame (0–5 Years)
1	Integrate the hazard analysis and mitigation strategy into the General Plan's Safety Element.	All	Local Plans and Regulations	Not Applicable Not Applicable	General Fund	Planning & Building Department	2 Years
2	Have a booth at the annual Safety Fair to provide outreach and education about what residents can do in their own homes. Coordinate this effort with social media outreach.	All	Education and Awareness	Existing Construction Not Applicable	General Fund	Fire Department	1 Year, Annually Thereafter
5	Develop a water conservation outreach program that focuses on recycled water.	Drought	Education and Awareness	Not Applicable Not Applicable	General Fund, WaterSMART Grants	Department of Public Utilities	1 Year
6	Install earthquake sensors that can automatically open vehicle bay doors at Police and Fire stations.	Earthquake	Structure and Infrastructure	Existing Construction Police and Fire Stations	Emergency Management Performance Grant (EMPG)	Fire Department	3–5 Years
8	Develop and implement plans to increase building owners' general knowledge of and appreciation for the value of seismic upgrading of their buildings' structural and nonstructural elements.	Earthquake	Local Plans and Regulations, Education and Awareness	Existing Construction Not Applicable	Hazard Mitigation Grant Program (HMGP)	Planning & Building Department	3–5 Years
10	The City is interested in removing storm drains from backyards and relocating the storm drains to streets. This is also an opportunity to increase stormwater capacity; ensure that relocation of storm drains also increases overall capacity.	Flooding	Structure and Infrastructure	Existing Construction Housing with storm drains in their back yards	Community Development Block Grant (CDBG) Program	Public Works Department	5 Years
13	Acquire, relocate, or elevate critical facilities within the 100-year floodplain.	Flooding	Structure and Infrastructure	Existing Construction Fire Station	HMGP	Public Works Department	5 Years

Table 7-4: 2018 Mitigation Action Plan

No.	Description	Hazard	Mitigation Category	New or Existing Construction Affected? Facility to Be Mitigated (if known and/or applicable)	Potential Funding Source	Department or Agency Lead	Time Frame (0–5 Years)
14	Encourage the use of Low Impact Development (LID) Best Management Practices (BMPs) to reduce stormwater runoff and increase groundwater recharge.	Flooding	Structure and Infrastructure, Natural Systems Protection	New and Existing Construction Not Applicable	General Fund	Public Works Department	1 Year, Ongoing
15	Develop a Healdsburg-specific outreach strategy to utilize the materials being developed through the Russian River Watershed Association on the in-development Storm Water Resource Plan (SWRP).	Flooding	Education and Awareness	Not Applicable Not Applicable	General Fund	Department of Public Utilities	1 Year
18	Underground power lines whenever they are relocated, such as during efforts to move power lines that travel through back yards.	High Winds	Structure and Infrastructure	Existing Construction Housing with power lines in their back yards	CDBG Program	Department of Public Utilities	3–5 Years
19	Implement landslide stabilization and/or protection measures into the North Fitch Mountain Slide Repair. Stabilization measures include grading the unstable portion of the slope to a lower gradient, construction of rock buttresses and retaining walls, and drainage improvements. Protection measures include containment and/or diversion of the moving debris, such as walls, berms, ditches, and catchment basins.	Landslide	Structure and Infrastructure, Natural Systems Protection	New and Existing Construction North Fitch Mountain landslide	HMGP	Public Works Department	3–5 Years

Table 7-4: 2018 Mitigation Action Plan

No.	Description	Hazard	Mitigation Category	New or Existing Construction Affected? Facility to Be Mitigated (if known and/or applicable)	Potential Funding Source	Department or Agency Lead	Time Frame (0–5 Years)
22	Implement an outreach program that educates residents on mitigation actions they can take at their homes such as removing dead or dry leaves and combustibles from roofs, decks, eaves, porches, and yards; and creating a defensible spaces or buffer zones around their houses.	Wildfire	Education and Awareness	Existing Construction Not Applicable	HMGP	Fire Department	1 Year, Ongoing
23	Install a storage tank for the Sunset pressure zone to increase the capacity and flow for fighting fires in this vulnerable area.	Wildfire	Structure and Infrastructure	New and Existing Construction Not Applicable	HMGP, EMPG	Public Works Department	3–5 Years
24	When replacing water lines, put in laterals for sprinklers to residential buildings (already included for commercial, industrial and new construction, but not for existing residential buildings).	Wildfire	Structure and Infrastructure	Existing Construction Existing Residential Buildings	General Fund, CDBG Program	Public Works Department	1 Year, Ongoing
25	Implement storm water runoff reduction projects to reduce the impacts of flooding.	Flood	Structure and Infrastructure	New and Existing Construction Not Applicable	HMGP, Prop 1	Public Works Department	2-5 Years

