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Carson City Hazard Mitigation Plan

2016

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Carson City
Hazard Mitigation Plan

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March 2016

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TABLE OF CONTENTS

TABLE OF CONTENTS

Tables

Figures

Appendices

BLM	United States Bureau of Land Management
CCHHS	Carson City Health & Human Services
CC PW	Carson City Public Works
CDC	Center for Disease Control
cfs	cubic feet per second
CFR	Code of Federal Regulations
City	Carson City
DHS	Department of Homeland Security
DMA 2000	Disaster Mitigation Act of 2000
DOJ	Department of Justice
DOT	United States Department of Transportation
EHS	Extremely Hazardous Substance
EMPG	Emergency Management Planning Grant
EOC	Emergency Operation Center
EPA	United States Environmental Protection Agency
EPCRA	Emergency Planning and Community Right to Know Act
FEMA	Federal Emergency Management Agency
FBI	Federal Bureau of Investigation
GIS	Geographic Information System
HAZUS-MH	(abbreviation for **HAZ**ards **U**nited **S**tates) is a geographic information system-based natural hazard loss estimation software package developed and freely distributed by the Federal Emergency Management Agency
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
M	Magnitude
MMI	Modified Mercalli Intensity
mph	miles per hour
NDEM	Nevada Division of Emergency Management
NDEP	Nevada Division of Environmental Protection
NDF	Nevada Division of Forestry
NDOT	Nevada Department of Transportation
NERMP	Nevada Earthquake Risk Mitigation Plan
NFIP	National Flood Insurance Program
NBMG	Nevada Bureau of Mines & Geology
NRC	National Response Center
NWS	National Weather Service

PDM	Pre-Disaster Mitigation
POC	Point of Contact
Planning Committee	Hazard Mitigation Planning Committee
SERC	State Emergency Response Commission
SFHA	Special Flood Hazard Area
SPWB	State Public Works Board
Stafford Act	Robert T. Stafford Disaster Relief and Emergency Assistance Act
State	State of Nevada
UBC	Uniform Building Code
UNR	University of Nevada Reno
URM	Unreinforced Masonry Buildings
USC	United States Code
USDA	US Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USGS	United States Geological Survey
WMD	Weapons of Mass Destruction

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Across the United States, natural and human-caused disasters have led to increasing levels of death, injury, property damage, and interruption of business and government services. The toll on families and individuals can be immense and damaged businesses cannot contribute to the economy. The time, money and effort to respond to and recover from these emergencies or disasters divert public resources and attention from other important programs and problems. With four Federal declarations in the last fifteen years, Carson City, Nevada, recognizes the consequences of disasters and the need to reduce the impacts of natural and human-caused hazards.

The elected and appointed officials of Carson City also know that with careful selection, mitigation actions in the form of projects and programs can become long-term, cost effective means for reducing the impact of natural and human-caused hazards. Applying this knowledge, the Carson City Hazard Mitigation Planning Committee updated the *Carson City, Nevada*, *Hazard Mitigation Plan*. With the support of various City officials, the State of Nevada, and the United States Department of Homeland Security/Federal Emergency Management Agency (FEMA), this plan is the result of several months' worth of work to update a hazard mitigation plan that will guide the City toward greater disaster resistance in full harmony with the character and needs of the community and region.

People and property in Carson City are at risk from a variety of hazards that have the potential for causing widespread loss of life and damage to property, infrastructure, and the environment. The purpose of hazard mitigation is to implement actions that eliminate the risk from hazards, or reduce the severity of the effects of hazards on people and property. Mitigation is any sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event. Mitigation encourages long-term reduction of hazard vulnerability. The goal of mitigation is to save lives and reduce property damage. Mitigation can reduce the enormous cost of disasters to property owners and all levels of government. In addition, mitigation can protect critical community facilities, reduce exposure to liability and minimize community disruption. Preparedness, response, and recovery measures support the concept of mitigation and may directly support identified mitigation actions.

The *Carson City, Nevada, Hazard Mitigation Plan* has been updated in compliance with Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act or the Act), 42 U.S.C. 5165, enacted under Sec. 104 the Disaster Mitigation Act of 2000 (DMA 2000), Public Law 106-390 of October 30, 2000. When the first plan was adopted in 2005, 11 mitigation actions were completed. Since the 2010 update, 13 mitigation actions have been completed. This updated plan identifies on-going and new hazard mitigation actions intended to eliminate or reduce the effects of future disasters throughout the City.

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This section provides an overview of the Disaster Mitigation Act of 2000 (DMA 2000; Public Law 106-390), the adoption of the updated *Carson City, Nevada, Hazard Mitigation Plan* (HMP) by the local governing body, and supporting documentation for the adoption.

1.1 DISASTER MITIGATION ACT OF 2000

The DMA 2000 was passed by Congress to emphasize the need for mitigation planning to reduce vulnerability to natural and human-caused hazards. The DMA 2000 amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act; 42 United States Code [USC] 5121-5206 [2008]) by repealing the act's previous Mitigation Planning section (409) and replacing it with a new Mitigation Planning section (322). In addition, Section 322 provides the legal basis for the Federal Emergency Management Agency's (FEMA's) mitigation plan requirements for mitigation grant assistance.

To implement the DMA 2000 planning requirements, the Federal Emergency Management Agency (FEMA) published an Interim Final Rule in the *Federal Register* on February 26, 2002. This rule (44 Code of Federal Regulations [CFR] Part 201) established the mitigation planning requirements for states, tribes, and local communities. The planning requirements are described in detail in Section 2 and identified in their appropriate sections throughout the Plan.

1.2 ADOPTION BY THE LOCAL GOVERNING BODY AND SUPPORTING DOCUMENT

The requirements for the adoption of an HMP by the local governing body, as stipulated in the DMA 2000 and its implementing regulations, are described below.

DMA 2000 REQUIREMENTS: PREREQUISITES
Adoption by the Local Governing Body
Requirement §201.6(c)(5): [The local hazard mitigation plan shall include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council).
Element
Has the local governing body adopted the plan?
Is supporting documentation, such as a resolution, included?
Source: FEMA, March 2008.

The Consolidated Municipality of Carson City, to be referred to as Carson City or the City throughout this plan, is the sole jurisdiction represented in this HMP. There are no other political subdivisions within Carson City. The Carson City HMP meets the requirements of Section 409 of the Stafford Act and Section 322 of the DMA 2000.

The local governing body of Carson City (Carson City Board of Supervisors) has adopted this update to the HMP. The signed resolution is provided in Appendix A.

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This section provides an overview of the City's HMP. This includes a review of the purpose and authority of the HMP and a description of the document.

2.1 PLAN PURPOSE AND AUTHORITY

The DMA 2000, also referred to as the 2000 Stafford Act amendments, was approved by Congress on October 10, 2000. On October 30, 2000, the President signed the bill into law, creating Public Law 106-390. The purposes of the DMA 2000 are to amend the Stafford Act, establish a national program for pre-disaster mitigation, and streamline administration of disaster relief.

The Carson City HMP meets the requirements of the DMA 2000, which calls for all communities to prepare hazard mitigation plans. By preparing this HMP, the City is eligible to receive Federal mitigation funding after disasters and to apply for mitigation grants before disasters strike. This HMP continues the ongoing process to evaluate the risks different types of hazards pose to the City, and to engage the City and the community in dialogue to identify the steps that are most important in reducing these risks. This constant focus on planning for disasters continues to make the City, including its residents, property, infrastructure, and the environment, much safer.

The local hazard mitigation planning requirements encourage agencies at all levels, local residents, businesses, and the non-profit sector to participate in the mitigation planning and implementation process. This broad public participation enables the development of mitigation actions that are supported by these various stakeholders and reflect the needs of the entire community.

States are required to coordinate with local governments in the formation of hazard mitigation strategies, and the local strategies combined with initiatives at the state level form the basis for the State Mitigation Plan. The information contained in HMPs helps states to identify technical assistance needs and prioritize project funding. Furthermore, as communities prepare their plans, states can continually improve the level of detail and comprehensiveness of statewide risk assessments.

For FEMA's Pre-Disaster Mitigation (PDM) grant program and Hazard Mitigation Grant Program (HMGP), a local jurisdiction must have an approved HMP to be eligible for PDM and HMGP funding for a Presidentially declared disaster after November 1, 2004. Plans approved any time after November 1, 2004, will allow communities to be eligible to receive PDM and HMGP project grants.

Adoption by the local governing body demonstrates the jurisdiction's commitment to fulfilling the mitigation goals and objectives outlined in the HMP. Adoption legitimizes the updated HMP and authorizes responsible agencies to execute their responsibilities. The resolution adopting this update to the HMP is included in Appendix A.

2.2 STAFFORD ACT GRANT PROGRAMS

The following grant programs require a State, tribe, or local entity to have a FEMA-approved State or Local Mitigation Plan.

Hazard Mitigation Grant Program (HMGP): HMGP provides grants to State, tribes, and local entities to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property as a result of natural disasters and to enable mitigation measures to be implemented during the immediate recovery from disaster. Projects must provide a long-term solution to a problem: for example, elevation of a home to reduce the risk of flood damages as opposed to buying sandbags and pumps to fight the flood. In addition, a project's potential savings must be more than the cost of implementing the project. Funds may be used to protect either public or private property or to purchase property that has been subjected to, or is in danger of, repetitive damage. The amount of funding available for the HMGP under a particular disaster declaration is limited. The program may provide a State or tribe with up to 20 percent of the total disaster grants awarded by FEMA. The cost-share for this grant is 75/25 percent (Federal/non-Federal).

Pre-Disaster Mitigation (PDM) Program: PDM provides funds to State, tribes, and local entities, including universities, for hazard-mitigation planning and the implementation of mitigation projects before a disaster event. PDM grants are awarded on a nationally competitive basis. Like HMGP funding, a PDM project's potential savings must be more than the cost of implementing the project. In addition, funds may be used to protect either public or private property or to purchase property that has been subjected to, or is in danger of, repetitive damage. Congress appropriates the total amount of PDM funding available on an annual basis. The cost-share for this grant is 75/25 percent (Federal/non-Federal).

Flood Mitigation Assistance (FMA): The FMA program provides funds on an annual basis so that measures can be taken to reduce or eliminate risk of flood damage to buildings insured under the National Flood Insurance Program (NFIP). FMA provides up to 75% Federal funding for a mitigation activity grant and/or up to 90% Federal funding for a mitigation activity grant containing a repetitive loss strategy.

Repetitive Flood Claims (RFC): The RFC program provides funds on an annual basis to reduce the risk of flood damage to individual properties insured under the NFIP that have had one or more claim payments for flood damages. RFC provides up to 100% Federal funding for eligible projects in communities that qualify for the program.

Severe Repetitive Loss (SRL): The SRL program provides funds on an annual basis to reduce the risk of flood damage to residential structures insured under the NFIP that have had one or more claim payments for flood damages. SRL provides up to 75% Federal funding for eligible projects in communities that qualify for the program.

2.3 PLAN ORGANIZATION

The remainder of this HMP consists of the following sections.

- ***Section Three - Community Description***

Section Three provides a general history and background of the City and historical trends for population, demographic and economic conditions that have shaped the area. Trends in land use and development are also discussed.

- ***Section Four - Planning Process***

Section Four describes the planning process, identifies Planning Committee members, and the key stakeholders within the community and surrounding region. In addition, this section documents public outreach activities and the review and incorporation of relevant plans, reports, and other appropriate information.

- ***Section Five - Risk Assessment***

Section Five describes the process through which the Planning Committee identified and compiled relevant data on all potential natural hazards that threaten the City and the immediate surrounding area. Information collected includes historical data on natural hazard events that have occurred in and around the City and how these events impacted residents and their property.

The descriptions of natural hazards that could affect the City are based on historical occurrences and best available data from agencies such as FEMA, the U.S. Geological Survey (USGS), and the National Weather Service (NWS). Detailed hazard profiles include information on the frequency, magnitude, location, and impact of each hazard as well as probabilities for future hazard events.

- ***Section Six – Vulnerability Analysis***

Section Six identifies potentially vulnerable assets such as people, housing units, critical facilities, infrastructure and lifelines, hazardous materials facilities, and commercial facilities. These data were compiled by assessing the potential impacts from each hazard using GIS and FEMA's natural hazards loss estimation model, HAZUS-MH. The resulting information identifies the full range of hazards that the City could face and potential social impacts, damages, and economic losses.

- ***Section Seven - Capability Assessment***

Although not required by the DMA 2000, Section Seven provides an overview of the City's resources in the following areas for addressing hazard mitigation activities:

- Legal and regulatory resources
- Administrative and technical: The staff, personnel, and department resources available to expedite the actions identified in the mitigation strategy
- Fiscal: The financial resources to implement the mitigation strategy

- ***Section Eight- Goals, Objectives & Actions - Mitigation Strategy***

As Section Eight describes, the Planning Committee developed a list of mitigation goals, objectives, and actions based upon the findings of the risk assessment and the capability assessment. Based upon these goals and objectives, the Planning Committee reviewed and prioritized a comprehensive range of appropriate mitigation actions to address the risks facing the community. Such measures include preventive actions, property protection techniques, natural resource protection strategies, structural projects, emergency services, and public information and awareness activities.

- ***Section Nine- Plan Maintenance Process***

Section Nine describes the Planning Committee's formal plan maintenance process to ensure that the HMP remains an active and applicable document. The process includes monitoring, evaluating, and updating the HMP; implementation through existing planning mechanisms; and continued public involvement.

- ***Section Ten - References***

Section Ten lists the reference materials used to prepare this update to the HMP.

- ***Appendices***

The appendices include the Adoption Resolution, a report on the Earthquake Hazards and Seismic Risk Mitigation in Carson City, Nevada prepared by Craig dePolo from the Bureau of Mines and Geology, UNR; Maps, Planning Committee Meetings, and Public Involvement process.

This section describes the history, location, and geography of the City as well as its government, demographic information, and current land use and development trends.

3.1 HISTORY, LOCATION, AND GEOGRAPHY

The Consolidated Municipality of Carson City, Nevada's territorial and state capital, has a rich and colorful frontier past. Carson City was founded as a community in 1858, seven years after the first settlement of Eagle Station trading post in 1851. Eagle Valley had been settled by ranchers. Carson City is named for the famous frontiersman and scout Christopher Houston "Kit" Carson. During his 1843-1844 expedition, John C. Fremont had named Carson City's nearby river for Kit Carson, Fremont's scout. Pioneer Abraham Curry arrived in Eagle Valley in 1858 and soon thereafter surveyed and plotted a town site. A cadre of well-connected attorneys whose names still decorate street signs here (Proctor, Musser) bought the richest part of the valley for $500 and a herd of horses. The farsighted and optimistic Curry set aside 10 acres expressly for the construction of a capitol -- this was before the formation of Nevada Territory in 1861. Carson City was soon designated both the territorial capital and county seat of the new Ormsby County. President Abraham Lincoln, recognizing the importance of Nevada's silver and gold to the Union's Civil War effort, signed the proclamation that ushered Nevada into statehood on October 31, 1864. Carson City was selected as the state capital at the Constitutional Convention and has retained that honor to the present day.

Following the discovery of gold and silver on the nearby Comstock Lode in 1859, Carson City became a thriving commercial center. To their astonishment and delight of its citizens, the discovery of the Comstock Lode brought their Carson City to life as a freight and transportation center. Abe Curry, then built the crude Warm Springs Hotel a mile to the east, and when Carson City was selected as the territorial capital in 1861, leased it to the Legislature as a meeting hall. The Legislature established Carson City as the seat of Ormsby County (named for one of the dead "heroes" at the Battle of Pyramid Lake). The legislators also leased the Warm Springs Hotel to serve as the Territorial Prison, and named their genial host and landlord, as its first warden. The property was eventually purchased by the state and is still a part of the state prison system.

Carson City was confirmed as Nevada's permanent capital with statehood in 1864, and development thereafter was no longer completely dependent on the health of the Comstock mines. Until they began to decline in the 1880s, these mines provided Carson City with most of its economic importance as a freight staging center, and as a marshalling point for much of the timber harvest in the Lake Tahoe basin. The United States Mint in Carson City was completed in 1869; it is today the site of the Nevada State Museum.

Long shallow flumes, capable of carrying enormous pine logs in a shallow spill of fast water, swooped down the steep eastern slope of the Sierra from Spooner Summit to Carson City. Scorched and smoldering where they had rubbed against the flume's sides in their dashing descent, the logs were fed into sawmills where they became timbers for the underground mines, and planed boards for the surface cities. The finished lumber was then loaded onto flatcars and rolled off to Silver City, Gold Hill and Virginia City via the Virginia and Truckee Railroad (V&T).

The V&T was completed between Carson City and Virginia City in 1869, with the railroad's shops and main offices in Carson City. The V&T rails were extended north to connect with the transcontinental railroad at Reno in 1872. By 1874, when the Comstock mines were reaching their peak production, 36 trains a day passed through Carson City. The huge sandstone V&T engine house and roundtable dominated the northeast corner of the city for well over a century. Neglected and falling into ruin since the track was torn up in 1950, they have now been torn down and the stones sent to create facades for wineries in the Napa Valley.

Like many other Nevada towns in its youth Carson City was made lively, and occasionally dangerous, by the presence of dozens of ruthless, restless men. Shootings, stabbings and street brawls were commonplace around Nevada, but Carson City was unique in contending with outbreaks from the State Prison.

After the turn of the century Carson City participated vicariously in the Tonopah and Goldfield booms far to the south. Much of the freight and passenger traffic bound for those two celebrated cities was routed to Reno and then through Carson City to Mound House on the V&T railroad. From there the narrow gauge Carson & Colorado carried it to Sodaville where freight wagons and stage coaches were waiting for the last leg of the journey.

This traffic through Carson City came to a sudden halt when the Southern Pacific built a branch line connecting with the C & C from the east that bypassed the V&T altogether. The capital then resumed the quiet lifestyle that evolved after the decline of the Comstock, and which still continues (with variations) today. At the turn of the century the railroad extended its line south into the Carson Valley, but the Minden-Gardnerville traffic never came close to replacing the Tonopah-Goldfield traffic, and the railroad, and Carson City, slipped back into quiescence. In 1930, the population had dwindled to1,800, about a quarter of what it had been at the peak of the mining boom 50 years earlier.

In 1933, the highway was paved through town, but for a long time afterward the kids could roller skate on it without worrying too much about traffic. In those innocent days Carson City advertised itself as America's smallest state capital.

In 1960, Carson City regained its 1880 population level, and in 1969, the Ormsby County was abolished, and its territory was merged with Carson City to form the Consolidated Municipality of Carson City. With the consolidation, the city limits today extend west across the Sierra Nevada to the California state line in the middle of Lake Tahoe. Like other independent cities in the United States, it is treated as a county-equivalent for census purposes, and in fact, with its area of 146 square miles, Carson City could now advertise itself as one of the largest state capitals in America!

Carson City is a growing area located along the eastern slopes of the Sierra Nevada Mountains in western Nevada at 4,687 feet above sea level. Average annual snowfall is 22.2" and average annual rainfall is 11.8". Temperatures range from average summer high of 89 degrees to average winter low of 19 degrees. There is an average of 266 days of sunshine. The Carson River runs along the eastern part of the city.

Recreational activities abound, including skiing, fishing, lakes and hiking, all within minutes of the metropolitan area. Citizens enjoy cultural events, quality public schools, and excellent public services. The economy is growing, housing is plentiful, and the cost of living is moderate. Carson City's climate is mild, with low humidity and rainfall, and we enjoy the full range of the four seasons. Appendix B, Figure B-1 Study Area Overview and Figure B-3 Public Land Ownership are attached.

3.2 GOVERNMENT

The debate concerning consolidation of Ormsby County and Carson City continued for some 20 years. Finally, the process was formally initiated and, after two legislative sessions, and a favorable statewide vote by the citizens in 1966, the required constitutional amendment was ratified by the electorate in November 1968. Thereafter the 55th Session of the Legislature passed Senate Bill No.75 and Ormsby County and Carson City were thereby consolidated into one municipal government known as Carson City Consolidated Municipality. The Charter was approved on April 1, 1969.

The local governing body is composed of a five-member elected representation called the Board of Supervisors (BOS). The Mayor and four Supervisors are elected by and accountable to the voters. All of the members of the Board serve four-year staggered terms. The Mayor and Supervisors from Wards 2 and 4 are elected during Presidential election years. The Supervisors from Wards 1 and 3 are elected during off-Presidential election years.

The Board of Supervisors appoints a City Manager to be responsible for the general direction, supervision, administration, and coordination of all affairs for the City. Below please see Carson City departments and key divisions.

Key Officials

Mayor	City Manager	District Attorney
Supervisor, Ward 1	Assessor	Environmental Health Division Manager
Supervisor, Ward 2	Engineering Manager	Finance Director/Risk Manager
Supervisor, Ward 3	Clerk-Recorder	Fire Chief/Emergency Management Director
Supervisor, Ward 4	Community Development Director	Judges
	Cooperative Extension Dean & Director	Sheriff

City Departments/Divisions

Alternative Sentencing	Cooperative Extension	Parks and Recreation
Animal Services	Courts	Public Guardian
Assessor	District Attorney	Public Works
Business Development – The BRIC	Finance/Comptroller	Recorder
City Manager's Office	Fire Department	Senior Center
Clerk-Recorder	Health and Human Services	Sheriff's Office
Community Development	Human Resource	Treasurer
Planning	Information Technology	Library
Development Engineering	Juvenile Probation Service	
Building & Safety		

Washoe Tribe

The Washoe Tribe boundary is within the Carson City boundary and a brief description is included in this plan. Washoe Tribe has an approved Tribal Level Multi-Hazard Mitigation Plan dated August 4, 2005 and an update is in process.

The ancestral homeland of the Washoe Tribe radiated from Lake Tahoe, a spiritual and cultural center in the central Sierra Nevada Mountain Range west of Carson City. The area originally encompassed over 1.5 million acres, the traditional homelands stretched from the Central Sierra Nevada in California to the Great Basin in Nevada.

Today, through ongoing tribal efforts and federal collaborations, the Tribe has recovered approximately 5,669 acres and approximately 65,420 acres of individual trust allotments within the ancestral homelands. Washoe Tribal lands are unique in that they do not comprise a single reservation, but are fractionated into several discrete parcels, located in six different counties and two different states. While the Tribe has some forested lands in the Sierra Nevada, most current lands are located just within the boundaries of the Great Basin Desert, in the Carson River Watershed.

The last Tribal census in 2010 determined the total tribal enrollment to be 1,649 (one-quarter or more blood quantum), with 590 Tribal members living on one of the four reservation communities. While not all of these Tribal members live within Carson City, a significant number do. In addition, the Tribe maintains around 304 employees, most of whom work out of the administration buildings in the Dresslerville parcel. While many of these employees are not residents of Tribal lands, they are nonetheless exposed to the hazards therein.

There are two federally recognized communities under the Washoe Tribe of Nevada and California that are located within the jurisdictional boundary covered by this hazard mitigation plan:

<u>Federally Recognized Communities:</u>

Carson Colony (Carson) west of Carson City, NV

Stewart Community (Stewart) southeast of Carson City, NV

Twenty miles south of Carson City, Washoe Tribal headquarters is centrally located on Tribal Land within the Dresslerville Community and within a 20-mile radius of nearly all current Tribal lands.

The Tribe is organized under the provisions of the Indian Reorganization Act of June 18, 1934, exercising rights of home rule and responsibility for the general welfare of its membership. The Washoe Tribal Council, a 12-member body, serves as the local authority for purposes of authorizing any planning program for the Tribe's future.

3.3 DEMOGRAPHICS

According to the U.S. Census Bureau 2010 census, the City's population was 55,274; and was estimated at 53,969 for July 1, 2014 by the NV State Demographer. Approximately 21.4 percent of the total population was under 18 years, 53.1 percent was between 18 and 64 years, and 16.5 percent was 65 years and over. While the City experienced a 1.4 percent growth rate from 2010-2014, it is well below the state average of 5.1 percent. The number of people per square mile is 382.1 (U.S. Census Bureau 2010.) The number of people within the City during the work day is much higher as many people working in the City commute from outside the City.

Carson City's nonfarm employment was 21,485 persons in 2012 (U.S. Census Bureau). This is a 1.6% change from 2011 to 2012. The economic base of the City primarily consists of government, trade, and service. The unemployment rate has been historically low, but has risen in the past years to 7.2 percent, (February 2015), according to the U.S. Bureau of Labor Statistics. In 2013, the median household income was $51,957 according to the U.S. Census Bureau.

Table 3-1 Census Data

2010 Census Demographic Summary ***Carson City, NV***									
	2010 Census		2000 Census		2000-2010 Average Annual Growth Rate	Median Age	Median Household Income *(in 2013 dollars)*	Median Rent	Median Housing Value
Carson City	55,274		52,457		2.8%	41.9	$51,957	$872	$198,900
2010 Census Tracts									
1.00	3,034	5.5%	3,175	6.1%	-.4%	50	$62,438	$890	$26.5200
2.00	3,526	6.4%	3,376	6.4%	.4%	49.1	$60,909	$825	$281,100
3.00	3,806	6.9%	3,626	6.9%	.5%	53.1	$93,456	$474	$449,700
4.00	3,811	6.9%	3,670	7.0%	.3%	41.7	$56,875	$896	$236,700
5.01	6,102	11.0%	8,128	15.5%	-2.5%	33.2	$54,414	$1,070	$184,100
5.02	3,140	5.7%			5.7%	40.5	$22,665	$694	$184,700
6.00	6,382	11.5%	6,057	11.5%	.5%	37.9	$47,417	$893	$179,700
7.01	3,901	7.0%	7,432	14.2%	-4.7%	41.2	$63,561	$1,312	$192,800
7.02	3,469	6.3%			6.3%	43.6	$50,851	$1,224	$189,400
8.00	4,781	8.6%	4,266	8.2%	1.2%	46.5	$65,776	$845	$303,500
9.00	5,178	9.4%	4,960	9.5%	.4%	44.9	$40,293	$952	$82,000
10.01	4,387	7.9%	7,747	14.8%	-4.3%	27.4	$39,080	$767	$154,800
10.02	3,757	6.8%			6.8%	43.5	$72,792	$960	$298,800

Source U.S. Census Bureau and 2009-2013 American Community Survey 5-year Estimate Census Tract: MI-T10-CTRM-00-32510

3.4 LAND USE AND DEVELOPMENT TRENDS

The majority of the City is already developed with infill being the primary future development. There are three ranches, Lompa (bisected by 395, eastern Carson), Schulz (southeast Carson) and Anderson (western Carson) that will provide some area for future development as well as the remaining sites in the Silver Oaks housing track. The City has approximately 1,200 approved single family residence parcels within the City for future development. The infill will trend towards higher density in residential development and multi-story office buildings for commercial development.

The Nevada State Demographer projects improving job growth conditions in Northern Nevada and projects growth in Carson City at approximately 1% per year over the next five years, with growth continuing at a similar pace in future years. A land use map is provided in Appendix B, Figure B-2 and a Population Density Map is provided in Appendix B, Figure B-4.

Carson City will have an impact from the Lands Bill that passed Congress in 2009 which includes trading of land with Carson City, Bureau of Land Management (BLM), U.S. Forestry Service and Washoe Tribe. The new land incorporated into Carson City should be examined for planning, zoning, and hazard evaluation.

This section provides an overview of the planning process; identifies Planning Committee members, and key stakeholders; documents public outreach efforts; and summarizes the review and incorporation of existing plans, studies, and reports used in the development of this update to the HMP. Additional information regarding the Planning Committee and public outreach efforts is provided in Appendices C, D and E.

The requirements for the planning process, as stipulated in the DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Planning Process

Documentation of the Planning Process

Requirement §201.6(b): In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

1. An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
2. An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and nonprofit interests to be involved in the planning process; and
3. Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

Requirement §201.6(c)(1): [The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

Element

- Does the new or updated plan provide a narrative description of the process followed to prepare the plan?
- Does the new or updated plan indicate who was involved in the planning process? (For example, who led the development at the staff level and were there any external contributors such as contractors? Who participated on the plan Committee, provided information, reviewed drafts, etc.?)
- Does the new or updated plan indicate how the public was involved? (Was the public provided an opportunity to comment on the plan during the drafting stage and prior to the plan approval?)
- Does the new or updated plan indicate that an opportunity was given for neighboring communities, agencies, businesses, academia, nonprofits, and other interested parties to be involved in the planning process?
- Does the updated plan document how the planning team reviewed and analyzed each section of the plan?
- Does the planning process describe the review and incorporation, if appropriate, of existing plans, studies, reports, and technical information?
- Does the updated plan indicate for each section whether or not it was revised as part of the update process?

Source: FEMA, March 2008.

4.1 OVERVIEW OF PLANNING PROCESS

The first step in the planning update process was to establish a Planning Committee composed of existing Carson City agencies. Robert Schreihans, Fire Chief, and Stacey Belt, Deputy Emergency Manager, both of Carson City, served as the primary Points of Contact (POC) for Carson City and the public.

The City, assisted by R.O. Anderson Engineering, Inc. and the State of Nevada Hazard Mitigation Officer updated this HMP. Each section of the previous HMP plan was reviewed for content and the committee revised every section of the plan.

The committee annually completed maintenance table top exercises, which compiled information on plan integration, hazards, new events, and the mitigation actions were reviewed and progress was documented.

The following table provides the new section format and provides details on the update.

Table 4-1 Plan Outline and Update Effort

Plan Section	Update Effort	What Changed
Section 1 – Official Record of Adoption	Minor Revision	The process for plan adoption remains the same but the update provides a discussion of the signed resolution provided in Appendix A.
Section 2 - Background	Minor Revision	This section continues to include the Disaster Mitigation Act of 2000 and Stafford Grant Programs for completeness. The only change was to spell out the section numbers to reflect the section headers of the plan, *i.e.* Section 1 is now Section One, and Section 2 is now Section Two, etc.
Section 3 – Community Description	Minor Revisions	This section was updated to include new demographic data information based on the 2010 Census information.
Section 4 – Planning Process	Major Revisions	This section details the current plan's planning process, public and stakeholders outreach efforts.
Section 5 – Hazard Analysis	Major Revisions	Epidemic was renamed to Infectious Diseases and was revised to expand the information on the H1N1 flu virus, rabies and foodborne disease outbreaks. Terrorism was renamed to Acts of Violence with terrorism, civil disorder and criminal acts being sub-categories of the hazard section. UNR, Nevada Bureau of Mines and Geology was recruited to prepare an in-depth study and analysis of the earthquake hazard. The committee rated the hazards according to low, moderate or high planning significance. The individual hazard sections were updated to include the last five year historical data with the inclusion of the effects of climate change to the hazards. The sections were then provided to the committee member with expertise to update history and revise as needed.
Section 6 – Vulnerability Analysis	Moderate Revisions	New HAZUS information was used for the earthquake hazard. Revised mapping, exhibits and tables included new analysis of residential, non-residential, and critical facilities based on mapping efforts tied to hazards. Identified URM's were included. Future development was included.
Section 7 – Capability Assessment	Minor Revisions	Reviewed all tables with committee for accuracy. Updated dates and Carson City Local Mitigation Capability Assessment Point of Contact Names and Phone numbers.
Section 8 – Mitigation Strategy	Moderate Revisions	The goals and actions were reviewed and progress was included, actions deleted, and actions added. The prioritization process was expanded to include the STAPLE+E process to better evaluate and prioritize actions.
Section 9 – Plan Maintenance	Minor Revisions	The planning process was reviewed by Committee. Planning forms were included in Appendix F to help with the maintenance process.
Section 10 – Reference	Minor Revisions	This section was updated with current information, including changes to the document dates and website addresses.

Once the Planning Committee was formed, the following five-step planning process took place during the 8-month period from March 17, 2015 to November 18, 2015.

- **Organize resources:** The Planning Committee identified resources, including Carson City staff, agencies, and local community members, which could provide technical expertise and historical information needed in the update of the HMP.
- **Assess risks:** The Planning Committee identified the hazards specific to Carson City, and developed the risk assessment for the thirteen identified hazards. The Planning Committee

reviewed the risk assessment, including the vulnerability analysis, prior to and during the development of the mitigation strategy.

- **Assess capabilities:** The Planning Committee reviewed current administrative and technical, legal and regulatory, and fiscal capabilities to determine whether existing provisions and requirements adequately address relevant hazards.
- **Develop a mitigation strategy:** After reviewing the risks posed by each hazard, the Planning Committee worked to develop a comprehensive range of potential mitigation goals, objectives, and actions. Subsequently, the Planning Committee identified and prioritized the actions to be implemented.
- **Monitor progress:** The Planning Committee developed an implementation process to ensure the success of an ongoing program to minimize hazard impacts to Carson City.

4.2 HAZARD MITIGATION PLANNING COMMITTEE

4.2.1 Formation of the Planning Committee

The planning process for the 2015 update to the plan began in March 2015. Robert Schreihans, Fire Chief and Emergency Manager for Carson City and Stacey Belt, Deputy Emergency Manager formed the advisory body, known as the Planning Committee, utilizing staff from relevant Carson City agencies and community organizations. The Planning Committee members are listed in Table 4-2. The Planning Committee meetings are described in Section 4.2.2.

Table 4-2 Carson City Hazard Mitigation Planning Committee & Participating Agencies

Name	Department	Action
Robert Schreihans	Emergency Management & Fire Department	Chair of the Committee. Attended meetings, reviewed drafts and provided input on the hazardous materials events, acts of violence. Also provided input on mitigation actions.
Stacey Belt	Emergency Management & Fire Department	Deputy Emergency Manager. Facilitated and attended meetings, reviewed drafts and provided edits and input on wildland fire, floods, drought, acts of violence, hazardous materials events sections.
Karen Johnson	Nevada DEM	Provided guidance on mitigation strategies and plan maintenance. Attended meetings, reviewed drafts and provided input on all hazard sections.
Lisa Christensen	Washoe Tribe of Nevada & California	Provided guidance on mitigation strategies and plan maintenance. Attended meetings, reviewed drafts and provided input on all hazard sections.
Debbie Tanaka	Nevada DEM	Provided guidance on mitigation strategies and plan maintenance. Attended meetings, reviewed drafts and provided input.
Connor Long	Nevada DEM	Attended meetings, reviewed drafts and provided input on the GIS mapping for the update.

Table 4-2 Carson City Hazard Mitigation Planning Committee & Participating Agencies
(continued)

Name	Department	Action
Brian Crowe	Western Nevada College	Provided information on college buildings for vulnerability assessment. Attended meetings, reviewed drafts and provided input on acts of violence, wildland fire, earthquake and seiche hazards.
Mark Korinek	Carson City School District	Provided information on school buildings. Attended meetings, reviewed drafts and provided input on utility loss and the wildland fire hazard sections.
Robb Fellows	Public Works (Storm Water/Flood Mgr.)	Provided flood hazard information. Attended meetings, reviewed drafts and provided input on the avalanche, landslide, volcano, floods, drought and severe weather hazard sections. Also provided input on mitigation actions.
Lee Plemel	Community Development Director	Attended meetings, reviewed drafts and provided input on demographics information and provided input on mitigation actions.
James Freed	Carson Tahoe Health Hospital	Attended meetings, reviewed drafts and provided input.
Ed James	Carson Water Subconservancy District	Attended meetings, reviewed drafts and provided input.
Bill Moline	Nevada Division of Forestry	Attended meetings, reviewed drafts and provided input on wildland fire hazard section.
Danny Rotter	Public Works	Provided information on flood, avalanche earthquake, seiche, landslide, utility loss and volcano hazards. Attended meetings, reviewed drafts, provided input, and provided mitigation actions.
Tom Tarulli	Fire Department	Provided information on wildland fire and hazardous materials events. Attended meetings, reviewed drafts and provided input and mitigation actions.
Dave Ruben	Fire Department	Provided information on wildland fire and hazardous materials events. Attended meetings, reviewed drafts and provided input and mitigation actions.
Jim Walker	Nevada Dept. of Transportation	Attended meetings, reviewed drafts and provided input, provided input on terrorism (acts of violence) hazard and input on mitigation actions.
Nick Marano	City Manager	Attended meetings, reviewed drafts and provided input.
Curtis Horton	Carson City Public Works	Attended meetings, reviewed drafts and provided input on the drought, earthquake, seiche, avalanche, landslide, volcano, floods and severe weather hazard sections.
Angela Barosso	Carson City Health & Human Services	Provided information on the epidemic (infectious disease) hazard section. Attended meetings, reviewed drafts and provided input and mitigation actions.

Table 4-2 Carson City Hazard Mitigation Planning Committee & Participating Agencies
(continued)

Name	Department	Action
Stephanie Hicks	R.O. Anderson Engineering, Inc.	Facilitated and coordinated meetings. Complied Edits, revisions and information from committee members.
Tammy Kinsley	R.O. Anderson Engineering, Inc.	Facilitated and coordinated meetings. Complied Edits, revisions and information from committee members.
Justina Hillman	Red Cross	Attended meetings, reviewed drafts and provided input.
Craig de Polo	Nevada Bureau of Mines & Geology	Attended Meetings, provided information on earthquakes, seiche, landslides and volcanic activity. Reviewed drafts and provided edits and analysis reports.
Ken Sandage	Sherriff's Office	Attended meetings, reviewed drafts and provided input on terrorism (acts of violence) and hazardous materials sections.
Jeff Melvin	Sherriff's Office	Attended meetings, reviewed drafts and provided input on terrorism (acts of violence).
James Freed	Carson Tahoe Regional Healthcare	Attended meetings, reviewed drafts and provided input on the epidemic (infectious disease) hazard section.
Chris Smallcomb	National Weather Service	Provided information on severe weather, drought, and flood hazards. Attended meetings, reviewed drafts and provided input and mitigation actions.
Shawn Keating	Carson City Building Division	Attended meetings, reviewed drafts and provided input to the utility loss, wildland fire, floods, hazardous materials, and terrorism (acts of violence) sections, and input on mitigation actions.
Mark Cyr	Salvation Army	Attended meetings, reviewed drafts and provided input.
Eric Von Schimmelmann	Carson City Information Technology	Attended meetings, reviewed drafts, provided input and edits to the update.
Eric Schmidt	Douglas County GIS	Attended meetings, reviewed drafts and provided input. Complied GIS mapping and vulnerability analysis.
Matthew Richardson	Douglas County GIS	Attended meetings, reviewed drafts and provided input. Compiled GIS mapping and vulnerability analysis.

Although individuals have changed, the departments they represent have remained largely the same. The Nevada Department of Transportation, Nevada State Public Works Board, and the Washoe Tribe of California and Nevada were asked and agreed to participate. This provided additional information and input since Carson City is the State Capitol, highways and bridges are critical infrastructure and the Washoe Tribe's boarders are within Carson City. The City divisions were represented by their experts, who provided information. Public comments were received from Phillip Harris from Taiyo America, who participated as a community representative by attending, providing input and review of the plan.

4.2.2 Planning Committee Meetings & Monthly Progress

- ***March 17, 2015***

During the kick-off meeting, held at Carson City Fire Station #1, R.O. Anderson presented to the Planning Committee, the objectives of the DMA 2000, the hazard mitigation planning process, Carson City Emergency Management/LEPC's role, the purpose of the plan, public participation, and the steps involved in updating the HMP and achieving the City's goals. Mitigation action items were reviewed from the 2014 annual review. The Hazard Identification Table and Hazard Ranking were reviewed and modifications to the hazards list were discussed and tallied for the 13 hazards in the plan. R.O. Anderson coordinated the formation of the Hazard Subcommittees for each hazard and future Planning Committee and Subcommittee meetings were discussed. See Appendix E for agenda, handouts and minutes.

- ***April 23, 2015***

R.O. Anderson and the Subcommittee members held a workshop, to discuss avalanche, drought, epidemic, earthquake, floods, landslide, seiche, severe weather and volcanic activity hazard profiles. Edits, changes and updates were gathered and discussed, specifically reviewing recent historical records based on number of events, climate change effects, and any community demographic changes within the last five years.

- ***April 29, 2015***

A hazard subcommittee workshop was held with the consultant to update the plan regarding hazardous materials events, terrorism, utility loss and wildland fire hazard profiles. Changes to the hazard profiles were discussed, specifically reviewing recent historical records based on number of events, climate change effects, and any community demographic changes within the last five years.

- ***June 10, 2015***

The Planning Committee met to review the hazard ranking results compiled by R.O. Anderson and from the March 17, 2015 meeting. The hazard profiles were edited based on information received from the subcommittee members. These included avalanche, drought, epidemic, floods, severe weather, utility loss and wildland fire hazard profiles. It was decided by the committee members that epidemic be renamed to infectious disease. Mitigation measures, goals and potential actions for the hazards were reviewed and evaluated with Table 8-2 Mitigation Goals and Potential Actions. Sections One through Four and the introduction of Section Five were also reviewed based on the information gathered by R.O. Anderson and the edits and input received from the subcommittee members. The next steps to updating the plan and future meetings were announced.

- ***July 22, 2015***

The Planning Committee met to review updates to the plan to date. The committee further discussed the hazard ranking results from the June 10, 2015 meeting. The Planning Committee discussed that all hazard sections, where applicable, needed to address the effects of "Climate Change." R. O. Anderson presented the public outreach questionnaire to the group and the format, and content was discussed. Additional discussion took place regarding hazardous materials events and terrorism hazard profiles. It was decided by the committee to change the hazard section terrorism to "acts of violence," with subheadings of terrorism, civil disorder and criminal acts. A mitigation action for back-up generators was added to Table 8-3 as Goal 5.L.

- ***August 26, 2015***

The consultant coordinated with Douglas County GIS, for updates to the figures and map exhibits of the Carson City plan, as well as the vulnerability analysis. The Planning Committee decided that Figure B-5 Potential Winter Storm Areas was not relevant to the plan update, since the entire area of Carson City has the potential of winter storms. All other figures in the Appendix B would be updated with current information.

Craig DePolo from the Nevada Bureau of Mines and Geology presented his revisions and edits to the volcanic activity, landslide, seiche and earthquake hazard sections of the plan. The consultant presented additional edits to Sections One through Five received from the Committee members. The Planning Committee reviewed Section 7 Capability Assessment, Section 8 Mitigation Strategies and Section 9 Plan Maintenance. The public workshop date was tentatively set for, Thursday, October 1, 2015 from 4:00 – 7:00 pm.

- ***October 1, 2015 Workshop***

The public workshop was held at the Carson City Fire Station #1, located at 777 S. Stewart St. Carson City, Nevada. Presentations were made regarding the progress of the 2015 Hazard Mitigation Plan update, the Carson City Fire Department fuels reduction program, information on the flood hazard for Carson City, and information on the earthquake hazards in Nevada and specifically for Carson City. Handouts on emergency preparedness, an information booklet on the 100 year anniversary of the 1915 earthquake in Nevada, and the mitigation questionnaire were provided to the public. Additionally, the public was notified of the website link to locate both the questionnaire online and the draft plan online.

- ***October 7, 2015***

The Planning Committee met to discuss the public workshop and public outreach questionnaire. The consultant presented Section 8, the initial results of the vulnerability analysis and the maps for the Appendix portion of the plan. Review of the draft plan was discussed and edits were made by the committee. The STAPLE+E was given to all committee members in attendance, with directions for filling out the STAPLE+E. The group spent time discussing the mitigation actions and evaluation of the actions to complete the STAPLE+E form. The consultant discussed the final steps for edits and review of the draft plan.

- ***October 2015***

The consultant continued to gather final edits from the Planning Committee members and GIS to complete the updated plan. Additional coordination between the consultant, Public Works, and GIS was needed to compile the most accurate information for critical facility structures affected by hazards. The consultant utilized email correspondence and phone calls to gather this information in order to complete the vulnerability analysis and Section 6 of the plan.

- ***November 2015***

The final edits based on information gathered from the planning committee and the public outreach were completed. It was decided, based on the edits received on the earthquake hazard section that seiche would be incorporated into the earthquake section and not carried through the vulnerability assessment. The HMP was submitted to DEM for review. Final revisions were made based on the DEM review. The finalized draft of the HMP was provided to DEM for submittal to FEMA.

- ***December 2015 – March 2016***

Following FEMA review, the plan was finalized and presented to the Carson City Board of Supervisors for adoption. The Resolution was forwarded to FEMA for final approval.

During the entire planning process with the consultant and the Planning Committee, communication through face-to-face meetings, email, and telephone conversations were conducted. Draft plan documents were posted on the City's website for ease of providing the information to committee members and the citizens of Carson City. The Planning Committee met formally five times, with two Subcommittee workshops and one public outreach workshop during the planning period (March 17 – October 7, 2015).

4.3 PUBLIC INVOLVEMENT

The public and stakeholder input in the previous plan was considered successful by the plan leads and was followed generally in this plan.

Questionnaire

The Carson City Hazard Mitigation Questionnaire was designed to help the Carson City Hazard Mitigation Committee identify the community's concerns about natural and human-caused hazards. The questionnaire was considered an essential development tool to the City's 2015 update to the hazard mitigation plan document. It was decided by the Committee to have the questionnaire available on the City's Emergency Management website, a press release provided the web link to the questionnaire and hard copies of the questionnaire available at the public workshop, held October 1, 2015. Approximately 111 questionnaire responses were returned via the workshop and online. Questionnaire responses were tallied and written comments were reviewed. The questionnaire and the results can be found in Appendix D.

Press Release & Public Awareness

A press release was posted on the City's website and emails were sent to BAC TV, KOLO TV, the Nevada Appeal, Reno Gazette-Journal and News Carson City. The press release can be found in Appendix D. Additionally, all committee planning meeting agendas were posted at the City offices and Carson City Fire Department. The public was welcome and invited to attend all meetings and the workshop.

Letters to Stakeholders and Neighboring Communities

The City emailed letters (see Appendix D) regarding the update of the HMP to the following entities:

- FEMA

- State NDEM, NDOT, SPWB, NDEP
- State Assembly & Senate Representative
- Counties of Washoe, Douglas, Lyon and Storey
- Carson City Public Airport
- Carson / Tahoe Regional Healthcare
- National Weather Service
- Western Nevada College
- Washoe Tribe of Nevada

FEMA will be sent the plan for review. The neighboring counties were aware of the planning effort and offered to provide answers to specific questions.

4.4 INCORPORATION OF EXISTING PLANS AND OTHER RELEVANT INFORMATION

During the planning process, the Planning Committee reviewed and incorporated information from existing plans, studies, reports, and technical reports into the HMP. A synopsis of the sources used follows.

- ***Carson City Building Code*** **(September 2013):** These regulations concern zoning districts, variances, and general development standards within Carson City and include the 2012 International Building Codes.
- ***Carson City Fire Code*** **(September 2013)*:*** This document includes a wildland/urban interface section that delineates regulations for building and maintaining homes in wildland fire prone areas, as per the 2012 International Fire Code.
- ***Carson City Mass Illness Plan*** **(Public Health Emergency Operations Plan,** *heard by Carson City as Information only on August 28, 2014):* This plan addresses the City's response to a pandemic/influenza outbreak.
- ***Carson City Master Plan – Land Use Element*** **(Carson City Planning April 2006):** Guiding principle includes a stewardship section which addresses Hazard Mitigation.
- ***Carson City Sandbagging Plan 2007:*** This document includes a plan in case of flood for sand bagging specific identified areas.
- ***Carson River Watershed Regional Floodplain Management Plan*** **(Carson Water Subconservancy District, 2013 adopted by Resolution No. 2013-R-40).** This plan provides strategies for floodplain management that can be applied regionally as well as locally.
- ***Community Wildfire Protection Plan*** **(July 2009):** This document includes findings and recommendations for mitigating the threat to property from wildland fires.