Section 8. Plan Implementation and Maintenance

Because this plan is a living document, it is important that it becomes a tool in the City's resources to ensure minimal damage in the event of a natural disaster. This section discusses plan adoption and the processes for monitoring, evaluating, and updating the LHMP to ensure the plan remains relevant and continues to address the changing environment in Healdsburg. In addition, this section describes the incorporation of the LHMP into existing City of Healdsburg planning mechanisms, as well as how the City will continue to engage the public.

The local hazard mitigation planning requirements for monitoring, evaluating, and updating the LHMP are as follows:

Regulation Checklist – 44 CFR 201.6 Local Mitigation Plans
Element A: Planning Process
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating, and updating the mitigation plan within a 5-year cycle? (Requirement § 201.6(c)(4)(1))

8.1 Plan Adoption

To comply with DMA 2000, the City of Healdsburg will officially adopt the 2018 City of Healdsburg LHMP within one year of receiving FEMA "approval pending adoption" status. The adoption of the LHMP recognizes the City's commitment to reducing the impacts of natural hazards in Healdsburg. The adoption resolution is presented in **Appendix E**.

8.2 Monitoring, Evaluating, and Updating the LHMP

Led by the Fire Chief, the LHMP Planning Team will meet annually to officially monitor and evaluate the plan. Forms have been developed to facilitate monitoring and evaluating the plan. A summary of the annual meeting will be posted on the City's website for public viewing.

- **Monitoring:** The Mitigation Project Progress Report form (**Appendix D**) will be used to monitor/track each of the mitigation actions included in the 2018 Mitigation Action Plan (and any additional actions that may be added). The LHMP Planning Team is looking into converting this Microsoft Word form into an Excel worksheet that will be housed on a shared drive for regular access by Planning Team members. At a minimum, the form will be updated annually as a progress report for discussion at the annual LHMP Planning Team meeting. This form discusses the status of the mitigation project, including any changes made to the project, identifies implementation problems, and describes appropriate strategies to overcome them.
- **Evaluating:** Evaluation of the 2018 LHMP will look at the overall effectiveness of the plan to analyze if the plan goal is being met and if the goal is still relevant, if progress is being made, and if there have been any changes in the community that would necessitate an informal update or an amendment to the plan. The Annual Review Questionnaire form (**Appendix D**) will be used to evaluate the plan. At a minimum, the form will be updated annually for discussion at the annual

LHMP Planning Team meeting; should a disaster occur, the Fire Chief will determine if an evaluation should occur prior to the scheduled annual evaluation.

- **Updating:** The LHMP will be updated every five years, as required by DMA 2000. After the third year, the LHMP Planning Team will look into funding/grants for the plan update. After the fourth year, the LHMP Planning Team will begin updating the plan. The plan update process will follow a similar planning process to that used to develop the 2018 LHMP. Future updates to the LHMP will account for any new hazard vulnerabilities, special circumstances, or new information that becomes available. Issues that arise during monitoring and evaluating the LHMP, which require changes to the risk assessment, mitigation strategy, and other components of the LHMP, will be incorporated into the next update of the City of Healdsburg LHMP in 2023.

The plan maintenance process is summarized in **Table 8-1**.

Table 8-1: Plan Monitoring, Evaluation, and Updating Process

	Monitor	Evaluate	Update
By Whom	Fire Chief has primary responsibility to call meetings and delegate responsibilities as necessary.	Fire Chief has primary responsibility to call meetings and delegate responsibilities as necessary.	Fire Chief has primary responsibility to call meetings and delegate responsibilities as necessary.
When	Annual meeting along with evaluation.	Annual meeting along with monitoring.	• Every 5 years. • Begin investigating funding/grants following third annual monitoring/ evaluation meeting. • Begin updating plan following fourth annual monitoring/evaluation meeting.
How	• Responsible agency to monitor mitigation action process regularly. Progress Report form to be updated at least annually. • LHMP Planning Team will reconvene to discuss/review Mitigation Project Progress Report form. • Summary of the annual meeting to be posted on the City's website.	• Annual Review Questionnaire form to be completed at least annually by each LHMP Planning Team member. • LHMP Planning Team will reconvene to discuss/review Annual Review Questionnaire forms. • Summary of the annual meeting to be posted on the City's website.	• Develop scope of work. • Investigate and apply for funding/budget cost. • Review/revise plan accounting for: – new hazard vulnerabilities – special circumstances – new information – new priorities – issues from monitoring/ evaluation – progress in mitigation efforts