- ***Emergency Operations Plan**:* This document is the main reference source for managing disasters and large scale emergencies in Carson City.
- ***Carson River Geographic Response Plan**:* This is a regional plan covering five counties in two states. The plan was developed to protect the health, safety, environment, and property (both public and private) from the effects of hazardous materials incidents in or near the Carson River.
- ***Carson City Hazardous Materials Response Plan**:* This plan provides guidance to emergency response personnel on the general plan of action for a response to a hazardous materials emergency and provides for a resource directory.
- ***Emergency Action Plan (*Brunswick Canyon Dam – Manhard Consult. Mar. 2005, Eagle Valley Dam - MacTec Jan. 2009, Shanandoah Heights Dam – Manhard Consult. Oct. 2006):** This plan provides a tool for development service personnel and public safety agencies to ensure public safety and minimize property damage.
- ***The State of Nevada Enhanced Hazard Mitigation Plan**:* This plan, prepared by NDEM, was used to ensure that the City's HMP was consistent with the State's Plan.
- ***FEMA Flood Insurance Study for Carson City, NV (*FEMA 2009*)*:** This outlined the principal flood problems and floodplains within the City.
- ***Washoe Tribe of Nevada & California Hazard Mitigation Plan 2005***

The following FEMA guides were also consulted for general information on the HMP process:

- ***How-To Guide #1: Getting Started: Building Support for Mitigation Planning* (FEMA 2002c)**
- ***How-To Guide #2: Understanding Your Risks – Identifying Hazards and Estimating Loss Potential* (FEMA 2001)**
- ***How-To Guide #3: Developing the Mitigation Plan: Identifying Mitigation Actions and Implementing Strategies* (FEMA 2003a)**
- ***How-To Guide #4: Bringing the Plan to Life: Implementing the Hazard Mitigation Plan* (FEMA 2003b)**

A complete list of the sources consulted is provided in Section 10, References.

A hazard analysis includes the identification and screening of each hazard and subsequent profiling of each hazard. Hazard identification is the process of recognizing the natural and human-caused events that threaten an area. Natural hazards result from unexpected or uncontrollable natural events of sufficient magnitude. Human-caused hazards result from human activity and include technological hazards and terrorism. Technological hazards are generally accidental or result from events with unintended consequences, for example, an accidental hazardous materials release. Terrorism is defined as the calculated use of violence or the threat of violence to attain goals that are political, religious, or ideological in nature.

Even though a particular hazard may not have occurred in recent history in the study area, all hazards that may potentially affect the study area are included in the screening process. The hazards that are unlikely to occur or for which the risk of damage is accepted as being very low, are eliminated from consideration.

All identified hazards will be profiled by describing hazards in terms of their nature, history, magnitude, frequency, location, and probability. Hazards are identified through the collection of historical and anecdotal information, review of existing plans and studies, and preparation of hazard maps of the study area. Hazard maps are used to determine the geographic extent of the hazards and define the approximate boundaries of the areas at risk.

5.1 HAZARD IDENTIFICATION AND SCREENING

The requirements for hazard identification, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Risk Assessment – Overall

Identifying Hazards
§201.6(c)(2)(i): [The risk assessment shall include a] description of the type of all natural hazards that can affect the jurisdiction.
Element

- Does the new or updated plan include a description of all the types of all natural hazards that affect the jurisdiction?

Source: FEMA, March 2008.

The first step of the hazard analysis is the identification and screening of hazards, as shown in Table 5-1.

During the first HMP meeting, the Planning Committee (comprised of representatives from City agencies, City governments, local businesses, State Division of Emergency Management and Western Nevada College) using *The State of Nevada Enhanced Hazard Mitigation Plan* and the City's previous plan as a starting point and reviewing previous disaster declarations, the Committee reviewed 13 existing hazards of the plan (10 natural hazards and 3 human-caused hazards.)

Each hazard was reviewed for climate change and to the extent each hazard was affected, information was added to the Extent and Probability of Future Events section of each hazard.

Table 5-1 Identification and Screening of Hazards

Hazard Type	Should It Be Profiled?	If Yes is this a New Hazard?	Explanation
Avalanche	Yes	No	Carson City is located in areas prone to frequent or significant snowfall. No historical record of avalanche or damage.
Drought	Yes	No	Statewide drought declarations were issued in 2013 -2015.
Earthquake	Yes	No	Several active fault zones pass through the City.
Infectious Disease	Yes	No	This hazard was reviewed by the committee members and it was decided to change the hazard name from epidemic to infectious disease, because of the number of outbreaks that have occurred in the past five years locally and nationally.
Flood	Yes	No	Flash floods and other flood events occur regularly during rainstorms.
Hazardous Materials	Yes	No	Carson City has facilities that handle or process hazardous materials.
Landslide	Yes	No	No significant historic events have occurred in the City; however due to the potential it was decided to keep in the plan.
Severe Weather Snow/Ice/Windstorm	Yes	No	Carson City is susceptible to severe weather. Previous events have caused damage to property.
Seiche	Yes	No	No recent historic events have occurred however the City boundary does include part of Lake Tahoe. If a large earthquake occurred in the Tahoe basin a seiche may impact roads and utility lines. The committee decided to keep this hazard in the plan as an awareness component, as future development around the lake is possible. Although impact is low, it was decided to keep as a moderate hazard, as any recovery effort would be a high impact to city resources.
Volcano	Yes	No	No significant historic events have occurred in the City. However there is a chance of the effects of ash fall to the city from neighboring state's dormant volcanos becoming active.
Utility Loss	Yes	No	This event has occurred and was addressed in the previous plan. The City combined radon gas, water disruption and communication loss in this assessment.
Acts of Violence	Yes	No	This hazard is addressed due to the significant number of state capitol buildings present. The committee decided to change the hazard name from terrorism to acts of violence with sub-categories of criminal acts, civil disorder and terrorism.
Wildland Fire	Yes	No	The terrain, vegetation, and weather conditions in the region are favorable for the ignition and rapid spread of wildland fires.

Assigning Vulnerability Ratings

During a Committee meeting the members were tasked to prioritize the hazards by their total impact in the community. An exercise requiring the committee to complete a form which tabulated their ratings of each hazard was accomplished. The exercise formula took into account the historical occurrence of each respective hazard, the potential area of impact when the disaster does occur, and the magnitude. Please see Table 5-2 below for scoring criteria.

It is important to note that hazards of the same magnitude and the same frequency can occur in similar sized areas; however, the overall impact to the areas would be different because of population densities and property values in the areas impacted.

Table 5-2 Vulnerability Ratings Rubric

		Frequency	Magnitude/Severity	Warning Time	Duration
Lowest	1	1000+ years	1-5% Damaged; No deaths; Local	> 48 hrs	1 - 3 Days
	2	100 -1000 years	5-15%; No deaths; City/Community	24 to 48 hrs	4 - 7 Days
	3	10 -100 years	15-30%; < 5 Deaths; County	12 to 24 hrs	8 - 14 Days
	4	5 -10 years	30-50%; > 5 Deaths; State	6 to12 hrs	15 - 20 Days
Highest	5	0 - 5 years	50+%; Significant Deaths; Region IX	< 6 hrs	20+ Days

The Committee referenced the NDEM historical records, and data provided in the 2010 Carson City Hazard Mitigation Plan, as well as HAZUS runs from the Nevada Bureau of Mines and Geology (NBMG) for scientific data used for magnitude, economic and frequency scores based on historical frequencies and/or projected probabilities of the hazards identified, as well as members' knowledge of previous occurrences and technical expertise.

The Committee calculated scores for magnitude, economic and frequency based on historical frequencies and/or projected probabilities of the hazards identified.

Upon obtaining total scores for each hazard, the Planning Committee utilized the scores to analyze and prioritize the hazards to focus upon during the profiling, vulnerability assessment and mitigation strategy. Table 5-3 provides the summary of the hazards scoring results of both the members present at the meeting and those that supplied feedback via e-mail after the meeting.

The Planning Committee determined that the 13 hazards still pose a threat to the City. Natural hazards include: avalanche, drought, earthquakes, floods, infectious disease, landslide, seiche, severe weather, volcano, and wildfire. Human-caused hazards include: acts of violence, hazardous materials, and utility loss.

Table 5-3 Hazards Rating

		Total
	Earthquakes	212
	Wildland Fire	184
High	Floods	165
	Severe Weather	152
	Landslides	146
	Acts of Violence	146
	Hazardous materials	134
	Utility Loss	129
	Drought	126
	Seiche	120
	Infectious Disease	117
Low	Avalanche	111
	Volcanic Activity	97

The Committee then discussed the results of the exercise and through Committee deliberation earthquake, infectious disease, flood, acts of violence, and wildfire remained as high hazards. Drought, utility loss, landslide, seiche, and severe weather were considered moderate hazards. It was determined by the committee that landslide be changed from a moderate ranking to a low ranking and that hazardous materials and severe weather be changed from a high ranking to a moderate ranking. Avalanche remained as low and volcanic activity was changed from low to a moderate hazard by the committee. Seiche was combined with the earthquake hazard profile.

Acts of violence, because of the sensitive nature of the hazard, will not be carried through the vulnerability assessment. Also, because of their low ranking avalanche, landslide and seiche will not be carried through the vulnerability assessment either.

Should the risk from these hazards increase in the future, the HMP can be updated to incorporate a vulnerability analyses for these hazards.

5.2 HAZARD PROFILES

The requirements for hazard profile, as stipulated in the DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Risk Assessment – Profiling Hazards

Profiling Hazards

Requirement §201.6(c)(2)(i): [The risk assessment **shall** include a] description of the location and extent of all natural hazards that can affect the jurisdiction. The plan **shall** include information on previous occurrences of hazard events and on the probability of future hazard events.

Element

- Does the risk assessment identify the **location** (i.e., geographic area affected) of each natural hazard addressed in the plan?
- Does the risk assessment identify the **extent** (i.e., magnitude or severity) of each hazard addressed in the plan?
- Does the plan provide information on **previous occurrences** of each hazard addressed in the plan?
- Does the plan include the **probability of future events** (i.e., chance of occurrence) for each hazard addressed in the plan?

Source: FEMA, March 2008.

The specific hazards selected by the Planning Committee for profiling have been examined in a methodical manner based on the following factors:

- Nature
- History
- Location of future events
- Extent of future events
- Climate change
- Probability of future events

Each hazard was reviewed for climate change. To the extent each hazard was affected, climate change considerations were incorporated in the *Location, Extent, and Probably of Future Events* section of each hazard profile.

The hazards profiled for the City and presented in Section 5.2 are in alphabetical order. The order of presentation does not signify the level of importance or risk. Committee members considered expert in the specific hazard (Flood Plain Manager for Floods) were tasked to review the previous HMP and make modifications to each profile. Revisions were made to update the historical information and new information was incorporated for current updates to this plan.

5.2.1 Acts of Violence

Planning Significance - High

5.2.1.1 Nature

The Carson City Sheriff's office utilizes the Policy 468 First Amendment Assemblies from their policy manual which states "Individuals or groups present on the public way, such as public facilities, streets or walkways, generally have the right to assemble, rally, demonstrate, protest or otherwise express their views and opinions through varying forms of communication, including the distribution of printed matter. These rights may be limited by laws and ordinances regulating such matters as the obstruction of individual or vehicle access or egress, trespass, noise, picketing, distribution of handbills and leafleting, and loitering. Participant behavior during a demonstration or other public assembly can vary. These may include but are not limited to:

- Lawful, constitutionally protected actions and speech;
- Civil disobedience (typically involving minor criminal acts) and;
- Rioting.

All of these behaviors may be present during the same event. The purpose of a law enforcement presence at the scene of public assemblies and demonstrations should be to preserve the peace, to protect life and prevent the destruction of property."

The Department of Justice (DOJ) Federal Bureau of Investigation (FBI) defines **terrorism** as "the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives" (28 C.F.R. Section 0.85). The FBI further describes terrorism as either domestic or international, depending on the origin, base, and objectives of the terrorist organization. For the purpose of this Section, the FBI uses the following definitions

- Domestic terrorism is the unlawful use, or threatened use, of force or violence by a group or individual based and operating entirely within the United States or Puerto Rico without foreign direction committed against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof in furtherance of political or social objectives.
- International terrorism involves violent acts or acts dangerous to human life that are a violation of the criminal laws of the United States or any state, or that would be a criminal violation if committed within the jurisdiction of the United States or any state. These acts appear to be intended to intimidate or coerce a civilian population, influence the policy of a government by intimidation or coercion, or affect the conduct of a government by assassination or kidnapping. International terrorist acts occur outside the United States or transcend national boundaries in terms of the means by which they are accomplished, the persons they appear intended to coerce or intimidate, or the locale in which their perpetrators operate or seek asylum.
- Weapons of Mass Destruction (WMD) associated with terrorism are defined as nuclear, biological and chemical in origin. Technological terrorism is defined as the intentional

disruption in the nation's data control systems. Attacks on financial, business, and governmental computer networks are being considered as technological terrorist-related acts.

Civil disorder/riotous behavior refers to a situation where groups intentionally choose not to observe the law. The most common reason for this activity is to bring attention to an issue, cause, or to the group's agenda. Civil disorder may also be defined as random acts of violence by three or more persons with the potential to injure people or damage property, but that does not meet the definition of a terrorist act. Civil disorder can take the form of small gatherings or large groups that block or impede access to a building, or disrupt normal activities by generating noise and intimidating people. Other examples range from peaceful sit-ins to a full-scale riot in which a group destroys property and disregards or retaliates against law enforcement response. Civil disorder varies widely in size and scope, and its overall impact is generally low. Civil disorder/riotous behavior can be further defined into the following four categories:

- Civil Disobedience – The refusal to obey civil laws in an effort to affect change in governmental policy or legislation.
- Protest – A usually organized demonstration of disapproval.
- Civil Disturbance – Group acts of violence and disorder prejudicial to public law and order.
- Rioting – A violent disturbance of the public peace by a statutorily defined number of people assembled for a common purpose.

Criminal Acts refers to an intentional act against the public to include mass casualty incidents and workplace violence. When mass causality incidents occur, emergency management teams are called upon to assist and mitigate the impact to the city. There have been several incidents in Carson City in the last decade. Criminal acts can be random in nature or preplanned and perpetrated by individuals or groups.

5.2.1.2 History

Terrorism

- Although no specific terrorism events have occurred in the last ten year history within the Carson City boundary, in May 2002, Lucas Helder was arrested for planting 18 pipe bombs in five states, including a location in Washoe County, NV. The accused mailbox bomber told authorities that he was planting the bombs in a pattern to show a smiley face during his five-state weekend spree, and that he was fully aware that people would be injured when they exploded.

Civil Disorder

- **March 11, 2015: Immigration protest in front of capitol blocking traffic**

  More than 100 people peacefully demonstrated Wednesday in front of the Nevada State Capitol Building in Carson City, Nevada protesting immigration issues, and specifically Nevada Attorney General Adam Laxalt's decision to join a lawsuit with 24 states challenging executive actions by President Barack Obama on immigration.

The demonstrators came throughout the state of Nevada make their plea to keep Nevada families together. The demonstration was organized by the Las Vegas Culinary Union and the Progressive Leadership Alliance of Nevada. Motorists, however, were not happy about the protest disrupting traffic through Carson Street past the capitol during lunch hour.

The protest was peaceful and no arrests were made. Carson City Sheriff's Office and Capitol Police allowed the demonstrators to protest, due to the number of people arriving from around the state to Carson City. Traffic was diverted around Carson Street to allow for the demonstration, which moved northbound through downtown.

- **August 25, 2014 Five arrested after Saturday night melee at Fuji Park**

  A disturbance call during a party at Fuji Park in Carson City led to the arrests of five people after a near-riot broke out in which officers were punched and kicked by several suspects. Officers from Douglas County and the Nevada Highway Patrol were called in as backup to control the melee.

  A Carson City man faces the most serious charge of felony assault after allegedly kicking an officer and knocking her to the ground. His bail was set at $22,500. Another officer reports being randomly punched in the head and face. One suspect was hit by an officer, who was hitting him and resisting arrest. According to dispatch via police scanner, officers deployed pepper spray and at least one officer was treated for injuries by the Carson City Fire Department.

  Also arrested in the incident was a 48-year-old man on a gross misdemeanor charge of battery on an officer after he allegedly took swings at one officer, punching him in the face and chest, and a 19-year-old man for misdemeanor violation of alternative sentencing and minor consuming.

- **June 3, 2013: Five arrested in Saturday night baby shower melee in Carson City**

  Four Carson City men and one woman were arrested and face multiple charges after law officers were assaulted when they attempted to break up a loud baby shower party.

  The Nevada Highway Patrol and the Douglas County Sheriff's Office was called in as backup as the party in the 1700 block of North Curry Street grew out of control, with three known gang members pushing, shoving and threatening officers.

  Those arrested include a 35-year-old man who faces a gross misdemeanor charge of battery on a police officer and a misdemeanor charge of resisting; a 23-year-old who faces a gross misdemeanor charge of battery on a police officer and misdemeanor obstructing, resisting; a 37-year-old who faces a gross misdemeanor charge of battery on an officer and misdemeanor resisting, obstructing; a 21-year-old man who faces a charge of misdemeanor obstructing and a 27-year-old woman who faces a misdemeanor obstructing charge.

Criminal Acts

- **IHOP: Sept 6, 2011** International House of Pancakes shooting incident in Carson City. On Sept. 6, 2011, Nevada Guardsmen Lt. Col. Heath Kelly, 35, Master Sgt. Christian Riege, 38, Sgt. 1st Class Miranda McElhiney, 31, and South Tahoe resident Florence Donovan-Gunderson, 67, were killed during an incident. Two other Soldiers and seven other patrons suffered injuries during the shooting rampage.

- **Sheriff shooting/domestic violence** shooting death of Carson City Deputy Carl Howell. Howell was killed Saturday, August 15, 2015 when responding at 2:18 a.m. to a domestic call near the 4100 block of Montez Drive after a man opened fire and Howell returned fire. The suspect died at the scene and Howell later died at the hospital.

5.2.1.3 Location, Extent, Probability of Future Events

Terrorist acts are likely to occur in populated areas or places where people gather. Sporting events and public facilities including the State Capital and legislative buildings, county courthouses and correctional facilities are specific locations where civil disorder may occur. Criminal acts commonly occur at schools, hospitals, restaurants, and casinos.

The overall magnitude and potential severity of impacts from terrorism, civil disorder and criminal acts is considered **Moderate** in Carson City. Considering a worst case scenario, civil disorder or criminal acts events can require Quad County, then state level support to respond to the incident, can impact critical facilities and disrupt services for 1 to 3 days, and have citywide economic impacts. More typical civil disorder and criminal acts events are handled at the city level, disrupt services for less than one day, and economic impacts are limited to the immediate community or part of the city involved.

Terrorism

All areas of Carson City are potentially susceptible to the impacts of terrorism though the risk is comparatively higher for the State Capitol Building, Supreme Court Building and Legislative Building, specifically every two years when the Legislature is in session, bringing potential protest groups into the city; as well as the potential at the State Computer Center , Carson City Airport, the Nevada State Military facilities in and around the Capital City and the downtown corridor. Special events (drawing up to 5,000 to 40,000 individuals per day), above-ground fuel tank farm, and the sewage plants are also susceptible to terrorist attacks. Additionally, rural areas of Nevada provide ample space to conduct training and practice employment of terrorist weapons without observation. Although Carson City, itself does not have extreme rural areas within the city boundaries, adjacent counties are in close proximity to the Capital City that do have these rural areas. The expanding presence of MDTO's (Major Drug Trafficking Organizations) in the U.S. is also likely to result in narco-terrorism events associated with protecting the lucrative drug traffic. With the recent adoption of medical marijuana facilities approved in the State and the Capital City, this has become an area of future concern, to be considered in this section and the Hazardous Materials section of the plan. Based on the Homeland Security Threatened Level System, it is anticipated that terrorism will remain a high threat to the United States into the foreseeable future. Because terrorism events typically are focused on a single high payoff area or facility, estimated damage is less than one percent damage to facilities in Carson City.

Civil Disorder
Based on assessment of previous occurrences and frequency of contributing factors of civil disorder and criminal acts, probability of future occurrence is considered Moderate, with an estimated occurrence of one incident every two years.

Criminal Acts
The overall magnitude and potential severity of impacts from criminal acts is considered high in Carson City. Assessment of probability of future criminal acts events in Carson City is gauged primarily on historical data. The consensus of the Planning Committee is that probability of future events is high.

5.2.2 Avalanche

Planning Significance - Low

5.2.2.1 Nature

An avalanche is a mass of snow sliding down a mountainside. An avalanche occurs when gravitational pull exceeds the bonding strength of the snow cover. There are four factors that contribute to an avalanche; a steep slope, a snow cover, a weak layer in the snow cover, and a trigger. About 90 percent of all avalanches start on slopes of the 30-45 degrees; about 98 percent of all avalanches occur on slopes of 25-50 degrees. Avalanches release most often on slopes above timberline, such as gullies, roads cuts, and small openings in the trees. Avalanches can also occur on small slopes well below timberline, such as gullies, road cuts, and small openings in the trees. Very dense trees can anchor the snow to steep slopes and prevent avalanches from starting; however, avalanches can release and travel through a moderately dense forest.

The vast majority of avalanches occur during and shortly after winter storms, during the winter and spring months between January and April. The most avalanche-prone months are in order, February, March, and January. The avalanche danger increases with major snowstorms and periods of thaw. Duration of avalanche impacts is generally one to three days or less.

5.2.2.2 History

Historically there are no known recorded avalanche events in Carson City. However, due to the potential of such occurrences in the Lake Tahoe area; sloping areas that may be prone to an avalanche event, the Planning Committee has decided to profile this hazard.

5.2.2.3 Location, Extent, and Probability of Future Events

The area affected is the western section of Carson City within the higher altitudes of the Sierra Nevada Mountains and near Lake Tahoe. There are no homes within the avalanche areas however there is Nevada State Route Highway 28 and some electrical and sewer utilities along the road. The avalanche hazard would not have disaster magnitude and would be rated as an emergency incident. There is a low probability of future events based on no previous occurrences. Currently, avalanche warnings are conducted by the Sierra Avalanche Center, for the back country areas of Lake Tahoe.

5.2.3 Drought

Planning Significance - Moderate

5.2.3.1 Nature

Drought is a normal, recurrent feature of virtually all climatic zones, including areas of both high and low rainfall, although characteristics will vary significantly from one region to another. Erroneously, many consider it a rare and random event. It differs from normal aridity, which is a permanent feature of the climate in areas of low rainfall. Drought is the result of a natural decline in the expected precipitation over an extended period of time, typically one or more seasons in length. Other climatic characteristics, such as high temperature, high wind, and low relative humidity, impact the severity of drought conditions. It is critical to note that the region depends almost exclusively on winter snowpack and rainfall for its water supply. Rains from summer thunderstorms do little to recharge reservoirs and ground water tables.

Drought can be defined using both conceptual and operational definitions. Conceptual definitions of drought are often utilized to assist in the widespread understanding of drought. Many conceptual definitions portray drought as a protracted period of deficient precipitation resulting in extensive damage to agricultural crops and the consequential economic losses. Operational definitions define the beginning, end, and degree of severity of drought. These definitions are often used to analyze drought frequency, severity, and duration for given periods of time. Such definitions often require extensive weather data on hourly, daily, monthly, or other time scales and are utilized to provide a greater understanding of drought from a regional perspective. Four common definitions for drought are provided as follows:

- Meteorological drought is defined solely on the degree of dryness, expressed as a departure of actual precipitation from an expected average or normal amount based on monthly, seasonal, or annual time scales.
- Hydrological drought is related to the effects of precipitation shortfalls on stream flows and reservoir, lake, and groundwater levels.
- Agricultural drought is defined principally in terms of soil moisture deficiencies relative to water demands of plant life, usually crops.
- Socioeconomic drought associates the supply and demand of economic goods or services with elements of meteorological, hydrologic, and agricultural drought. Socioeconomic drought occurs when the demand for water exceeds the supply as a result of weather-related supply shortfall. This may also be called a water management drought.

A drought's severity depends on numerous factors, including duration, intensity, and geographic extent as well as regional water supply demands by humans and vegetation. Due to its multi- dimensional nature, drought is difficult to define in exact terms and also poses difficulties in terms of comprehensive risk assessments. Implications from this drought include increased risk of wildfires, water shortages, insect infestations, and crop damages.

Drought differs from other natural hazards in three ways. First, the onset and end of a drought are difficult to determine due to the slow accumulation ("creeping hazard") and lingering of effects of an event after its apparent end. Second, the lack of an exact and universally accepted definition adds to the confusion of its existence and severity. Third, in contrast with other natural hazards, the impact of drought is less obvious and may be spread over a larger geographic area. These characteristics have hindered the preparation of drought contingency or mitigation plans by many governments.

5.2.3.2 History

The US Drought Monitor (USDM) produced weekly since 2000 can be used to visualize trends in drought over the region. The map, which rates drought from D0 (abnormally dry) to D4 (exceptional drought), is based on measurements of climatic, hydrologic and soil conditions as well as reported impacts and observations from more than 350 contributors around the country.

According to information from the USDM, Nevada has been, for the most part, in some degree of drought since 2000, as seen in **Figures 5-1 and 5-2.**

Figure 5-1 Drought Severity Comparison
April 15 2014 vs April 7, 2015

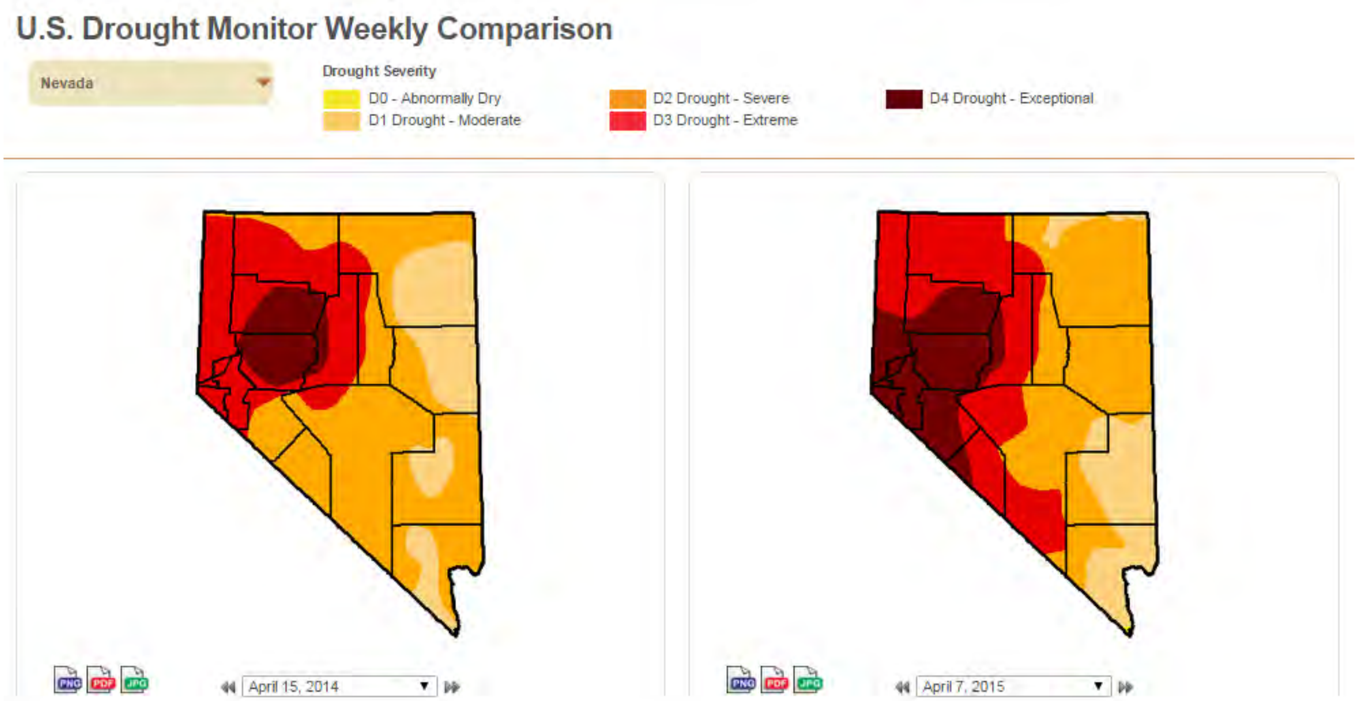


Figure 5-2 Drought Severity Comparison
November 29, 2011 vs November 25, 3014

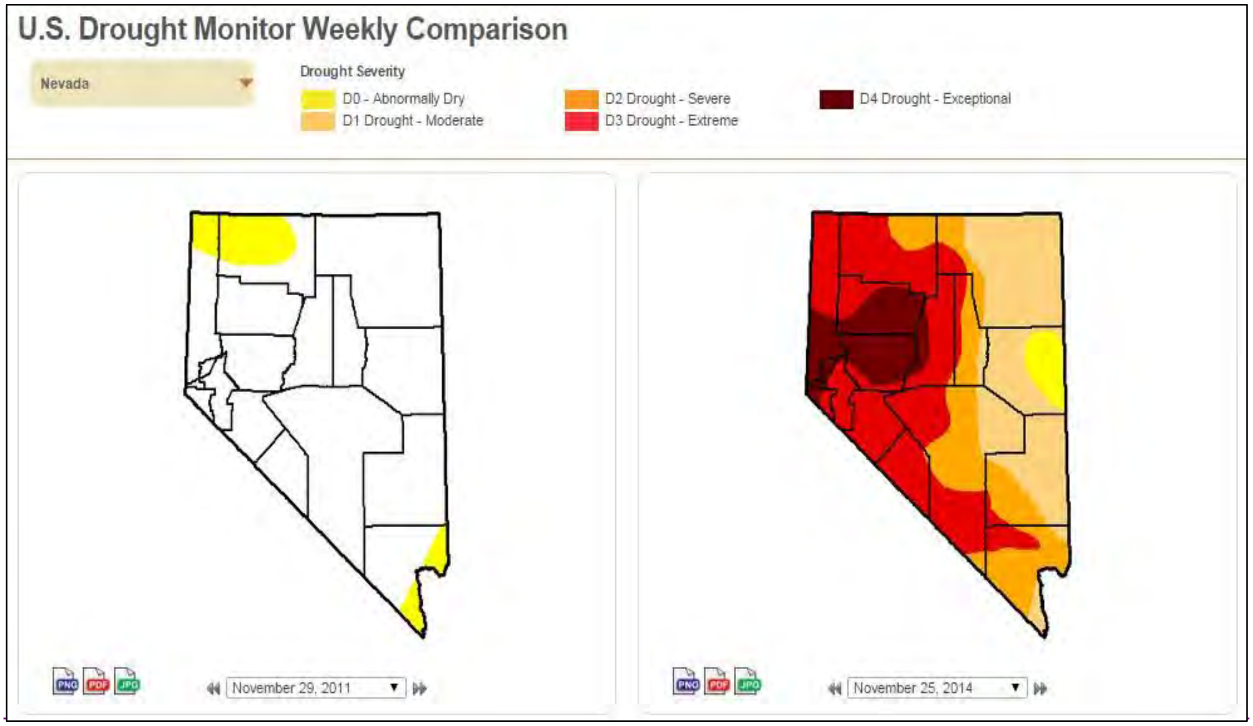
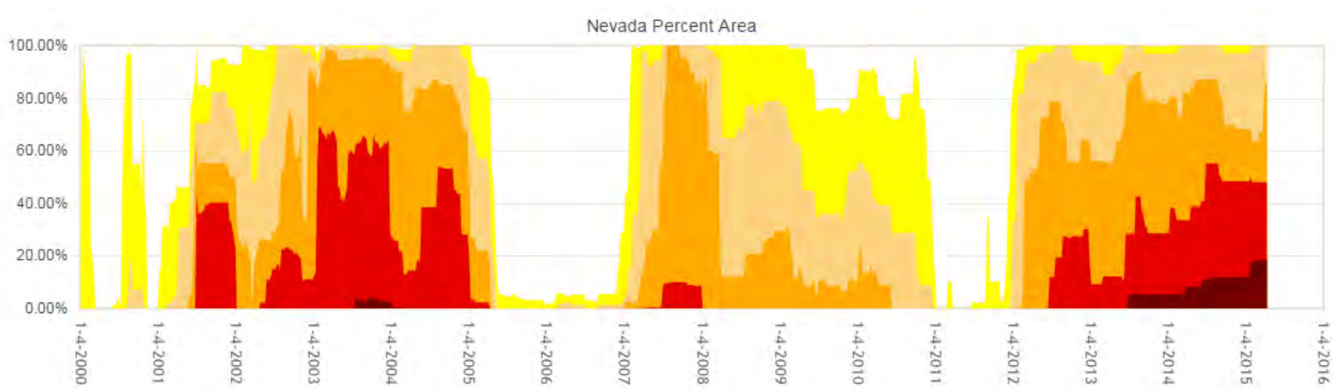


Figure 5-3 shows the percentage of the state suffering from a given drought level (D0-yellow, D1-tan, D2-orange, D3-red, D4-dark red). During these same periods Carson City has suffered varying degrees of drought as well. The ongoing drought since 2012 is the most severe the region has seen since at least 2000, exacerbated by abnormally warm temperatures year-round, below average numbers of winter storms, and the resultant meager snowpack.

Figure 5-3 Nevada Percent Area



Two pronounced but relatively brief wet periods are noted, from 2005-6 and 2010-11, where the region saw particularly wet/snowy winters including one major flood in December 2005.

5.2.3.3 Location, Extent, and Probability of Future Events

In Carson City, moderate, severe and extreme drought conditions (D-0 to D-4 rated intensities on the U.S. Seasonal Drought Monitor) have persisted over the past five years. The U.S. Seasonal Drought Outlook forecasts that Nevada, including Carson City, will continue to be affected by drought. However impacts to Carson City will initially be less than other communities in Nevada. Carson City relies primarily on ground water; however over the course of many years they have practiced conjunctive use of surface water and ground water and have developed and utilized a ground water recharge program which helps maintain higher levels in the aquifers from which they pump in effect banking water for future use. Also the City is not a heavily agricultural area, this helps reduce the demand for surface water and pumping for crop irrigation.

Carson City water system operations are constantly monitored and adjusted to maintain peak efficiencies with care and concern for the use of both ground and surface water resources. Carson City has continued to develop other sources such as the regional water line project also known as the north/south transmission project, which will allow us to capture and utilize our Carson Valley water from Minden. This line is in service currently, this line allows the City to periodically rest and recover some of our Eagle Valley and Dayton Valley wells thus helping reduce strain on the aquifer. The second phase of the regional water line project is an east west transmission main which will be completed in 16/17 FY and will provide the City, the ability to supply water to the west side of town again reducing the load on the wells helping with aquifer recover and allowing the City to better manage our surface water.

Climate Change

There is an expectation that the effects of climate change will result in rising snow levels. The rising snow levels will result in a large fraction of winter precipitation falling as rain instead of snow. As a result of the predicted changing precipitation source, maintaining the current practice of conjunctive use and ground water recharge will become even more important for maintaining and storing water supplies.

Disruption of services is highly variable: in urban areas with municipal water systems and reservoir storage, disruption may be quite minimal during a typical few-year drought. In that same drought, however, disruption of water supplies to rural and agricultural communities, it may be considerable as those areas depend more on ground water which can be depleted quickly in drought conditions.

Drought is one of the least predictable hazards. The current state of seasonal weather prediction science is such that it is nearly impossible to predict well in advance the beginning or the ending of droughts with meaningful confidence levels. With that said, periods of drought have regularly occurred in the recent history of Carson City and Nevada, and as such drought can be expected to occur with some regularity in the future.

5.2.4 Earthquake

Planning Significance - High

5.2.4.1 Nature

An earthquake is a sudden motion of a fault that creates shaking and trembling of the Earth. The effects of an earthquake can be felt far beyond the site of its occurrence. Earthquakes usually occur without warning and, after just a few seconds, can cause massive damage and extensive injuries and casualties. The most common effect of earthquakes is ground motion, or the vibration or shaking of the ground during an earthquake.

The severity of ground motion generally increases with the magnitude of an earthquake (amount of energy release) and decreases with distance from the fault or epicenter of the earthquake. The shaking is made up of waves in the Earth's interior, known as body waves, and waves that travel along the Earth's surface, known as surface waves. There are two kinds of body waves: P (primary) waves are longitudinal or compressional waves similar in character to sound waves that cause back-and-forth oscillation along the direction of travel, and S (secondary) waves, also known as shear waves, which are slower than P waves and cause the ground to vibrate from side-to-side (horizontal motion). There are also two kinds of surface waves: Raleigh waves, which have retro-elliptical motion, and Love waves, which have side-to-side motion. Surface waves travel more slowly and tend to have longer periods than body waves.

An additional hazard associated with earthquakes is surface faulting. Surface faulting occurs when an earthquake breeches the ground surface along a fault and forms a scarp or tear. Displacement along faults, both in terms of length and width, varies but can be significant (e.g., from several inches to 20 feet), as can the length of the surface rupture (e.g., as long as a few hundred feet to 50 miles). Surface faulting can cause severe damage to buildings constructed over faults, as well as railways, highways, pipelines, and tunnels. If the amount of surface offset can be anticipated, there are mitigation techniques that can help minimize damage to structures that have to cross faults (like pipelines).

Earthquake-related ground failure due to liquefaction is a secondary seismic hazard. Liquefaction occurs when seismic waves pass through saturated granular soil, distorting its granular structure and causing some of the granules to collapse into the empty spaces between grains. This increases the pore-water pressure and when this pressure is sufficient, soil can behave like a fluid for a brief period and flow. Liquefaction causes lateral spreads (horizontal ground movements of commonly many feet wide, but up to 100 feet), flow failures (massive flows of soil, typically hundreds of feet, but up to miles), and loss of bearing strength (which can cause structures to settle or tip). Thus, liquefaction can cause severe damage to property. When liquefied soil gains a pathway to the surface, it can erupt as a mixture of sand and water, and build small sand "volcanoes".

The size of an earthquake is commonly expressed in two ways, earthquake magnitude (M) and Modified Mercalli Intensity (MMI). Earthquake magnitudes are correlated to the energy release of an earthquake and are determined by seismologists from seismic waves. Earthquake magnitudes also can be correlated with fault rupture length and maximum surface displacement, and is the basis for earthquake scenario models. The Modified Mercalli Intensity scale is based on the effects of an earthquake and considers human experience, shaking effects, and inflicted damage.

There are two general effects from earthquakes to water bodies, such as Lake Tahoe, and these are called seiches and tsunamis. A seiche is a back-and-forth oscillation of an enclosed body of water that is excited by seismic waves. It is similar to the sloshing back-and-forth that can occur in a bath tub when the water is disturbed. A tsunami is a wave or displacement of water that occurs when there is a fault offset of the floor of a water body, or if there is a large landslide into a water body. Tsunami forming landslides may be triggered by seismic waves, but can also form at times when there is no earthquake. A tsunami can develop into a seiche as the disturbance dissipates by sloshing back-and-forth. A seiche or tsunami can occur at Lake Tahoe and the people along the shoreline would be the most effected. When an earthquake occurs at Lake Tahoe, there will not be enough time to determine if a tsunami has formed and send out a warning. The response of people to a local earthquake will have to be automatic, to head to higher ground immediately when the shaking subsides.

5.2.4.2 History

Nevada is ranked third in the Nation, having the highest number of large earthquakes. Western Nevada is the most seismically active part of the state, being part of the Basin and Range extensional province and the Walker Lane, which carries part of the Pacific and North American plate motion. Carson City has been strongly shaken many times in the past (**Table 5-4**) and has a high rate of background seismicity. **(Fig. 5-4**)

Table 5- 4 Major Historical Earthquakes That Have Produced Strong Ground Motion in Carson City

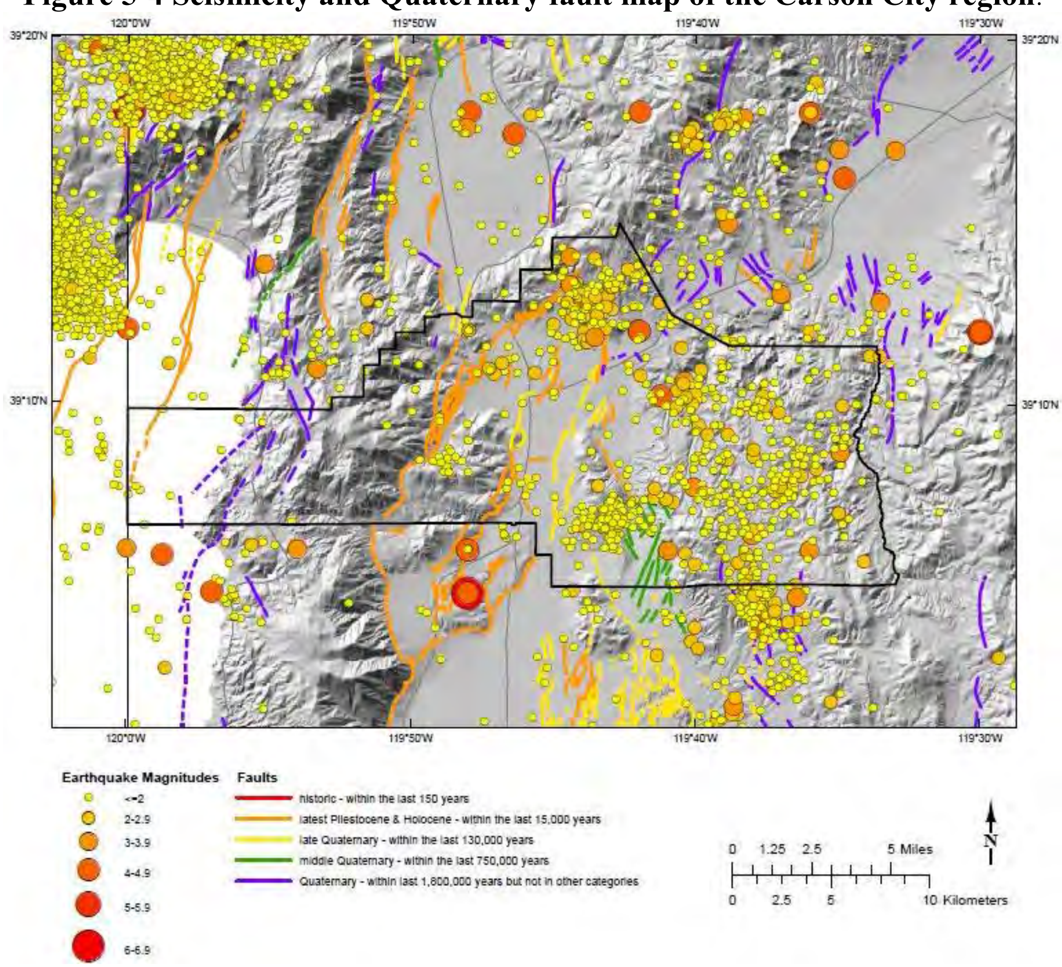
Date	Magnitude	Nearest Community	Effects	MMI CC*
Sept. 3, 1857	6.3	Incline Village	unknown	**?**
March 15, 1860	6.5	Reno	content damage	**VI**
May 30, 1868	6.0	Virginia City	two eqs. panic	**VI**
Dec. 27, 1869	6.4, 6.2	Virginia City	content dam, wall cracks	**VI+**
June 3, 1887	6.5	Carson City	build. damage, liquef	**VII-VIII**
Jan. 27, 1896	5+	Carson City	cracked walls, fallen plaster	**VI+**
May 15 1897	5+	Virginia City	fallen plaster	**VI+**
Dec. 20, 1932	7.1	Gabbs	surface rupt., chim. dam	**VI**
June 25, 1933	6.0	Wabuska	build. and chim. damage	**VI+**
July 6, 1954	6.2	Fallon	build. and plaster damage	**VI**
Dec. 16, 1954	7.1, 6.9	Incline Village	build. and plaster damage	**VI+**

**Modified Mercalli Intensity in Carson City, NV*

The first recorded earthquake in Carson City occurred in 1857. This earthquake was estimated as a magnitude 6.0; however, because of fires in Virginia City and San Francisco most of the records for this event have been destroyed. The best documented earthquake of the 19th century was also the largest event in Carson City's history and occurred June 3, 1887. The earthquake shook western Nevada, the Sierra Nevada, and the central Great Basin. Rock falls, landslides, and liquefaction occurred, several buildings were severely cracked, and large amounts of plaster fell. There are no accounts of death or serious injury, and major concerns were limited to fixing buildings and re-establishing businesses. If the 1887 earthquake occurred today, there would be much more structural and nonstructural damage because of the exposure of risk (population and infrastructure) is so much greater. The Carson City area continues to be highly active with earthquakes, especially in the eastern half of the county.

Table 5-4 indicates that 13 to 14 earthquakes have caused Modified Mercalli Intensity VI or greater intensity shaking in Carson City over the last 158 years. This is an average of once every 12 years. One event, the 1887 earthquake, caused severe damage to Carson City during this 158-year time period.

Figure 5-4 Seismicity and Quaternary fault map of the Carson City region.



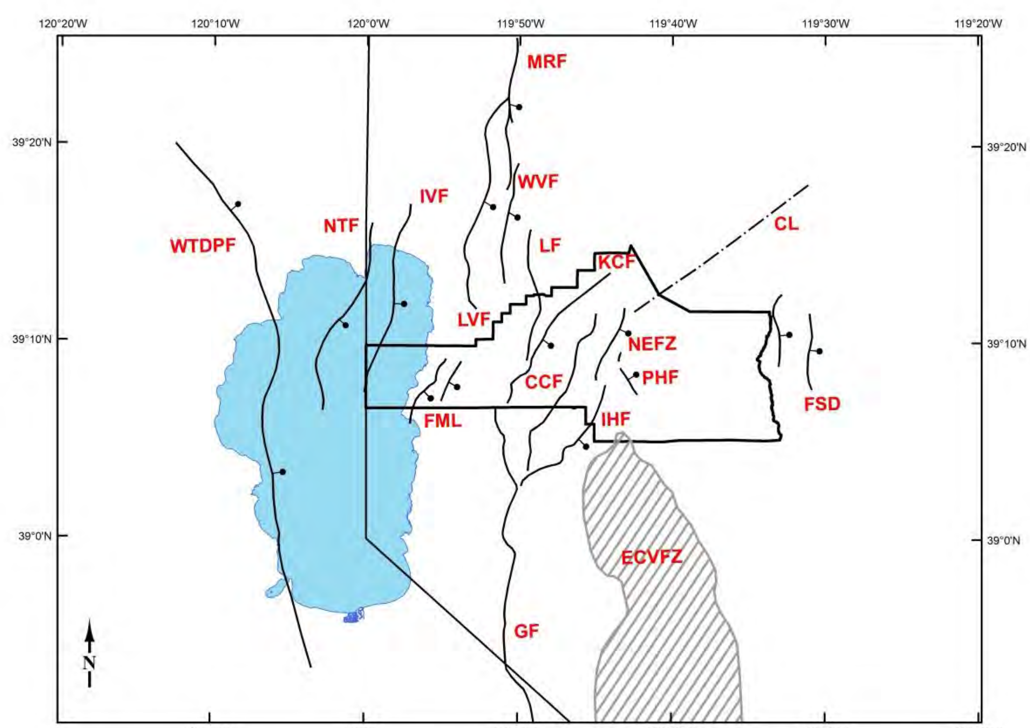
There have been historical instances of collateral earthquake effects during Nevada earthquakes, such as liquefaction, rock fall, and fire following earthquake. Several instances of surface rupture have also accompanied large Nevada earthquakes.

There have not been any well documented occurrences of seiches or tsunamis occurring in Lake Tahoe, but geologic evidence for paleoseismic events within the basin has been found and these events almost certainly would have created these water disturbances. In addition, seiches and a possible tsunami have occurred in water bodies near large earthquakes in the western United States. For example, a seiche was reported in Mono Lake from the 1932 M7.1 Cedar Mountain, Nevada earthquake.