8.3 Incorporation into Existing Planning Mechanisms

The local hazard mitigation planning requirement for integrating the LHMP into other planning mechanisms is as follows:

Regulation Checklist – 44 CFR 201.6 Local Mitigation Plans
Element C: Mitigation Strategy
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement § 201.6(c)(4)(iii))

Another important implementation mechanism is to incorporate the recommendations and underlying principles of the LHMP into other community plans and mechanisms, such as comprehensive planning, capital improvement budgeting, economic goals and incentives, and regional plans. Mitigation is most successful when it is incorporated within the day-to-day functions and priorities of government and development. Thus, the integration of a variety of City administrative departments into the LHMP Planning Team provides an opportunity for constant and pervasive efforts to network, identify, and highlight mitigation activities and opportunities at all levels of government, through the monitoring of agendas, attendance at meetings, and distribution of memos. This collaborative effort is also important in the monitoring of funding opportunities that can be leveraged to implement the mitigation actions.

Unfortunately, the previous version of the LHMP was not incorporated into other local planning mechanisms. The City does understand the value of plan integration and had identified integration opportunities below. One key difference from the previous version, is that the City had complete ownership of the planning process for this 2018 LHMP, as this version is a standalone plan. This leads to greater investment in the planning process and a better understanding of what is included in the plan, which also increases the likelihood of applying the 2018 LHMP to future planning efforts.

Based on the comprehensive nature of the LHMP, the LHMP Planning Team believes that this document will be highly useful when updating existing and developing new planning mechanisms in the City. Specific documents that have been identified for incorporating elements of the LHMP include:

- **Building/Development Codes and Ordinances:** The 2018 LHMP will provide information to enable the City to make decisions on appropriate building/development codes and ordinances. Appropriate building codes and ordinances can increase Healdsburg's resilience following natural disasters.
- **Emergency Operation Plan**: The 2018 LHMP will provide information on risk and vulnerability that will be extremely important to consider and incorporate into the City's emergency management plans including the Emergency Operations Plan. Probability and vulnerability can direct emergency management and response efforts and can influence public outreach efforts around emergency preparedness.
- **General Plan**: The 2018 LHMP will provide information that can be incorporated into the Land Use and the Safety sections of the plan during the next General Plan update. Specific risk and vulnerability information from the LHMP can help to identify areas where development should not take place.
- **CWPP:** The 2018 LHMP highlights wildfire areas of concerns in the city. Suitable mitigation actions contained in the LHMP can be included in the CWPP currently being developed for Fitch Mountain.

- **Capital Improvement Plan (CIP):** Projects identified in the 2018 LHMP can be included in the annual CIP.

8.4 Continued Public Involvement

As occurred during the development of the 2018 LHMP, the LHMP Planning Team will involve the public during the monitoring, evaluating and updating processes. A downloadable copy of the 2018 LHMP and any proposed changes or updates will be posted on the City's website, and a point of contact will be provided to which people can direct their comments or concerns. Following the annual monitoring/evaluating meeting, a summary of the meeting will be posted to the City's website for public viewing.

As noted above, LHMP Planning Team will continue to oversee implementation, examine the annual review questionnaires and project progress reports, modify the implementation strategy and process as needed, and update the LHMP as required. The LHMP Planning Team will also look for opportunities to raise community awareness about the 2018 LHMP and the hazards that affect the city. This effort could include attendance and provision of materials at City-sponsored events, public mailings, and social media posts (such as Facebook, Twitter, and Nextdoor). Per the responses from the Hazard Questionnaire, the preferred methods for the public to receive information are: newspaper, City's website, social media, utility bills, and mail. Any public comments received regarding the 2018 LHMP will be collected by the LHMP Planning Team, addressed as needed, and considered during future LHMP updates.

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