5.2.4.3 Location, Extent, and Probability of Future Events

A large earthquake near Carson City would impact the entire community. The **Figure 5-5** below provides a map of the major faults in Carson City. The map in Appendix B, Figure B-9 shows greater detail of the fault lines in Carson City.

Figure 5-5
Schematic map of major late Quaternary faults in the Carson City region, with county outlined.

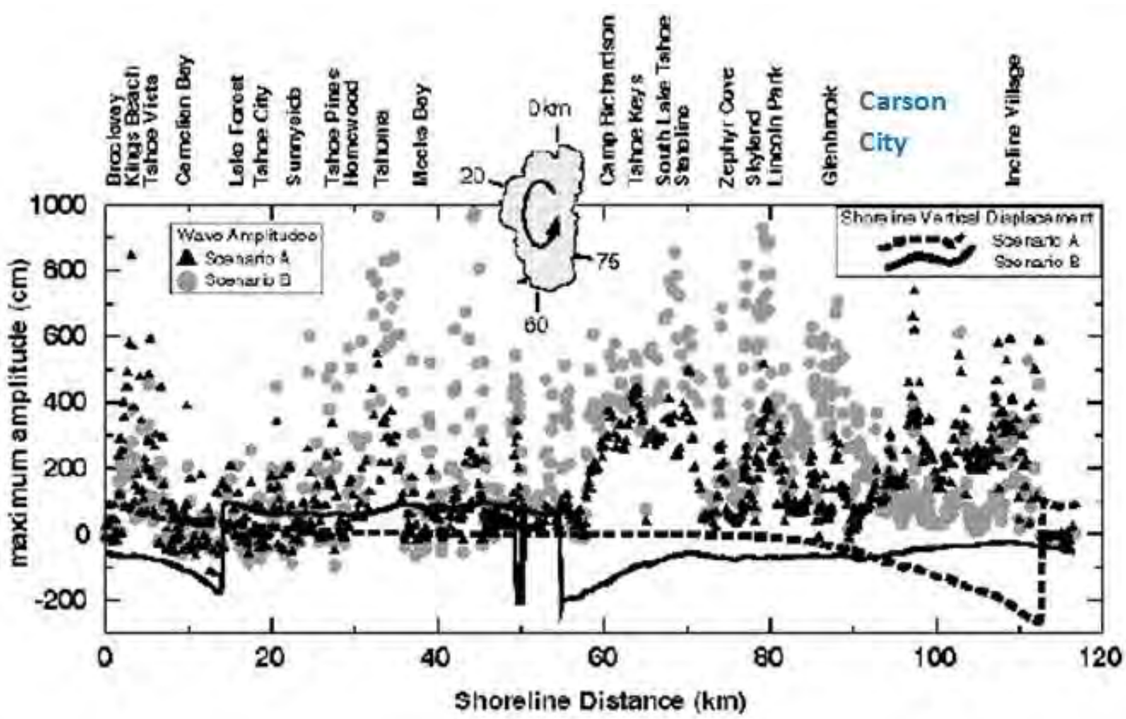


Legend: CCF – Carson City fault, CL – Carson lineament, ECVFZ – Eastern Carson Valley fault zone, FML – faults near Marlette Lake, FSD – faults southwest of Dayton, GF – Genoa fault, IVF – Incline Village fault, IHF – Indian Hill fault, KCF – Kings Canyon fault, LF – Lakeview fault, LVF – Little Valley fault, MRF – Mt. Rose fault zone, NEFZ – New Empire fault zone, NTF – North Tahoe fault, PHF – Prison Hill fault, WTDPF – West Tahoe – Dollar Point fault, WVF – Washoe Valley fault.

Any of the faults shown on **Figure 5-5** could be the source of future earthquakes which could damage Carson City. Fortunately, the Genoa fault, one of the largest earthquake threats in the region and the most damaging scenario modeled, is thought to have had a major earthquake about 300 to 400 years ago, and we can hope that it will be a long while before it has another event.

The wave heights of Lake Tahoe tsunamis have been modeled by Ichinose and others (2000) and are shown in Figure 5-6. Two scenarios are shown, a rupture on the North Tahoe-Incline Village fault (A – black triangles), and a rupture on the West Tahoe-Dollar Point fault zone (B – gray dots). In these model runs, wave heights of 15 to 23 feet were generated at the lake shore in Carson City, but to the south are wave heights of as high as 30 feet. These are reasonable wave heights to consider when thinking about the tsunami/seiche hazard along this shoreline.

Figure 5-6 Wave Heights of Lake Tahoe Tsunamis



Source: The Potential Hazard from Tsunami and Seiche Waves Generated by Future Lake earthquakes within The Lake Tahoe Basin, California-Nevada, Gene A. Ichinose, and others (2000), Nevada Seismological laboratory; University of Nevada; (University of Nevada 2000 study)

Carson City's boundary along the lake includes a few privately owned structures. The road and utilities are at a high enough elevation that they would not be affected by a 30 foot wave. Because of the low exposure of Carson City to the impacts from a tsunami or seiche, this hazard is considered low in Carson City.

The earthquake probability estimations for several communities are given in **Table 5-5.** These were generated using the website https://geohazards.usgs.gov/eqprob/2009/index.php. The probabilities were estimated for earthquakes of magnitude ≥5.5, ≥6, ≥6.5, and ≥7 occurring within 50 years and 31 miles (50 km) of communities in different parts of the county **(Table 5-**

5). The specific locations include the State Capitol, Lakeview, East New Empire, Stewart, and Lake Tahoe. **Table 5-5** indicates that the chances of having a M≥5.5 earthquake, which can be potentially damaging if nearby, is 79-82% over the next 50 years, a very substantial probability. Considering earthquakes of magnitude M≥6, a 59-63% chance of occurrence in the next 50 years within 31 miles, is estimated. This is a similar sized earthquake that occurred in Wells, Nevada in 2008. The probability of a M≥6.5 earthquake occurring in the next 50 years and within 31 miles is 43-47% and the probability of a M≥7.0 earthquake occurring is 15-16%. A magnitude M≥6.5 event would likely have damaging effects throughout the county. The probabilities of having an earthquake in Carson City are significant and are some of the highest probabilities of having an event in Nevada. Annual probabilities range from about a 7% chance per year of having a M≥5.5 within 31 miles, to a 1% chance per year for a M≥6.5 within 31 miles, to a 0.2% chance per year of having a M≥7.2 within 31 miles.

Table 5-5

Probabilities of Potentially Damaging Earthquakes in Carson City within 50 years and 31 miles (50 km)

Community	M≥ 5.5	M≥ 6	M≥ 6.5	M≥ 7
State Capitol	82%	63%	46%	16%
Lakeview	82%	63%	46%	16%
East New Empire	82%	63%	47%	16%
Stewart	81%	61%	46%	16%
Lake Tahoe	79%	59%	43%	15%

Table 5-6

Poisson Probabilities of Modified Mercalli Intensity Ground Motions Occurring in Carson City Based on U.S. Geological Survey Hazard Curves

Earthquake Intensity*	50-Year Probability
VI	78 – 79%
VII	55 – 57%
VIII	19 – 25%
IX	6 – 10%

**Intensity VI levels of ground motion can cause cracks in walls and people to be frightened; intensity VII levels can cause chimneys to topple and an emergency response; intensity VIII levels can cause weak buildings to partially collapse and a recovery effort to be mounted; intensity IX levels can cause damage to some modern buildings.*

Table 5-6 illustrates the 50-year probabilities of have different intensity levels of shaking in Carson City. The probabilities presented in **Table 5-6** indicate that it is likely (78-79%) Carson City will experience Modified Mercalli Intensity VI shaking levels within a 50-year time period. The chances of damaging ground motion associated with Intensity VII and an emergency response associated with an earthquake are 55-57% within a 50-year time period. Stronger ground motion associated with Intensities VIII and IX have a 19-25% and 6-10% chance of occurring in 50 years, respectively. Communities that experience these levels of ground motion and damage (if it occurs) have to engage in community recovery efforts that can last over a year.

5.2.5 Floods

Planning Significance - High

5.2.5.1 Nature

Flooding as defined by the National Flood Insurance Program is a general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from:

- Overflow of inland or tidal waters;
- Unusual and rapid accumulation or runoff of surface waters from any source;
- Mudflow a river of liquid and flowing mud on the surfaces of normally dry land areas, as when earth is carried by a current of water, or;
- Collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above.

Floodplains are lowlands adjacent to water bodies that are subject to recurring floods. Floods are natural events that are considered hazards only when people and property are affected.

Nationwide, floods result in more deaths than any other natural hazard. Physical damage from floods includes the following:

- Inundation of structures, causing water damage to structural elements and contents.
- Erosion or scouring of stream banks, roadway embankments, foundations, footings for bridge piers, and other features.
- Impact damage to structures, roads, bridges, culverts, and other features from high-velocity flow and from debris carried by floodwaters. Such debris may also accumulate on bridge piers and in culverts, increasing loads on these features or causing overtopping or backwater effects.
- Destruction of crops, erosion of topsoil, and deposition of debris and sediment on croplands.
- Release of sewage and hazardous or toxic materials as wastewater treatment plants are inundated, storage tanks are damaged, and pipelines are severed.

Floods also cause economic losses through closure of businesses and government facilities; disrupt communications; disrupt the provision of utilities such as water and sewer service; result in excessive expenditures for emergency response; and generally disrupt the normal function of a community.

In Carson City, flooding is most commonly associated with unusually heavy rainfall in the State of Nevada and can be influenced by both frontal systems out of the Northern Pacific Ocean and tropical storms coming from the South. Due to the aridity of the City, the area is dry except during and shortly after these storms. When a major storm develops, water collects rapidly in a short period of time. As a consequence, flows are of the flash-flood type. Flash floods are generally understood to involve a rapid rise in water level, high velocity, and large amounts of debris, which can lead to significant damage that includes the uprooting of trees, undermining of buildings and bridges, and scouring of new channels. The intensity of flash flooding is a function of the intensity and duration of rainfall, steepness of the watershed, stream gradients, watershed vegetation, natural and artificial flood storage areas, and configuration of the streambed and floodplain. It is important to note that even in drought, scattered summer thunderstorms can bring excessive rainfall and flash flooding, particularly near wildfire burn scars that enhance water runoff. These kinds of floods produce debris flows, large amounts of water runoff laden with burn debris and mud.

In areas where alluvial fans are present, the flow paths of flash floods lack definition. Flow depths with alluvial fan flooding are generally shallow with damage resulting from inundation, variable flow paths, localized scour, and the deposition of debris.

5.2.5.2 History

The storm water problems of Carson City are different than those in many other communities. The core of the urban area is directly below several canyons that drain into the Carson Range. They are prone to flooding and flow of sediment and debris. However, there is no large river in Carson City that poses the risk of massive, life threatening flooding of the scale that exists in other parts of the country. Even though the flooding problems in Carson City are relatively localized, many homes and businesses are directly impacted and people's lives are disrupted by storm water. By creating saturated soil conditions, storm water also contributes to some other pressing problems in the urban area. Water quality impacts directly resulting from storm water run-off are not generally recognized, but there is a general public concern regarding the association of storm water and waste water problems based on health considerations. (Carson City Stormwater Management Utility Final Funding Report; Water Resources Inc. 12/14/2002)

Table 5-7 Historical Flash Floods in the Carson River Drainage

Date	Location	Description
July 25, 1875	Ash and Kings Canyon Creeks; Carson City	Torrential rains on the logged-off Carson range sent flash flooding into Carson City on Ash and Kings Canyon Creeks, and into Carson City. Ranches below the mouths of these Creeks suffered extensive damage through erosion and deposition on their croplands. On Kings Canyon, the toll road (predecessor to U.S. 50) and bridge were washed away; the tollgate keeper and his family were rescued. In Carson City, streets and basements were flooded, and gardens were washed away.
July 13-17, 1911	Daggett Pass to Carson Valley (Kingsbury Grade-Haines Canyon); Kings Canyon Road (Clear Creek); Dayton-El Dorado Canyon- Churchill Canyon	A wall of water rolled down Haines Canyon on the afternoon of July 15, and took out everything in its path. A large portion of the lower section of Kingsbury Grade road was destroyed. The Kingsbury Grade toll-house, built in 1959 was also destroyed. Luckily, no automobiles were on the road at the time. The Kings Canyon Road to Spooner Summit (predecessor to U.S. 50) was also severely damaged along its higher reaches in this storm by Clear Creek, and was closed for 11 days. Severe flash flooding also occurred on July 15th on the Dayton, El Dorado and Churchill Canyons out of the north and east slopes of the Como Range east of

Table 5-7 Historical Flash Floods in the Carson River Drainage

Date	Location	Description
	(northeast slopes of the Como Range); Canyons on the East Side of the Virginia and Flowery Ranges.	Carson City. On July 17th, flash flooding occurred on most of the canyons draining the east side of the Virginia and Flowery Range (east of Virginia City) and also on the west slopes of the Como Range. Some ranches in the area sustained severe agricultural and irrigation structure damage.
July 18-27, 1913	Carson and Eagle Valley (Carson City)	Ten daily thunderstorms, with the worst being on the 21st, 22nd, 23rd and 27th were probably the longest-lasting, most widespread and destructive in recorded history. Flash flooding was occurring simultaneously from Lassen County south to the Walker River drainage in Mono County and eastward to Lovelock in Pershing County. In the Carson Drainage, flash floods washed out Kings Canyon Road to Spooner Summit (predecessor to U.S. 50), caused extensive flash flood damage, especially to roads, throughout the Carson and Eagle Valleys. The heavy rain caused the Carson River to rise out of its banks in a few locations near Carson City, causing severe agricultural damage. The Cradlebaugh Road connecting Carson City and Gardnerville was severely damaged, and was closed for two days. Likewise, the main road from Carson City to Reno was impassable through Pleasant Valley. Virginia City sustained major flash flooding on the 22nd, with many basements and ground floors flooded.
July 11, 1927	Kings Canyon Creek, Carson City	The same storm which caused the Grass Lake Dam on Browns Canyon Creek to fail further north (see Truckee River Flash Flood section) caused flash flooding on Kings Canyon Creek, and sent mud and debris into parts of Carson City.
July 31, 1949	Cottonwood and Hennington Sloughs-Gardnerville	Heavy rain in Alpine County caused flash flooding on tributaries of the upper East Fork of the Carson River. Cottonwood and Hennington Sloughs south of Gardnerville received most of the flow, and consequently caused damage to irrigation structures in the area. However, the storms only caused a very slight rise on the East Fork of the Carson near Gardnerville, with the flow rising from 95 to 237 cfs.
Aug. 16, 1958	Carson City	Thunderstorms over Eagle Valley and surrounding mountains dumped over an inch of rain in less than an hour, causing a flash flood off C-Hill southwest of Carson City, which had just been burned. Residences along Circle Drive and Sharrow Way had a flow of sediment 3 to 4 inches deep through their yards.
July 29, 1960	Kings Canyon Creek	There were flash-flood producing thunderstorms across much of western Nevada this afternoon, affecting the Truckee, Carson, and Walker Basins. Thunderstorms over the Carson Range caused an extensive mudflow (as well as boulders and pine trees), out of Kings Canyon Creek. The channel of the creek was scoured down to bedrock due to the large amount of debris the creek carried. Ranch land was covered with debris, and a few homes suffered flood damage. Two trailers were carried as far as 600 feet by the mudflow. The flow was estimated at about 200 cfs on Kings Canyon Creek.
Aug. 5, 1971	Genoa	Thunderstorms caused a flash flood which sent a four foot wall of water down School Canyon (just north of Genoa Canyon). Flash flooding occurred from Kingsbury Grade north to Jacks Valley.
Aug. 6, 1974	Silver Springs	Thunderstorms caused flash flooding and mudslides that closed highways, cut power for many hours, and closed highways in the area for over 24 hours.

Table 5-7 Historical Flash Floods in the Carson River Drainage

Date	Location	Description
June 14, 1984	Dayton	Isolated heavy thunderstorms caused flash flooding which closed Highway 50 on the afternoon of the 14th.
July 14, 1992	Johnson Lane Area	Heavy rainfall from a thunderstorm in the Pine Nut Mountains east of Carson City and Minden caused Johnson Lane Wash to flood very quickly, with a few homes receiving minor damage. Less than $5000 damage.
July 22, 1994	Johnson Lane Area	Very heavy rainfall from a thunderstorm in the Pine Nut Mountains east of Carson City and Minden caused Johnson Lane Wash to flood very quickly, with up to three feet of water damaging many homes, and numerous backyards and garages. A number of homes had to be evacuated, and there was severe damage to roads and some damage to underground utilities in the area. Many local roads were closed for hours. Damage was estimated at over $500,000.
Mar. 10, 1995	Storey County, Carson City, Douglas County (Johnson Lane), Lyon County	Six Mile Canyon, between Virginia City and U.S. Highway 50 was closed due to flash flooding caused by very heavy rainfall (about 0.2 to 0.5 in. per hour in the afternoon and evening hours, with moderate rainfall from 10am to 10pm, with 12 hour totals of from 1 to 3.5 inches). In Carson City, flash flooding caused water over three feet deep in many parts of the city, stranding people in their cars all over the City. Over $2 million in damage due to small stream flooding occurred in Douglas County, where 4 homes and 8 businesses were damaged in Genoa. In northern Douglas County, the Johnson Lane area again sustained major flood damage...over $300,000 in damages to homes, drainage structures and roads. Heavy rain in the northern Pine Nut Mountains caused the Hughes Gavel Pit near Dayton to flood, causing about $300,000 damage to the pit and mining equipment. Also, a subdivision about 5 miles northeast of Dayton flooded, causing about $60,000 damage.
June 26, 1995	Carson City and Douglas County	Strong thunderstorms dropped heavy rain across western NV, causing flash flooding in Carson City and Douglas County. Rainfall rates of from 1 to 2 inches per hour were reported by spotters in these areas. About a dozen homes were damaged, as basements, garages and yards were flooded, and many roads were inaccessible. U.S. 395 through Gardnerville was closed for many hours.
Dec. 12, 1995	Carson City, Gardnerville, Dayton	Many roads closed and some businesses flooded due very heavy rainfall.
Aug. 13, 1996	Gardnerville	Up to 2 inches of rain in 20 minutes (3 inches in less than an hour) caused extensive street flooding, flooding of several homes, duplexes and businesses which necessitated evacuation. The heavy rain also caused a mudslide. The flooding was mostly due to plugged storm drains; the slide blocked U.S. 395. A convalescent home was sandbagged as over a foot of water collected near the front door, but the facility was not evacuated.
Jan. 1-3, 1997	Carson Basin	Extremely heavy rainfall combined with snow levels above 10,000 feet and complete melt-off of a heavy low-elevation snow pack cause moderate to severe flash flooding and small stream flooding on streams coming out of the mountains throughout the Carson Basin, especially above Carson City, throughout this period. Damages are too numerous to mention here, but amounted to millions of dollars, separate from losses due to mainstream river flooding. Rain-swollen Ash Canyon, Kings Canyon and Vicee Canyon Creeks caused

Table 5-7 Historical Flash Floods in the Carson River Drainage

Date	Location	Description
	Carson City	extensive flood damage to homes, businesses and roads in downtown Carson City.
December 31, 2005 January 1, 2006 New Year's Flood	Carson City	In Carson City, King Street was completely closed due to the flooding. Portions of Stewart, Mountain, and Curry Streets were also closed. Flooding occurred on US Hwy 395 near Carson Mall. 2 Business & 12 houses were flooded. At the Waterfall Fire burn area west of Carson City, the heavy rain caused damage to trees & vegetation on the mountainside, along with rockslides & mudslides. FEMA 1629, New Year's Flood
July 20, 2014	Southeast and North Carson City	Although the storm didn't last very long, it dropped about 1 inch of rain in 20 minutes. Hail was part of the storm in the Goni area where the ground was covered with a couple inches of ice. Heavy sediment and debris on streets and on yards was a common outcome of the storm.
July 20, 2014	Prison Hill area and Carson City and Goni areas of Carson City	A second flash flood hit the city, mainly on the east side which dropped about 1.5 inches of rain in 30 minutes. Again, flows cause sediment deposits and sever erosion in the Prison Hill and Goni areas. There were some streets that received 5 to 6 feet of dirt and debris on them. Wind gusts were measured at 61 mph. Cleanup effort began immediately and continued until December of 2014.
August 11, 2014	Carson City	Moderately high atmospheric moisture with slow-moving thunderstorms brought heavy rain and isolated severe thunderstorms. Extensive damage from flash floods and debris flows was reported in Douglas County and Carson City. A NWS spotter reported 1.10 inches of rain in just 25 minutes from one storm. Water over roads and mud debris along and near Center Drive were reported by a fire department official. Extensive damage to streets due to undermining was noted along with minor water and mud intrusions into several homes. One home had up to a foot of water and mud in the garage along with damage to the garage door.

5.2.5.3 Location, Extent, and Probability of Future Events

Flooding, whether localized or basin-wide, is a common phenomenon in the Carson River Basin and occurs with some regularity over the historic period of record. There is no reason to assume this will change now or in the future. Earlier snowmelt or less overall snow accumulation (in favor of more rain at higher elevations) may occur in response to climate change. However, both localized and regional-scale flooding will continue to be of concern to communities living on or near flood- prone areas. From the USGS website http://nevada.usgs.gov/crfld/floodhistory.cfm#

Floods are described in terms of their extent (including the horizontal area affected and the vertical depth of floodwaters) and the related probability of occurrence. Flood studies often use historical records, such as stream flow gages, to determine the probability of occurrence for floods of different magnitudes. The probability of occurrence is expressed as a percentage for the chance of a flood of a specific extent occurring in any given year.

Factors contributing to the frequency and severity of flooding include the following:

- Rainfall intensity and duration

- Antecedent moisture conditions
- Watershed conditions, including steepness of terrain, soil types, amount and type of vegetation, and density of development
- The existence of attenuating features in the watershed, including natural features such as swamps and lakes and human-built features such as dams
- The existence of flood control features, such as levees and flood control channels
- Velocity of flow
- Availability of sediment for transport, and the erodibility of the bed and banks of the watercourse

These factors are evaluated using (1) a hydrologic analysis to determine the probability that a discharge of a certain size will occur, and (2) a hydraulic analysis to determine the characteristics and depth of the flood that results from that discharge.

The magnitude of flood used as the standard for floodplain management in the United States is a flood having a 1 percent probability of occurrence in any given year. This flood is also known as the 100-year flood or base flood. The most readily available source of information regarding the 100-year flood is the system of Flood Insurance Rate Maps (FIRMs) prepared by FEMA. These maps are used to support the National Flood Insurance Program (NFIP). The FIRMs show 100- year floodplain boundaries for identified flood hazards. These areas are also referred to as Special Flood Hazard Areas (SFHAs) and are the basis for flood insurance and floodplain management requirements. The FIRMs also show floodplain boundaries for the 500-year flood, which is the flood having a 0.2 percent chance of occurrence in any given year. FEMA has prepared a FIRM for Carson City, dated 2009 and this was used by the Carson City Floodplain Manager to create the flood map, see Appendix B, Figure B-8 which uses the 100-year flood as a basis and provides the areas susceptible to flood. At this time FEMA is in the process of updating the Flood Insurance Rate Maps for Carson City.

The current state of predictive science allows for a greater heads-up on major river floods than even just five or ten years ago. The large atmospheric river storms that often create floods can be tracked across the Pacific Ocean 5-8 days in advance, with more detailed river forecasts up to 2-4 days in advance. It should be noted that uncertainties in snow level forecasts remain one of the biggest flood prediction challenges and are often of low confidence until 12-24 hours ahead of the storm.

The prediction of weather patterns favorable for flash flooding from thunderstorms has advanced in recent years, such that a general heads-up can be given 1-3 days in advance. However, due to the localized nature of thunderstorms that create flash floods, the current predictability of specific flash floods is limited to about 15-45 minutes of warning, but is sometimes zero.

Climate Change

According to the Washoe County Regional Resiliency Study, the northern Nevada region can expect higher probability of localized rain events with more water and associated flooding. Increased warming increases the capacity of the atmosphere to hold moisture, which leads to more water vapor in the atmosphere. Warmer conditions between summer thunderstorms can additionally dry and compact the soil, making it more impervious to heavy rain, and further increase the rate of runoff during flash flood events.

5.2.6 Hazardous Materials Events

Planning Significance - Moderate

5.2.6.1 Nature

Hazardous materials may include hundreds of substances that pose a significant risk to humans. These substances may be highly toxic, reactive, corrosive, flammable, radioactive, or infectious. Hazard materials are regulated by numerous Federal, State, and local agencies including the U.S. Environmental Protection Agency (EPA), U.S. Department of Transportation (DOT), National Fire Protection Association, FEMA, U.S. Army, and International Maritime Organization.

Hazardous material releases may occur from any of the following:

- Fixed site facilities (such as refineries, chemical plants, medical marijuana production facilities, storefronts, warehouses, single-family residences, storage facilities, manufacturing, warehouses, wastewater treatment plants, swimming pools, dry cleaners, automotive sales/repair, and gas stations)
- Highway and rail transportation (such as tanker trucks, chemical trucks, and railroad tankers)
- Air transportation (such as cargo packages)
- Pipeline transportation (liquid petroleum, natural gas, and other chemicals)

Unless exempted, facilities that use, manufacture, or store hazardous materials in the United States fall under the regulatory requirements of the Emergency Planning and Community Right to Know Act (EPCRA) of 1986, enacted as Title III of the Federal Superfund Amendments and Reauthorization Act (42 USC 11001–11050; 1988). Under EPCRA regulations, hazardous materials that pose the greatest risk for causing catastrophic emergencies are identified as Extremely Hazardous Substances (EHSs). These chemicals are identified by the EPA in the *List of Lists – Consolidated List of Chemicals Subject to the Emergency Planning and Community Right-to-Know Act (EPCRA) and Section 112 of the Clean Air Act*. Releases of EHSs can occur during transport to and from fixed site facilities. Transportation-related releases are generally more troublesome because they may occur anywhere, including close to human populations, critical facilities, or sensitive environmental areas. Transportation-related EHS releases are also more difficult to mitigate due to the variability of locations and distance from response resources.

In addition to accidental human-caused hazardous material events, natural hazards may cause the release of hazardous materials and complicate response activities. The impact of earthquakes on fixed facilities may be particularly serious due to the impairment or failure of the physical integrity of containment facilities. The threat of any hazardous material event may be magnified due to restricted access, reduced fire suppression and spill containment, and even complete cut-off of response personnel and equipment. In addition, the risk of terrorism involving hazardous materials is considered a major threat due to the location of hazardous material facilities and transport routes throughout communities and the frequently limited antiterrorism security at these facilities.

On behalf of several Federal agencies including the EPA and the DOT, the National Response Center (NRC) serves as the point of contact for reporting oil, chemical, radiological, biological, and etiological discharges into the environment within the United States.

5.2.6.2 History

The NRC Web-based query system of non-Privacy Act data shows that since 1999 to 2009 there were ten oil and chemical spills that have occurred within Carson City. In addition to oil and chemical spills, the EPA recorded three airborne hazardous material releases during this time frame. More recently, over the past five years, from 2010 to 2015, there have been six hazardous material release events in Carson City which included three raw sewages spills.

Table 5-8 Hazardous Material Release in Carson City

Location	Date	Substance	Description
2727 Lockheed Way	5/5/1999	Sulfuric Acid	One 30 gal. drum. Drum was punctured by a forklift causing a spill.
NV 798 @ Marker 17	1/8/2002	Arsenic Tri sulfide	A pile of rocks found in parking area. Material may be ore that contained 2.6lbs of arsenic tri sulfide.
Washoe Tribe Snider & Clear Cr. Rd	/31/2002	Sewage	Old sewer line next to creek has leaked.
S. Lake Tahoe	11/13/2002	Oil/Diesel	Pleasure craft sank.
Entire W. Side Carson	7/14/2004	Other	Potential release from auto body shop and fertilizer store.
Timberline Subdivision	7/16/2004	Natural Gas	Wildland fire destroyed 8 homes. Gas main shut off.
Ash Canyon Water Storage Tank	11/17/2004	Diesel	Diesel release from a temp. storage tank due to tank tipped over.
1111 N. Saliman Rd	9/14/2005	Mercury	Mercury release from portable blood pressure machine break.
3915 Fairview	4/17/2007	Chromic Acid Flakes	Acid flakes were accidently mixed in with caustic based sludge creating vapors making one employee sick. Bldg evacuated. Road closed.
Carson High School	2/6/2009	Mercury	Release of mercury from unknown source. School evacuated.
3301 E. 5th St.	6/18/2008	Mercury	Release of mercury due to broken thermometer near drain.
1600 Airport Rd	8/9/2009	Mercury	Release of mercury from unknown source. A 20 unit apartment building evacuated. Three month cleanup.

Source: NRC and EPA

Table 5-8 Hazardous Material Release in Carson City *(continued)*

Location	Date	Substance	Description	Response Agency
3701 North Carson Street in Carson City	1/23/2010	Non-PCB mineral oil	Car hit ground mounted transformer causing damage.	Carson City Fire Dept.
Frontier Village Mobile Home Park on C Street Off Roop Street near Winnie, Storm Drains between C Street and Dan Street	10/10/2011	Oil from Fog Seal material	Sierra Stripers crew allegedly failed to heed weather conditions. The company laid down slurry and the rain carried the material to Roop St. via gutters and storm drains.	Carson City Fire Dept.
3155 South Carson Street	2/24/2012	Raw sewage	Sewer mainline backed up and overflowed out of an MHP space's cleanout, which did not have the cap in place. Sewage flowed off the property, onto the adjacent property to the north and into the stormdrain system.	Carson City Fire Dept.
West Course, left course at Arrowhead Drive and Bowers Lane	4/9/2012	Treated effluent	Two inch line broke and released the effluent to the adjacent area.	Carson City Fire Dept.
Sewage overflow at manhole at the corner of Baker and Armory in Carson City	12/8/2013	Sewage	Sewage backup overflowed out of a manhole.	Carson City Fire Dept.
Spill on Stewart Community Tribal Property	3/4/2015	Raw sewage	48,079 gallons of raw sewage spilled on to Washoe Stewart Community property.	Carson City Public Works, Washoe Tribe – Carson Colony and NDEP.

Source: Carson City Fire Department and the Washoe Tribe of Nevada and California

5.2.6.3 Location, Extent, and Probability of Future Events

The EPA regulates 11 facilities within the City that are permitted to discharge to water and 151 that handle hazardous waste; 4 have reported toxic releases and 2 produce and release air pollutants; and 5 are active and/or archived cleanup sites. However, while several of the small, fixed facilities (e.g., body shops) have varying uses of hazardous chemicals, in general these facilities do not pose a significant risk to the City.

In addition to fixed facilities, hazardous material events have the potential to occur along Interstate 580, U.S.50 and U.S. 395. The trucks that use these transportation arteries commonly carry a variety of hazardous materials including gasoline, other crude oil derivatives, and other chemicals known to cause human health problems.

Comprehensive information on the probability and magnitude of hazardous material events from all types of sources (such as fixed facilities or transport vehicles) is not available. Wide variations among the characteristics of hazardous material sources and among the materials themselves make such an evaluation difficult. While it is beyond the scope of this HMP to evaluate the probability and magnitude of hazardous material events in the City in detail, it is possible to determine the exposure of population, buildings, and critical facilities should such an event occur. EHSs, as shown in Appendix B, Figure B-3, pose the greatest risk for causing catastrophic emergencies. Areas at risk for hazardous material events include any area within a 1-mile radius of Interstate 580, U.S.50 and U.S. 395 and EHS fixed facilities.

5.2.7 Infectious Disease

Planning Significance - High

5.2.7.1 Nature

A disease is a pathological (unhealthy or ill) condition of a living organism or part of the organism that is characterized by an identifiable group of symptoms or signs. Disease can affect any living organism, including people, animals, and plants. Disease can both directly (via infection) and indirectly (via secondary impacts) harm these living things. Some infections can cause disease in both people and animals. The major concern here is an epidemic, a disease that affects an unexpected number of people or sentinel animals at one time. (Note: an epidemic can result from even one case of illness if that illness is unheard of in the affected population, i.e., smallpox.)

Of great concern for human health are infectious diseases caused by the entry and growth of microorganisms in man. Most, but not all, infectious diseases are communicable. They can be spread by coming into direct contact with someone infected with the disease, someone in a carrier state who is not sick at the time, or another living organism that carries the pathogen.

Disease-producing organisms can also be spread by indirect contact with something a contagious person or other carrier has touched and contaminated, like a tissue or doorknob, or another medium (e.g., water, air, food). In response to the threat of emerging infectious diseases, the CDC launched a national effort to protect the US public in a plan titled *Addressing Emerging Infectious Disease Threats*. Based on the CDC's plan, major improvements to the US health system have been implemented, including improvements in surveillance, applied research, public health infrastructure, and prevention of emerging infectious diseases (CDC, October 1998).

Despite these improvements, infectious diseases are the leading cause of death in humans worldwide and the third leading cause of death in humans in the U.S. (American Society for Microbiology, June 21, 1999). A recent follow-up report from the Institute of Medicine titled *Microbial Threats to Health: Emergence, Detection, and Response*, notes that the impact of infectious diseases on the U.S. has only grown in the last ten years and that public health and medical communities remain inadequately prepared. Further improvements are necessary to prevent, detect, and control emerging, as well as resurging, microbial threats to health. The dangers posed by infectious diseases are compounded by other important trends: the continuing increase in antimicrobial resistance; the diminished capacity of the U.S. to recognize and respond to microbial threats; and the intentional use of biological agents to do harm (Institute of Medicine, 2003).

The CDC has established a national list of over 50 nationally reportable diseases. A reportable disease is one that, by law, must be reported by health providers to report to federal, state or local public health officials. Reportable diseases are those of public interest by reason of their communicability, severity, or frequency. The long list includes such diseases as the following: AIDS; anthrax; botulism; cholera; diphtheria; encephalitis; gonorrhea; Hantavirus pulmonary syndrome; hepatitis (A, B, C); HIV (pediatric); Legionellosis; Lyme disease; malaria; measles; mumps; plague; polio (paralytic); rabies (animal and human); Rocky Mountain spotted fever; rubella (also congenital); Salmonellosis; SARS; Streptococcal disease (Group A); Streptococcal toxic-shock syndrome; *Streptococcus pneumonia* (drug resistant); syphilis (also congenital); tetanus; Toxic-shock syndrome; Trichinosis, tuberculosis, Typhoid fever; and Yellow fever (Centers for Disease Control and Prevention, May 2, 2003).

Many other hazards, such as floods, earthquakes or droughts, may create conditions that significantly increase the frequency and severity of diseases. These hazards can affect basic services (e.g., water supply and quality, wastewater disposal, electricity), the availability and quality of food, and the public and agricultural health system capacities. As a result, concentrated areas of diseases may result and, if not mitigated right away, increase, potentially leading to large losses of life and damage to the economic value of the area's goods and services.

5.2.7.2 History

The influenza pandemic of 1918 and 1919, known as the Spanish Flu, had the highest mortality rate in recent history for an infectious disease. More than 20 million persons were killed worldwide, some 500,000 of which were in the U.S. alone (Centers for Disease Control and Prevention, October 1998). More recent incidences of major infectious diseases affecting people in the U.S. include the following:

- **Measles** is an acute viral respiratory illness. Since 2000, when measles was declared eliminated from the U.S., the annual number of cases has ranged from a low of 37 in 2004 to a high of 668 in 2014. Measles is still common in many parts of the world including some countries in Europe, Asia, the Pacific, and Africa; travelers with measles continue to bring the disease into the U.S. In December 2014, a large outbreak of measles started in California when at least 40 people who visited or worked at Disneyland theme park in Orange County contracted measles; 166 people from 19 states and the District of Columbia were reported to have measles. On April 17, 2015, the outbreak was declared over.
- **Ebola Virus Disease (EVD)** Ebola, previously known as Ebola hemorrhagic fever, is a rare and deadly disease caused by infection with one of the Ebola virus strains. The current outbreak in West Africa (first cases notified in March 2014), is the largest and most complex Ebola outbreak since the Ebola virus was first discovered in 1976. There have been more cases and deaths in this outbreak than all others combined. It started in Guinea then spread across land borders to Sierra Leone and Liberia. Two imported cases, including one death, and two locally acquired cases in healthcare workers were reported in the United States. CDC and its partners have been taking precautions to prevent additional Ebola cases in the United States. Carson City Health and Human Services monitored its first traveler who had returned from an Ebola-infected country and was visiting nearby. The traveler was low risk and all reporting protocols were followed and the traveler left Nevada without incident.
- **Pertussis** is a highly contagious respiratory tract infection. Although it initially resembles an ordinary cold, whooping cough can turn more serious, particularly in infants. On June 13, 2014, the California Department of Public Health declared a pertussis epidemic. Due to close proximity and the high level between Nevada and California, Nevada public health officials began advising residents to protect themselves and their families by making sure their vaccinations were up to date. On

October 20, 2014, the Division of Public and Behavioral Health, declared an outbreak of pertussis in Elko County, Nevada. Overall, Nevada had 114 cases of pertussis in 2014, 177 in 2013 and 115 in 2012, compared to 40 in 2011.

- **H1N1** In the spring of 2009, a new flu virus spread quickly across the United States and the world. The first U.S. case of H1N1 (swine flu) was diagnosed on April 15, 2009. By April 21, the Centers for Disease Control and Prevention (CDC) were working to develop a vaccine for this new virus. On April 26, the U.S. government declared H1N1 a public health emergency. By June, 18,000 cases of H1N1 had been reported in the United States. A total of 74 countries were affected by the pandemic. H1N1 vaccine supply was limited in the beginning. People at the highest risk of complications got the vaccine first. By November 2009, 48 states had reported cases of H1N1, mostly in young people. That same month, over 61 million vaccine doses were ready. Reports of flu activity began to decline in parts of the country, which gave the medical community a chance to vaccinate more people. 80 million people were vaccinated against H1N1, which minimized the impact of the illness.

The CDC estimates that 43 million to 89 million people had H1N1 between April 2009 and April 2010. They estimate between 8,870 and 18,300 H1N1 related deaths. On August 10, 2010, the World Health Organization (WHO) declared an end to the global H1N1 flu pandemic. H1N1 is now a human seasonal flu virus that also circulates in pigs. While the H1N1 viruses have continued to circulate since the pandemic, 2014 is the first season since 2009 that H1N1 has been so predominant in the United States.

The CDC chart below in **Figure 5-7** shows the estimates of the impact of the 2009 H1N1 outbreak in the U.S. and demonstrates how easily the U.S. medical system can be overwhelmed by a pandemic.

Figure 5-7

CDC Estimates of 2009 H1N1 Cases and Related Hospitalizations and Deaths from April 2009-April 10, 2010, By Age Group		
Outcome and age group	Mid-level Range	Estimated Range
Illnesses		
0-17 years	20,000,000	14 -28 million
18-64 years	35,000,000	25 - 52 million
65 and older	6,000,000	4 - 9 million
Total illnesses	61,000,000	43 - 89 million
Hospitalizations		
0-17 years	87,000	62 - 128 thousand
18-64 years	160,000	114 - 235 thousand
65 and older	27,000	19 - 40 thousand
Total hospitalizations	274,000	195 - 403 thousand
Deaths		
0-17 years	1,280	910 - 1880
18-64 years	9,570	6,800 – 14,040
65 and older	1,620	1,160 - 2,380
Total deaths	12,470	8,870 - 18,300

Source: http://www.cdc.gov/h1n1flu/estimates_2009_h1n1.htm

- **Rabies** is a preventable viral disease of mammals most often transmitted through the bite of a rabid animal; the principal rabies hosts today are wild carnivores and bats. The number of rabies-related human deaths in the United States has declined from more than 100 annually at the turn of the century to one or two per year in the 1990's. Modern day prophylaxis has proven nearly 100% successful. However, if a person is bitten by a possibly rabid animal, rabies is still a medical urgency and medical attention should be pursued quickly.
    - On February 17, 2014, a nine-week-old canine was diagnosed in Northern Nevada with rabies. The canine had been purchased from a litter five (5) weeks prior. To identify persons and animals that may have been exposed to rabies that might require rabies post exposure prophylaxis (PEP), Carson City Health and Human Services, Douglas County Animal Services, and Nevada Department of Agriculture conducted investigations at 12 households. In all, 9 of 43 persons assessed for rabies exposure were advised and chose to receive PEP.
    - In the United States, human fatalities associated with rabies occur in people who fail to seek medical assistance, usually because they were unaware of their exposure.
- **West Nile Virus (WNV)**, a seasonal infection transmitted by mosquitoes, caused an epidemic which grew from an initial U.S. outbreak of 62 disease cases in 1999 to 4,156 reported cases, including 284 deaths, in 2002. However due to communities' aggressive approach to mosquito control the number of cases dropped to 1356 with 44 deaths in 2008 (Centers for Disease Control

and Prevention, October 2009). Carson City had a small number of human cases in 2007-08 and also experienced the drop-off in cases after 2008.

- **Severe acute respiratory syndrome (SARS**) is estimated to have killed 774 and infected 8,098 worldwide. In the U.S., there were 175 suspect cases and 8 confirmed cases all who traveled to other parts of the world, although no reported deaths (Centers for Disease Control and Prevention, October 2009).
- The Federal government estimates that there are about 48 million cases of foodborne illness annually–the equivalent of sickening 1 in 6 Americans each year. And each year these illnesses result in an estimated 128,000 hospitalizations and 3,000 deaths. The most common are:
    - **Norovirus** is the most common cause of acute gastroenteritis and foodborne-disease outbreaks in the United States. Each year, it causes 19-21 million illnesses and contributes to 56,000-71,000 hospitalizations and 570-800 deaths. Carson City Health and Human Services has responded to a number of norovirus cases over the last 10 years, mainly in nursing homes. Epidemiology staff provides education and information to mitigate the effects and to prevent the spread of the disease in the community.
    - **Escherichia coli (abbreviated as *E. coli***) are bacteria found in the environment, foods, and intestines of people and animals. *E. coli* are a large and diverse group of bacteria. Although most strains of *E. coli* are harmless, others can make you sick. Some kinds of *E. coli* can cause diarrhea, while others cause urinary tract infections, respiratory illness and pneumonia, and other illnesses. Experts think that there may be about 70,000 infections with *E. coli* O157 each year in the United States. (Centers for Disease Control and Prevention, October 2009).
    - **Salmonella** CDC estimates that approximately 1.2 million illnesses and approximately 450 deaths occur due to non-typhoidal *Salmonella* annually in the United States.

During January 1, 2009 through December 31, 2010, **Figure 5-8** public health departments reported 1,527 foodborne disease outbreaks, resulting in 29,444 cases of illness, 1,184 hospitalizations, and 23 deaths. Among the 790 outbreaks with a laboratory-confirmed illness, norovirus was the most commonly reported infection, accounting for 42% of outbreaks; followed by *Salmonella*, with 30% of outbreaks.

Figure 5-8

Foodborne Disease Outbreaks, 2009-2010*

Outbreaks reported:	1,527
Cases of illness:	29,444
Hospitalizations	1,184
Deaths:	23

*Source: Foodborne Disease Outbreak Surveillance System, 2009-2010 are the most recent years for which outbreak data are finalized.

Table 5-9 Historic Occurrences of Epidemics Registered in Nevada

Date	Details
February 1992	Cholera outbreak confirmed. At least 26 passengers from Aerolineas Argentinas Flight 386 that brought a cholera outbreak to Los Angeles traveled on to Las Vegas, where 10 showed symptoms of the disease. Cholera or cholera-like symptoms developed in 67 passengers of Flight 386.
Spring 2000	Five cases of the measles confirmed. Outbreak identified and confirmed, Clark County Health District (CCHD) Office of Epidemiology (OOE) worked with the Immunization Clinic and the media to alert the community about the prevention of the spread of the disease.
October 2004	Norovirus confirmed at a major public accommodation facility on the Strip
2004	During October 13-19, a total of 200 cases of human **West Nile Virus** were reported in 20 states, which included Nevada. During 2004, 40 states including Nevada reported a total of 2,151 cases of human West Nile Virus.
Fall 2004	**Chickenpox** (varicella) outbreak in Clark County, Nevada elementary school. 32 students from all grades were infected.
April 2006	**Norovirus** outbreak at a Reno, Nevada daycare, Noah's Ark. 30 norovirus cases were confirmed. 2 additional people were infected after the daycare had been cleaned and sanitized.
March 2007	A **norovirus** outbreak in Las Vegas, Nevada sickened at least 215 inmates and 41 staff members at the Clark County Detention Center. Most of those sickened complained of stomach-related distress such as diarrhea, vomiting and cramps. None were hospitalized.
April 2009	H1N1 virus confirmed by the WHO as a worldwide epidemic. The CDC is currently working on vaccinating the public for the 2015-2016 flu seasons.
2009 - 2012	The **novel H1N1** influenza virus became a global pandemic and in Nevada thousands of people were infected leading to 40 deaths.

5.2.7.3 Location, Extent, and Probability of Future Events

The probability and magnitude of disease occurrence, particularly an epidemic, is difficult to evaluate due to the wide variation in disease characteristics, such as rate of spread, morbidity and mortality, detection and response time, and the availability of vaccines and other forms of prevention. A review of the historical record (see above) indicates that disease related disasters do occur in humans with some regularity and varying degrees of severity. There is growing concern, however, about emerging infectious diseases as well as the possibility of a bioterrorism attack.

According to the CDC, “The U.S. experiences flu epidemics every year – it’s called the “flu season. It’s not possible to predict what this flu season will be like. Flu seasons are unpredictable in a number of ways. While flu spreads every year, the timing, severity, and length of the season varies from one year to another.” In Carson City from the 2010 through the 2014 flu seasons, the average number of reported cases was 110. To date for 2015, Carson City has seen 436 flu cases, a 25% increase over the average. This increase is noteworthy, but it has not outrun our resources or ability to manage. Overall, foodborne illnesses are underreported. The CDC estimates that 1 in 6 Americans will get a foodborne illness in a given year. For Carson City, that would be approximately 9,000 people. Carson City has averaged 17 confirmed cases in the last five years, so the probability of having a foodborne epidemic is low. Carson City Health has averaged approximately 220 confirmed cases of reportable diseases each year for the last five years, with 42% being flu, and the rest encompassing a range from hepatitis to MRSA, RSV, Rotavirus, tuberculosis and a variety of foodborne illnesses. Although there may be a low probability for a major infectious disease outbreak occurring locally, such as the recent measles outbreaks in Ohio and California or the pertussis outbreak in California, the impacts would be substantial. Contact tracing, case investigations and provider/ patient interactions would tax our ability to mitigate and respond effectively (at least in the beginning), and the number of worried well would greatly overburden the healthcare system.

Climate Change

Temperature dependencies are seen in correlations between disease rates and weather variations over weeks, months or years and in close geographic associations between key climate variables and the distributions of important vectorborne diseases. These temperature dependencies can impact both humans and livestock. Temperature has also been found to affect food-borne infectious diseases.

Epidemics constitute a significant risk to the population of Nevada, particularly as it relates to the frequency in which the Carson City population travels and the proximity of Lake Tahoe and Reno’s tourist population. Of highest concern is in the Reno area, in various entertainment venues, and tourist destinations in the region, plus the Reno/Tahoe International Airport. The transient nature of the population, coupled with dense population gatherings increase the potential for an epidemic, as well as for its spread into Carson City.

An epidemic in Carson City would affect a regional response requiring coordination among Carson Tahoe Regional Medical Center, City, neighboring counties, state and federal agencies. Segments of the population at highest risk for contracting an illness from a foreign pathogen are the very young, the elderly, or individuals who currently experience respiratory or immune deficiencies. These segments of the population are present within Carson City.

Due to the wide variation in disease characteristics, the warning time for a disease disaster can vary from no time to months, depending upon the nature of the disease. No warning time may be available due to an extremely contagious disease with a short incubation period, particularly if combined with a terrorist attack in a crowded environment. However, there are agencies in place that have capabilities to prevent, detect, and respond to these types of diseases, such as Carson City Health and Human Services (CCHHS), the Centers for Disease Control (CDC), and the Division of Public and Behavioral Health (DPBH). This provides a positive, balancing influence to the overall outcome of a disease disaster event.

CCHHS conducts surveillance of communicable disease occurrences in the municipality of Carson City. They also implement control measures and develop reports as mandated by Nevada Revised Statutes (NRS), as well as receive and investigate complaints from the public regarding possible foodborne illness.

5.2.8 Landslide

Planning Significance - Low

5.2.8.1 Nature

A landslide is the movement of rock and soil downslope that may take place gradually over a small area or may be very rapid and involve a large area, such as landslides that have been documented at Slide Mountain. Landslides occur when the force of gravity on a slope overcomes the strength of earth materials in the slope, and the slope fails. A stable slope can be made unstable and susceptible to landslides by an increase in the gravitational force or a decrease in the resisting force (the strength of the slope). Increases in gravitational forces include putting weight on a slope, such as a building, mine dump, roadway fill, or even heavy rain. Decreases in the strength of supporting materials include weathering (for example, groundwater deterioration or undermining), stream erosion or other forms of removal of material from the base of a slope, and infiltration of water. Water infiltration can increase pore pressure along planes of weakness, which can reduce friction and promote slope failure. Some slopes have geology that is favorably oriented for landslides. For example, dip slopes have planes of weakness that are parallel to the slope and can favor slope failure.

Figure 5 -9 Typical Landslide

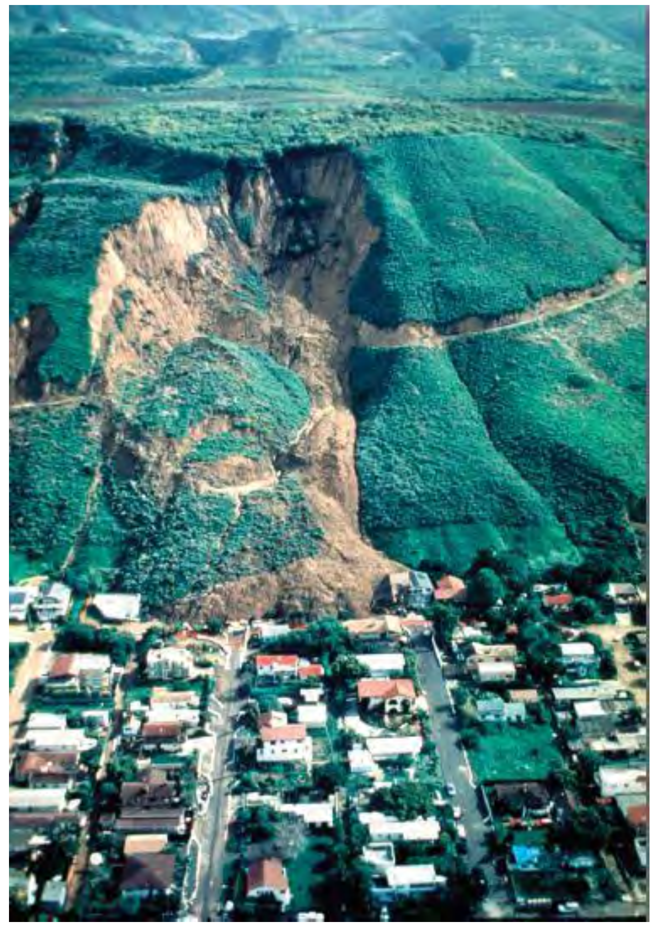


Photo by R.L. Schuster, U.S. Geological Survey. 1995

Examples of landslide triggers include shaking from earthquakes, heavy rainfall (especially on fire-burned slopes and vegetation-stripped areas that cause large amounts of rapid runoff), and volcanic activity (which is accompanied by earthquakes and can load slopes with ash and debris). In Carson City, uplift along the range-bounding fault has over-steepened the base of the range front, and combined with occasional strong ground motion from earthquakes, has formed a number of landslides in the hillslope; some of these can be seen with partial shadowing from the late afternoon sun angle. Another area of tectonically over-steepened slope bases occur is along C-Hill, where the Carson City fault runs along the base of the mountain. In general, steeper slopes have greater gravitational potential, and thus are more susceptible to landslides.

Landslides include five modes of slope movement: falls, topples, slides, spreads, and flows. These are further subdivided by the type of geological material, such as bedrock or earth materials (the latter term implied soil or alluvial materials). Some examples of different kinds of landslides are shown in Figure 5-10. Identifying different parts of a landslide is useful when surveying an area for this hazard. Different parts of a rotational earth slide are shown in **Figure 5-11.**

A common type of landslide in Nevada is a rock fall. These can develop with very little material on a steep slope and can become quite substantial in size and impact. They are common when earthquakes or heavy downpours occur in an area. Rock falls can directly injure or kill people, can invade and damage houses and buildings, and can block transportation routes, especially in the mountainous areas. Rock falls are commonly triggered by heavy rainfall or earthquakes.

Figure 5-10 Schematic Illustrations of Different Types of Landslides.

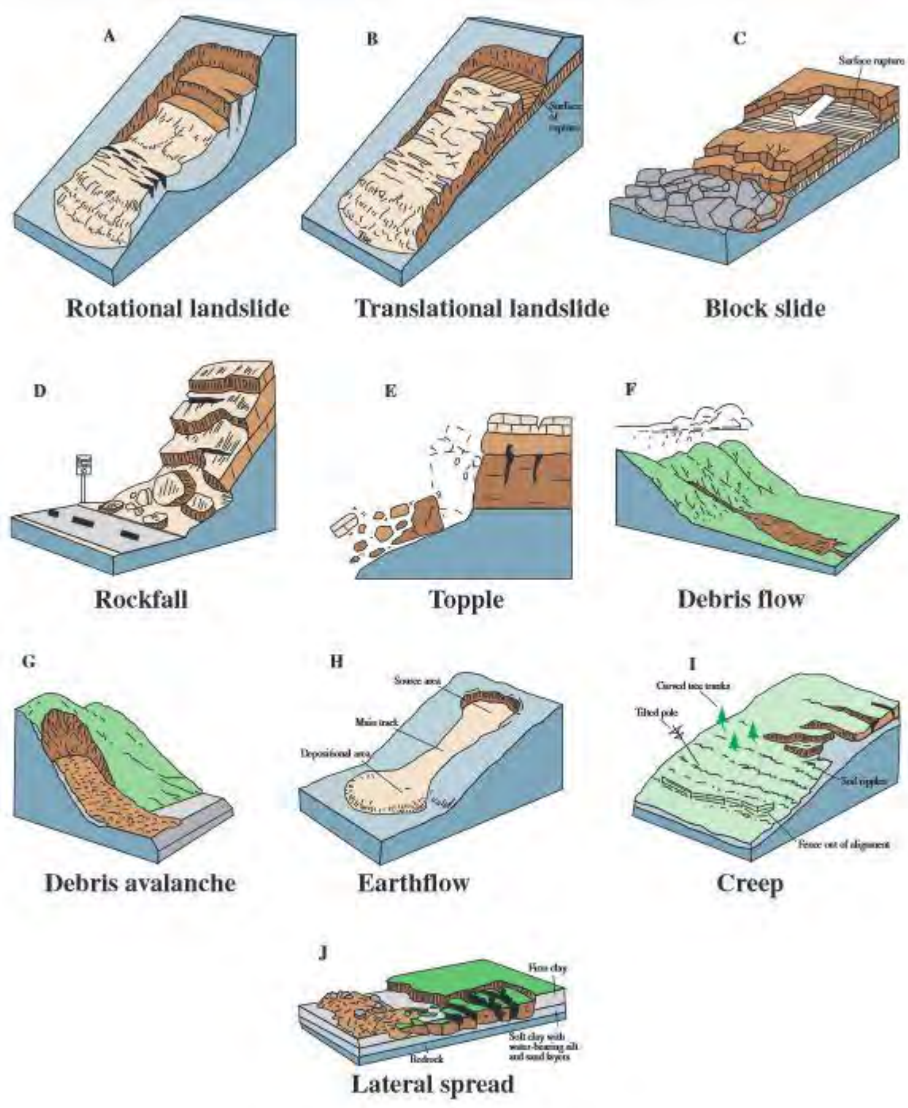


Figure 5-11 Different Parts of a Rotational Earth Slide

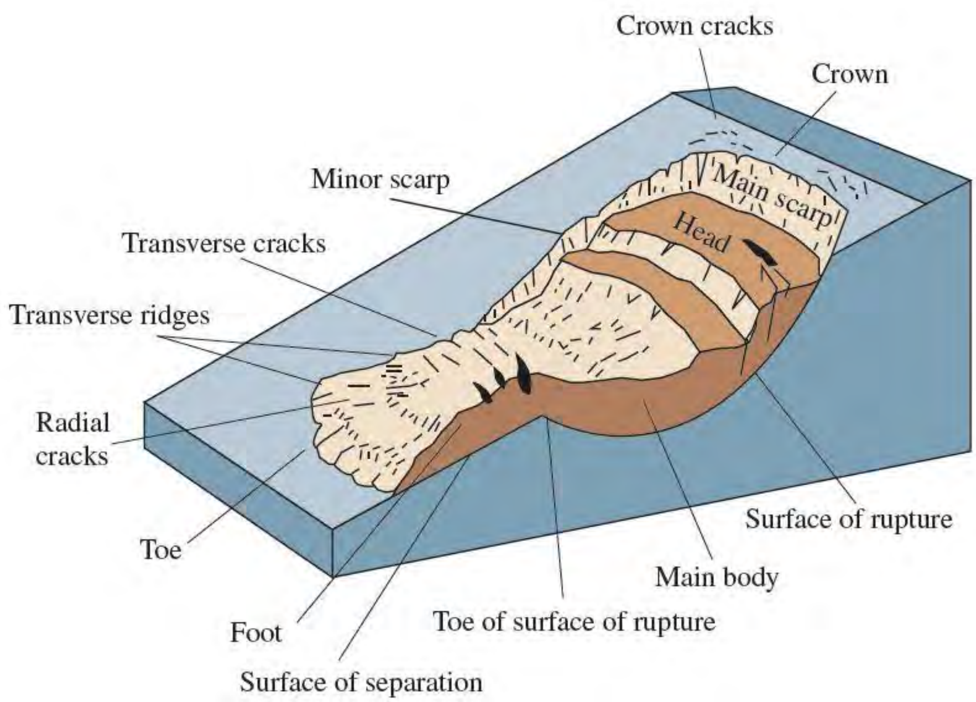


Figure 5-11, an idealized earth rotational slump with the different features of the slide identified. Hazards in the upper part of the slide include downslope movement and foundation distortion. In the lower part of the slide buildings can be impacted by the slide and damaged and/or moved.

5.2.8.2 History

The largest recorded event in recent history in neighboring Washoe County was on May 30, 1983, on the eastern slopes of Slide Mountain. The rockslide killed one man, destroyed a house and caused $2 million in damage to the area. There are no other recorded landslides, but this may be because there was no damage from previous landslide events, such as the 1852 slide in the same area.

Although evidence of landslides has been documented on the Ash Canyon area, these did not affect the public.

5.2.8.3 Location, Extent, and Probability of Future Events

Landslides tend to originate in mountainous and hilly areas with steeper slopes, but can run out on adjacent areas with lower slopes. The distance a landslide can travel depends on factors, such as the momentum a landslide gains traveling down a slope and whether air gets trapped underneath the slide material, decreasing the basal friction.

An important exception to having a steep slope for a landslide potential is the phenomena of a lateral spread, which can occur on low slopes. These are special situations where shallow levels of groundwater and subsurface sediment are pressurized during earthquakes, and the overlying ground flows sideways. This is known as liquefaction and is discussed further in the earthquake hazard section. Lateral spreads can cause sideways movement of the ground, formation of large cracks, formation of sand blows or sand volcanoes, expulsion of subsurface water and sand (including geysering of water), and ground settlement.

One approach to finding areas with landslide potential is to examine the slopes and terrane of an area for existing landslide scars and/or landslides and rock falls. For example, landslides and landslide scars can be seen along the range fronts (such as in the Kings Canyon and Ash Canyon areas), in drainage basins (such as Ash Canyon), and in the upper parts of the Carson Range. A landslide survey would be a useful tool for planning future development and infrastructure.

During the Waterfall Fire in 2004, the area west of Carson City (Ash Canyon, Kings Canyon, and Combs Canyon) lost soil-retaining vegetation which may pose a threat for small landslides during heavy precipitation. However, each year that goes by reduces that threat. Examples of areas where a rock fall hazard might be considered are the Silver Oak residential area in the center of town and locations around Prison Hill. Landslide risk will need to be re-evaluated if development continues at the base of possible slide-area slopes. Currently, the probability of a landslide is considered low within Carson City, partly based on no previous occurrences within the City and low exposure to potential landslide areas.

In general, landslide mitigation involves the careful location of structures to avoid being involved in, or hit by, a landslide. Potential landslide areas and runout areas can be delineated and avoided. Existing landslides can be stabilized by adding material that buttresses the base of the slide and removing material from the upper part of the slide to reduce gravitational potential. In some cases slopes are reinforced with retention structures that help hold a slope in place. Slopes can also be mechanically stabilized with strong root systems or geofabric-reinforced buttresses. If a landslide exists below a construction site, the slope can be stabilized and the potential for the progression of the landslide upslope can be reduced by installing straight shaft piers into ground immediately downslope from the foundation. When considering the mitigation of a an existing landslide, it is important to identify the extent of the slide, the failure surface below the slide, and any older failure surfaces below that from older landslides. In extraordinary cases, landslides can be anchored in place using piers or anchors to reduce the chances of further movement.

The probability is less than a 1% chance of occurrence for a landslide that has significant damage to property. The chances of having a landslide are the highest in the mountainous areas with steep slopes and substantially increase when triggering factors such heavy rain or an earthquake occur.

5.2.9 Severe Weather

Planning Significance - Moderate

5.2.9.1 Nature

Thunderstorms, hailstorms, tornadoes, windstorms, and winter storms were combined into the category of severe weather. Thunderstorms are further defined due to the numerous threats associated with them.

Thunderstorms:

Thunderstorms are formed from a combination of moisture, rapidly rising warm air, and a force capable of lifting the air, such as warm and cold fronts or mountainous terrain. A thunderstorm produces lightning, thunder, and rainfall and can develop in just minutes. Thunderstorms may occur singly, in clusters, or in lines. As a result, it is possible for several thunderstorms to affect one location in the course of a few hours. The main threats from thunderstorms are hail, wildfires, deadly lightning, tornadoes, flash floods, and downburst winds. Flash floods and wildfires are detailed in this plan.

Hailstorms:

Hail is a form of solid precipitation which consists of balls or irregular lumps of ice, that are individually called hail stones. Hail stones consist mainly of water ice and measure between 0.20” and 6.00” (5 and 150 millimeters) in diameter, with the larger stones coming from severe and dangerous thunderstorms. Hail is possible with most thunderstorms as strong rising air currents in the thundercloud transport moisture laden air well above the freezing level converting super-cooled water vapor into hail stones. The stronger the updraft into the thunderstorm, the longer these initially small hails stones stay suspended in the storm, allowing them to grow to in size to the point where they eventually become too heavy for the updraft to keep them aloft, and they fall to the surface.

Tornadoes:

A tornado is a violent, rotating column of air which is in contact with both the surface of the earth and a thunderstorm cloud. Tornadoes come in many sizes but are typically in the form of a visible condensation funnel, whose narrow end touches the earth and is often encircled by a cloud of debris. Most tornadoes have wind speeds between 65 mph and 110 mph, are approximately 250 feet across, and travel less than a mile before dissipating. Some attain wind speeds of more than 300 mph, stretch more than a mile across, and stay on the ground for dozens of miles.

Downburst Winds:

A downburst is created by an area of significantly rain-cooled air that, after hitting ground level, spreads out in all directions producing strong winds. Unlike winds in a tornado, winds in a downburst are directed outwards from the point where it hits land or water. Dry downbursts are associated with thunderstorms with very little rain, while wet downbursts are created by thunderstorms with high amounts of rainfall. Downburst winds are often termed microbursts, macrobursts, or outflow thunderstorm winds. Most downburst winds that impact Carson City occur as dry downbursts due to the high cloud bases of the associated thunderstorms, which allows for much of the rainfall to evaporate before reaching the ground. They are also usually microbursts compared to macrobursts since the area affected is typically less than 2.5 miles. Macrobursts do occur in the region when individual thunderstorm cells organize into a line or cluster, but are less common. Downburst winds are typically 35 to 75 mph, but can exceed over 100 mph in rare cases.

Downburst winds typically damages fences, roofs, weakened structures, trees, and power lines. Downbursts do pose a significant risk to aviation, especially to aircraft taking off and landing due to strong winds that change direction over very short distances. In addition, small aircraft on the ground can incur damage if not secured. Downburst winds do pose a significant risk to new lightning induced wildfire starts, allowing small fires to grow quickly. During periods of drought, dust storms result from downburst winds and cause visibilities to drop below ½ mile, creating hazardous driving conditions. Downburst winds from thunderstorms are common in Carson City from late spring through early fall.

Downslope Wind Storms:

Winds are horizontal flows of air that blow from areas of high pressure to areas of low pressure. Wind strength depends on the difference between the high- and low-pressure systems and the distance between them. Therefore, a strong pressure gradient results from a large pressure difference over short distance between places and causes strong winds.

Strong and/or severe winds often precede or follow frontal activity, including cold fronts, warm fronts, and dry lines. Down-slope wind storms are common in Carson City during the winter months when winter storms approach the Sierra. Strong winds ahead of a cold front are ducted down to the surface due to mountain waves, enhancing wind speeds that are often stronger than Down-slope wind storms seen in the rest of the United States. Down-slope winds in the lee of the Sierra typically produce sustained southwest winds of 30 to 50 mph with gusts to 70 mph. During the strongest down slope wind storms, winds can exceed over 100 mph and last numerous hours.

Down-slope wind storms and can overturn mobile homes, tear roofs off of houses, down fences, topple trees, snap power lines, shatter windows, and sandblast paint from cars. Other associated hazards include utility outages, arcing power lines, and dust storms.

In addition to strong and/or severe winds caused by large regional frontal systems, locally strong winds caused from the funneling of winds through mountain peaks or drainages do occur. Areas impacted by these local winds are much smaller in scale, although wind speeds can be equally as strong as those caused by large scale weather systems.

Winter Storms:

Winter storms can bring heavy rain, snow, high winds, extreme cold, and freezing rain to the region. In Nevada, winter storms are massive low-pressure weather systems originating in the North Pacific Ocean that sweep across the western states. Winter storms can also plunge southward from arctic regions and drop heavy amounts of snow and ice. The severity of winter storms is generally minor. However, a heavy accumulation of snow or ice can create hazardous conditions. Additionally, a large winter storm event can also cause exceptionally high rainfall that persists for days, resulting in heavy flooding. Winter storms that are able to tap into subtropical moisture are the ones most likely to lead to flooding due to heavy warm rain. Flooding is exacerbated by warm heavy rains falling on low elevation snowpack. The current predictability of winter storms is roughly 3-5 days in advance with a general heads-up, with more specific information 1-3 days in advance. Some of the larger "atmospheric river" winter storms can be identified by forecasters up to 7 days in advance, though there are often large errors in track and intensity this far in advance.

5.2.9.2 History

The National Climate Data Center identified major winter storms in Carson City and FEMA declared two Snow Emergencies between 1996 and 2014. The area is subject to more numerous light snowfalls and winter weather events where snow accumulates to 5 or so inches, including the occasional narrow lake effect snow from Lake Tahoe. The more significant storms include the following:

- On January 1-2, 1997, a winter storm with heavy rainfall on top of a deep snowpack resulted in extensive flooding and damage across the region. This is one of the largest floods on record for the region.
- On December 29, 2004 through January 2, 2005, a storm which dropped heavy snow, shutting down roads and requiring snow removal. (FEMA 3202.)
- On January 2 through 10, 2005, a storm which dropped several feet of snow, shutting down roads and requiring snow removal. This series of storms remains the "benchmark" for big snowstorms in the region. (FEMA 3204.)
- On December 30 -31, 2005 heavy rain of up to 6 inches in a 24 hour period was reported. The rain caused flooding in Carson City. (FEMA 1629; see Floods)
- On February 26, 2006, heavy rain up to 3.5 inches fell west of Carson City.
- From January 4-6, 2008, a powerful winter storm brought high winds and heavy snows to Carson City. 15 inches of snowfall was reported. Another storm on February 2, 2008 brought 16 inches of snow to the Carson City foothills.
- On December 6, 2009 a cold storm brought heavy snow to the region including 14-18 inches of snow in Carson City.
- On February 25, 2011, heavy snow fell in Carson City with 12-18 inches in the west side of town. The snow was enough for Governor Sandoval to send home early non-emergency state workers.
- On December 6, 2013, a band of snow produced 6-10 inches of accumulation in Carson City.

Between 1994 and 2014, a total of 10 severe windstorms were reported in Carson City. The severe winds reported were either associated with approaching winter storms (more common) or with downbursts in summer thunderstorms (less common).

- On July 26, 1998, in the central portion of Carson City, thunderstorm winds estimated to 60 knots knocked over a tree which downed power and telephone lines near the Carson River, three miles east of Carson City NV.

- On July 20, 2003, a women and child were slightly injured by falling tree branches when thunderstorm wind gusts estimated at 50 knots blew through Mills Park in Carson City.
- On April 27, 2005, an F0 tornado was reported near the Carson-Tahoe Hospital.
- On June 5, 2007, the Nevada Appeal newspaper reported that strong wind gusts up to 48 knots brought down tree limbs in Carson City. One downed tree limb on Fifth Street knocked out power to 900 residents, including the Carson City Courthouse and Sheriff's Department. A late-season cold front moved through the Sierra and western Nevada on June 5th. Strong winds accompanied the front and caused damage mainly in western Nevada.
- On February 25, 2009, a possible dust devil descended the foothills just west of Carson City. Flying debris generated by the dust devil damaged 12 automobiles in the DMV parking lot. A low pressure system brought strong winds to the northern Sierra and western Nevada.
- On March 29, 2010, a storm brought high winds to Carson City, causing difficulty controlling a fire which caused extensive damage to a furniture store ($250k to $500k damage according to fire chief) and a hair salon.
- On January 19, 2012, a winter storm brought high winds to much of the region, with gusts 60 to 84 mph being reported.
- On December 1, 2012, a winter storm brought high winds of 60-70 mph with gusts to 88 mph in the foothills. Damage reports included downed fences and power lines.
- On March 20, 2013, a winter storm brought damaging winds to the region, with gusts 58-66 mph reported. High winds caused power outages in Carson City, with power poles knocked down.
- On December 11, 2014, a particularly strong windstorm produced widespread damage, trees down, and power outages across the region. Wind gusts over 80 mph were common.

5.2.9.3 Location, Extent, and Probability of Future Events

Thunderstorms that produce hail and downburst winds occur in Carson City every year. An active thunderstorm pattern, resulting from monsoon moisture over the Southwestern United States being transported into Nevada can lead to a prolonged period of thunderstorm days and severe weather. In addition, weak weather systems moving over Nevada after a period of hot weather often leads to dry thunderstorms with strong downburst winds. The current predictability of specific thunderstorms is limited to 0-30 minutes ahead, though forecasters are able to highlight days where the ingredients for thunderstorms are likely to combine up to 1-3 days in advance.

Hailstorms are a common occurrence in Carson City, especially during the late spring through early fall months when thunderstorms are most frequent. Hail sizes are typically between pea and marble size, but can get larger than golf balls during the strongest storms that impact the area. A Severe Thunderstorm for hail, as defined by the National Weather Service, is a thunderstorm capable of producing hail stones greater than 1” in diameter, which usually occurs only a few times per year. The current predictability of severe hailstorms is limited to 0-30 minutes of warning in advance.

Tornadoes are rare in Carson City due to high thunderstorm cloud bases and the mountainous terrain creating erratic wind flows detrimental to tornado formation. Historically, tornadoes in the region are usually weak, often categorized as EF0 (65-85 mph) or EF1 (86-110 mph) on the Enhanced Fujita Scale. An upper level low pressure system is often required for tornado development in Carson City due to the need for sufficient wind shear in the lower atmosphere, which is necessary to create an environment favorable for tornado genesis. The current predictability of tornadoes in the western US is limited to 0-15 minutes of warning in advance.

Severe thunderstorm wind events in Carson City occur every year mainly during the prime summer thunderstorm season from June-August. These can be isolated microbursts or parts of more widespread thunderstorm outbreaks. In these thunderstorm wind events, the current predictability of severe downburst winds is limited to 0-30 minutes of warning in advance. Carson City also experiences local ”zephyr” winds gusting to 20-30 mph each summer day due to the areas valley/mountain topography.

Down-slope wind storms occur on-average two to three times per winter season, Extreme down-slope wind storms with gusts in excess of 80 to 100 mph are less frequent, occurring a few times per decade. The most recent example is the December 11, 2014 windstorm where widespread gusts over 80 mph were observed near Carson City. The current predictability of downslope wind storms is roughly 2-4 days in advance with a general heads-up or High Wind Watch, with more specific information 1-2 days in advance with a High Wind Warning. The areas of worst damage from downslope wind storms are often dictated by just subtle changes in wind direction, which limits how predictable the storms are.

Winter storms that generate heavy rainfall that leads to flooding in Carson City generally occur once every several years. The area is subject to numerous light snowfalls and winter weather events where snow accumulates up to 5 or so inches, including the occasional narrow lake effect snow from Lake Tahoe. These smaller events take place 1-3 times each winter, even in drought years. Snowfall accumulation in Carson City from the bigger snowstorms can often be between 12-24 inches over a 24-hour period. Heavy snowfall events of this magnitude, occurring roughly once every 1-3 years, are generally associated with a strong low pressure system dropping out of the Gulf of Alaska The current state of predictive science allows for a greater heads-up on major winter storms than even just 5 or 10 years ago. The large atmospheric river storms that often create big snowfalls can be tracked across the Pacific Ocean 5-8 days in advance, with more detailed river forecasts up to 2-4 days in advance. It should be noted that uncertainties in rain-snow line elevation forecasts remain one of the biggest prediction challenges and are often of low confidence until 12-24 hours ahead of the storm. See Appendix B, Figure B-5 for Potential Winter Storm Areas.

Given the number of hail storms, wind events, and snow storms in the historical record - there is a probable, 100% chance that Carson City will have a least one of these events in a given year.

Climate Change

Climate change could result in a higher probability of wetter winter storms. The effect of a warming climate on hailstorm frequency and intensity is largely unknown. Lightning occurrence might increase with climate variability due to increased water vapor in the atmosphere related to warming. For the Sierra Front, it is not clear that windstorms will change in magnitude or frequency resulting from climate variability.

5.2.10 Utility Loss

Planning Significance - Moderate

5.2.10.1 Nature

This section will address electrical utility, natural gas utility and water utility loss. Any disruption in the supply of energy, gas or water utility causes human suffering and economic loss. The causes of most of the shortages are beyond the control of local governments. Response to these emergencies may include rationing and emergency supply distribution.

Telephone loss is not included in this section. AT&T is the community provider and is responsible for restoration plans. Responsible distributors:

Table 5-10 Utility Distributors

Utility	Company
Electricity	NV Energy
Natural Gas	Southwest Gas Corp.
Water	Carson City Public Works

Carson City electricity is generated at the following sites within the State of Nevada.

Table 5-11 Electrical Generation Sites

Electrical Generation Site	Location
Valmy	East of Winnemucca
Tracey	East of Sparks
Naniwa	East of Sparks
Fort Churchill	East of Carson City

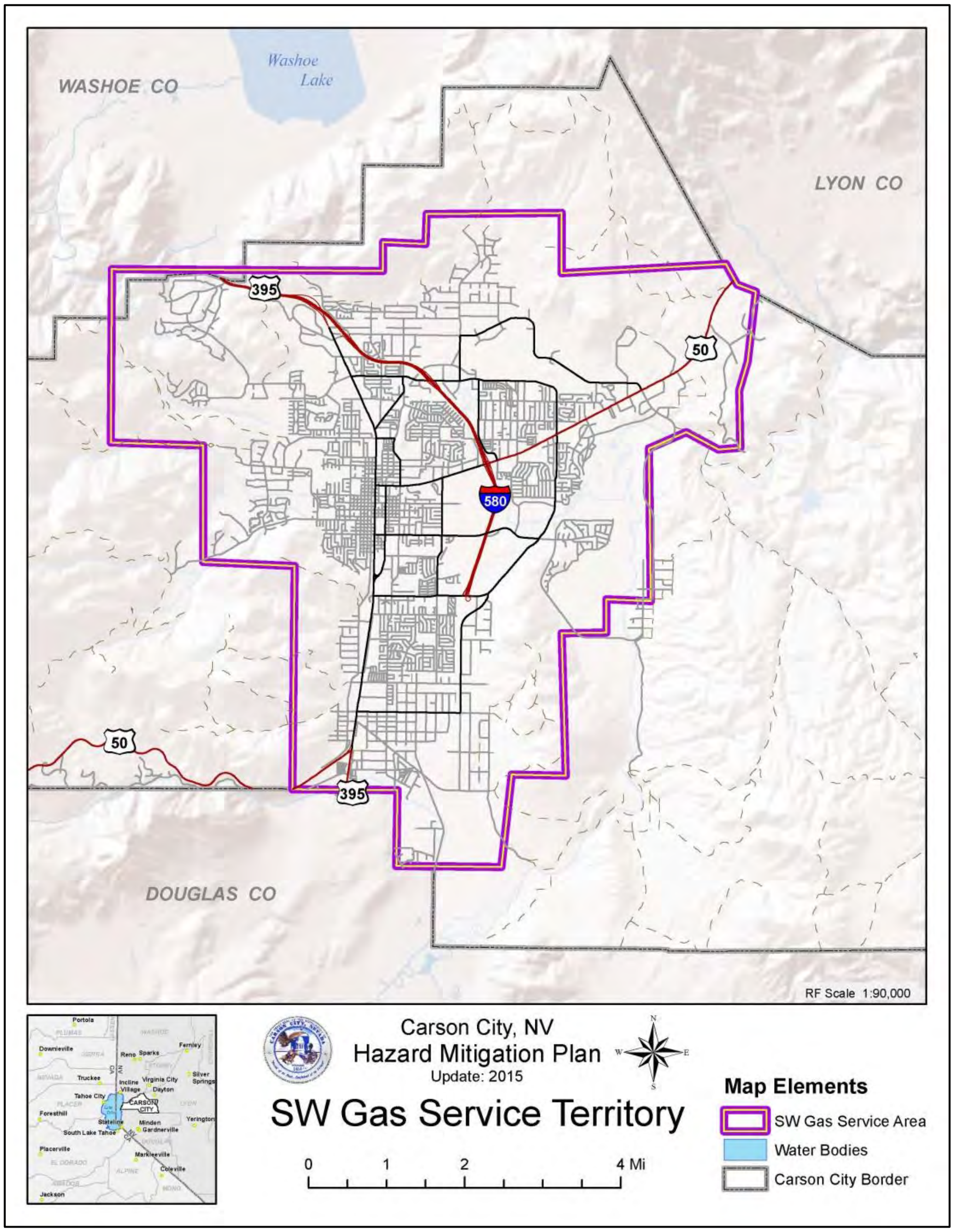
There are two high pressure natural gas transmission lines that supply Carson City, and they are run by Paiute Pipeline and Tuscarora Gas Transmission Company. These companies sell gas to Southwest Gas Corporation. Both transmission lines originate in Canada but enter Nevada in different locations.

Table 5-12 High Pressure Natural Gas Transmission Lines

Attribute	Paiute Pipeline	Tuscarora Gas Transmission
Date of Construction	1963	1995
Entry to Nevada	Approx. Mountain Home, ID	Herlong, CA
Size of Pipeline	12”, 16”, & 20”	20”
Line Pressure	1400 psl	1000 psi
Buried Depth	24” to 60”	24” to 60”
Purpose	Natural gas for industry, business and residential uses	Natural gas to the SPPCO Tracy-Clark Power Plant

Both lines are monitored by telemetry and can be remotely shut down. Both lines have block valves that are consistent with industry standards applicable at the time of installation. The map below provides the Southwest gas territory boundary.

Figure 5-13 Southwest Gas Service Territory Map



Water is provided by Carson City Public Works Department and is provided through watersheds and ground water. With a growing population and economy, increasing environmental concerns, how we choose to collect, store, distribute, use and dispose of water has never been more critical.

5.2.10.2 History

The West Coast energy shortages have raised the issue among local jurisdictions on the prioritization of risks for communities in Northern Nevada.

Carson City's primary source of water is surface water. The other sources of water are pumped from wells within Carson City and purchased from the State of Nevada through the Marlette Hobart pipeline. In 2009, Carson City is still feeling the effects of the Waterfall Fire. From 14 July through 20 July, 2004, the Waterfall Fire burned the eastern flank of the Carson Range along the margins of Carson City and throughout most of three of the four watersheds contributing surface water from the Carson Range to the Eagle Valley. The Carson Range flanks the western margin of the Eagle Valley, and rises to over 9,000 feet in elevation. The impacted watersheds are Kings Canyon Creek, North Kings Canyon Creek, Ash Canyon Creek, and Vicee Canyon Creek. Of these watersheds, only the uppermost portion of Ash Canyon Creek was left unburned.

5.2.10.3 Location, Extent, and Probability of Future Events

Nevada Power Company representatives report that the power systems under their control meet or exceed building standards, and they have had an ongoing mitigation program in place since 1980 to retrofit their facilities for risk exposure. However, the water, electrical and gas supplies are at low risk both inside Carson City and along power pipelines outside the City. The following is a list of the source of potential damage.

1. Construction

Excavation is the most likely cause of damage to a water line, electrical wire or pipeline. The potential for rupture, due to nearby excavation, is greatest in areas where the pipeline corridor intersects highways and railroad right-of-ways and areas of new construction. Breaks in the pipeline caused by excavation are the most easily preventable type of break. Public education and awareness for the need to locate pipelines before digging or operating heavy equipment near a pipeline and coordinated efforts to make pipeline and utility locations easy to identify, will help to prevent future breaks. As the area within the pipeline corridor continues to grow and expand, the potential for damage will also increase.

2. Earthquake

Earthquakes pose a threat to water lines, the electrical grid and the sewer pipeline. An earthquake has the potential to damage and create ground deformations through liquefaction, surface rupture, and landslide. The pipeline is constructed of high-grade steel using modern full penetration welding techniques. Pipelines have withstood major earthquakes in the past with minor to no damage due to the ability of welded steel pipe to withstand considerable ground deformation without failure. The ductility of high-grade steel pipe provides the pipe with a large amount of resistance to rupture from most ground deformation and shaking. The pipeline was constructed to withstand a 7.5 magnitude earthquake and has a proven track record in this area.

Damage to tanks and connections, however, are common during events of extreme shaking. Tank damage such as sidewall buckling, separation of sidewalls from the bottom plate, and sloshing of liquids can result from severe shaking. If connections between pipes and tanks are not flexible they are vulnerable to damage during earthquakes. Containment dikes serve as a good line of defense in the event pipe connections break. Once contained within the dikes the petroleum products can be kept from ignition sources and the spill can be controlled.

3. Flood and Erosion

River and stream crossings at locations where a pipeline is near an embankment are subject to erosion. Floodwaters pose the greatest threat to breaking a pipeline, since flooding can result in large amounts of erosion and mass wasting along drainage over a very short period of time. Preventative measures have kept stream erosion from causing any breaks in the pipeline in the past, however heavy flood waters can change the whole course of a river or stream in minutes. Some of these crossing may be at higher risk of erosion or embankment failure due to soil types, nearby tectonic activity, and gradient of the embankments and river. There are many washes, dry creeks, marshes, and irrigation ditches that drain into the Carson River that are traversed by the pipeline. It is imperative that, in the event of a spill, an assessment of the location is made to determine if it is in drainage.

4. Corrosion & Settlement

Pipelines are often subject to corrosion due to saline or alkaline ground water or in some cases chemical spills near the pipeline. Corrosion can, in extreme cases, lead to seepage and leakage underground.

5. Landslide

In the mountainous terrain landslides and avalanches have the potential of disrupting power or uncovering and/or damaging the pipeline. The greatest hazard exists where the electrical wire or pipeline crosses steep mountainous areas. Earthquakes, flooding and times of high run off can lead to an increased likelihood of landslides.

6. Wildland Fire

In the mountainous terrain wildland fires have the potential for disrupting power.

Water

1. Earthquake

Earthquake has a high probability of impacting the water and waste water in the entire Carson City area due to underground and above ground piping that would be damaged. Please see earthquake section for probability and frequency.

2. Flood

Flooding has historically impacted the waste water treatment facility since it lies in a low area northeast of the city. Impact historically is for a short duration, however the probability of an event occurring is high.

3. Wildland Fire

Since the majority of Carson City's water is obtained from surface water from Ash & Kings Canyon, wildland fires in those areas provides the greatest risk to water loss. Mike Dondero, Nevada Division of Forestry (*retired*), states that fire in that area reoccurs every fifteen (15) years. The probability for a future water loss event is high. The extent of damage caused by a fire can be determined from the section below titled Potential Impacts of the Waterfall Fire.

5.2.11 Volcanic Activity

Planning Significance - Moderate

5.2.11.1 Nature

A volcano is an opening, or rupture, in a planet's surface or crust, which allows hot, molten rock, ash and gases to escape from below the surface. Volcanic activity involving the extrusion of rock tends to form mountains or features like mountains over a period of time.

Volcanoes are generally found where tectonic plates pull apart or come together. By contrast, volcanoes are usually not created where two tectonic plates slide past one another. Volcanoes can also form where there is stretching and thinning of the earth's crust (called "non-hotspot intra plate volcanism"), such as in the Rio Grande Rift in North America.

5.2.11.2 History

Nevada has a long history of volcanism. In western Nevada, the most recent episode was between 2.6 to 1 million years ago (Henry and Cousens, 2013). At about 1.36 million years ago, two lava flows erupted out of a volcanic cone at McCellan Peak and "flowed ~6 km [3.6 mi] into what is now suburbs of Carson City and across U.S. Highway 50" (Henry and Cousens, 2013). It has been a long time since these eruptions, but still renewed activity is not out of the question. In 2003, an earthquake swarm just north of Lake Tahoe was interpreted to have been caused by a magmatic dike injection that went a distance of 3 miles (from 20 miles deep to 17 miles deep) in about 23 days (Smith and others, 2004).

Volcanic activity from surrounding states, particularly California and Oregon, has created ash clouds that have drifted over Nevada. Numerous young ash beds in western Nevada and the 1915 Lassen Peak eruptions attest to this. In 1915, fine ash from Lassen Peak was deposited as far east as Winnemucca, Nevada.

5.2.11.3 Location, Extent, and Probability of Future Events

Any volcanic activity that produces ash would impact Carson City's water for a short period of time. The probability of an ash event occurring is low. The following Forum Report was made available to the Hazard Mitigation Steering Committee on volcanic hazard risks in Nevada from the Nevada Bureau of Mines and Geology.

Volcanic Hazards

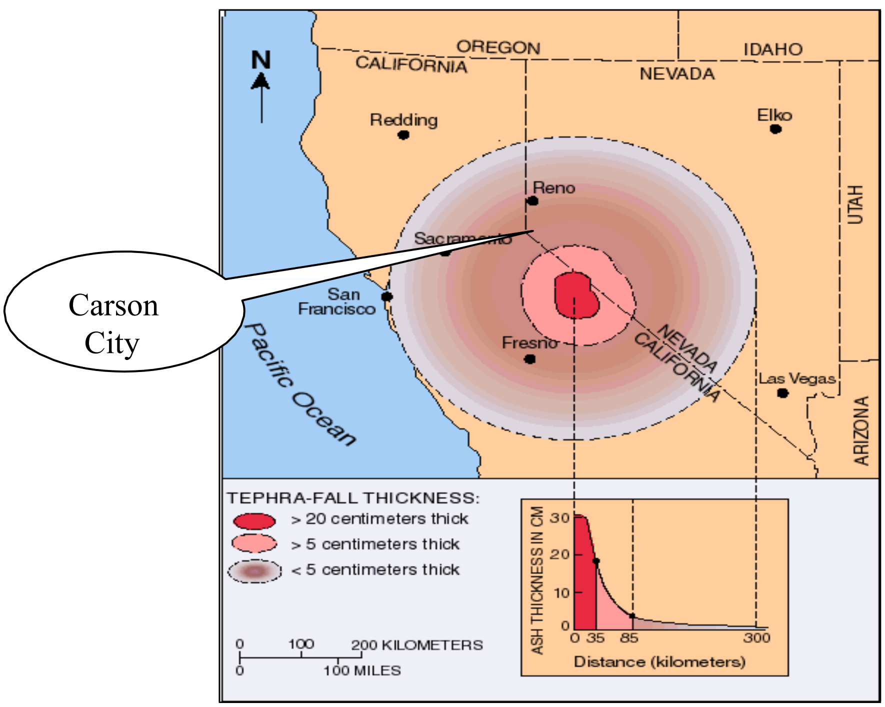
Jon Price, State Geologist and Larry Garside, Research Geologist, Nevada Bureau of Mines and Geology. 6/04/02

> "The most likely volcanic hazard for Nevada is an eruption from the Mono Craters area near Lee Vining and Mono Lake in Eastern California. Small eruptions from these volcanoes have sent ash into Nevada as recently as about 260 years ago. Other volcanoes that could deposit ash in Nevada include Mount Lassen, Mount Shasta and the Long Valley Caldera in California and volcanoes in the Cascade Mountains in Oregon.

The biggest threat for Nevada from eruptions in California and Oregon is damage to flying aircraft. Ash from eruptions in California or Oregon is not likely to cause long-term problems in Nevada, because the ash deposits are likely to be thin, typically only a few inches thick at most.

A massive eruption from the Long Valley Caldera near Mammoth Lakes, California over 700,000 years ago devastated a considerable area in Owens Valley when thick, hot flows of ash were deposited as far south as Bishop. Air-fall ash from these eruptions did collect as thick piles of ash in parts of Nevada, and some of the ash may have been hot enough or thick enough to devastate the landscape locally. Scientist would expect to see strong indications from seismographs before another eruption of this magnitude. The U.S. Geological Survey continues to monitor the area around Mammoth Lakes, and will issue warnings prior to any subsurface changes that could precede a major eruption. Below please see the volcanic ash dispersal map for the Long Valley Caldera."

Figure 5-14 Volcanic Ash Dispersal Map for the Long Valley Caldera



Source: USGS Volcano hazards program; C.D. Miller, J. Johnson; http://lvo.wr.usgs.gov/zones/TephraFall.html

The probability of eruptions inside Nevada are not likely in the near future, judging from past activity and lack of earthquakes that would suggest current movement of magma. This opinion may change if seismic signals indicate possible movement of magma in the future. Our ability to monitor small tremors associated with magma at depth is limited by the currently limited number of seismographs that are operated in Nevada. The Nevada Seismological Laboratory and the U.S. Geological Survey have joint responsibilities for earthquake monitoring and warnings. The Advanced National Seismic System, which is authorized by Congress but currently has been funded at only a fraction of its intended size, will help to monitor for earthquakes and pending volcanic eruptions.

The Soda Lake and Little Soda Lake (near Fallon in Churchill County) maars (volcanoes that form by explosions when magma rises near the surface of the earth and boils the groundwater) are probably the youngest volcanoes within the borders of the State. They have not erupted in recorded history, although they definitely are younger then the last high stand of Lake Lahontan, about 13,000 years ago because deposits from these volcanoes overlie sediments deposited in the lake. On the basis of preliminary helium isotopic studies (Thure Cerling, University of Utah, personal communication, 1997), the eruption at Soda Lake may be younger than 1,500 years before present.

Other relatively young volcanoes occur in the Crater Flat – Lunar Crater Zone, Nye County, which includes basaltic volcanoes ranging in age from about 38,000 to 1 million years old (Smith, E.I. Keenan, D.L., Plank, T. 2002, Episodic Volcanism and Hot Mantle: Implications for Volcanic Hazard Studies at the Proposed Nuclear Waste Repository at Yucca Mountain, Nevada:GSA Today, v.12, no.4, p. 4-10); in Clayton Valley, near Silver Peak in Esmeralda County; near Winnemucca in Humboldt County; and near Reno in Storey County. Most of these are basaltic volcanoes, which typically form small cinder cones and small lava flows. There are also some one million-year-old rhyolitic lava flows in the Reno area near Steamboat Hot Springs.

Volcanic activity is usually preceded by months of earthquake activity as magma breaks its way towards the surface, so a “surprise” eruption is not a credible scenario. If volcanic activity was to resume today, it would likely be preceded by months of earthquake activity and ground deformation that would be measured by geodetic instruments. The length of time to become aware of volcanic activity and planning a response would be relatively short, but would potentially be months. Volcanic response plans prepared by other states with higher volcanic risks would be useful to have available if a response was ever needed.

The environmental effects of a volcano occurring in neighboring states would affect the Carson City area with ash fall from winds blowing it into the valley area. This ash fall could last hours or days depending on the severity of the event. The ash has the potential to get into air conditioning and heating units, car motor systems and building ventilation equipment. Also, the obvious potential to pollute the air, causing those sensitive to pollutants to remain indoors and refrain from normal outdoor activities would be an environmental impact from ash fall.

5.2.12 Wildland Fire

Planning Significance - High

5.2.12.1 Nature

A wildland fire is a type of wildfire that spreads through consumption of vegetation. It often begins unnoticed, spreads quickly, and is usually signaled by dense smoke that may be visible from miles around. Wildland fires can be caused by human activities (such as arson or campfires) or by natural events such as lightning. Wildland fires often occur in forests or other areas with ample vegetation. In addition to wildland fires, wildfires can be classified as urban fires, interface or intermix fires, and prescribed fires.

The following three factors contribute significantly to wildland fire behavior and can be used to identify wildland fire hazard areas.

Topography: As slope increases, the rate of wildland fire spread increases. South-facing slopes are also subject to more solar radiation, making them drier and thereby intensifying wildland fire behavior. However, ridge tops may mark the end of wildland fire spread, since fire spreads more slowly or may even be unable to spread downhill.

Fuel: The type and condition of vegetation plays a significant role in the occurrence and spread of wildland fires. Certain types of plants are more susceptible to burning or will burn with greater intensity. Dense or overgrown vegetation increases the amount of combustible material available to fuel the fire (referred to as the “fuel load”). The ratio of living to dead plant matter is also important. The risk of fire is increased significantly during periods of prolonged drought, as the moisture content of both living and dead plant matter decreases. The fuel’s continuity, both horizontally and vertically, is also an important factor.

Weather: The most variable factor affecting wildland fire behavior is weather. Temperature, humidity, wind, and lightning can affect chances for ignition and spread of fire. Extreme weather, such as high temperatures and low humidity, can lead to extreme wildland fire activity. By contrast, cooling and higher humidity often signals reduced wildland fire occurrence and easier containment.

The frequency and severity of wildland fires also depends upon other hazards, such as lightning, drought, and infestations. If not promptly controlled, wildland fires may grow into an emergency or disaster. Even small fires can threaten lives and resources and destroy improved properties. In addition to affecting people, wildland fires may severely affect livestock and pets. Such events may require emergency watering/feeding, evacuation, and shelter.

The indirect effects of wildland fires can be catastrophic. In addition to stripping the land of vegetation and destroying forest resources, large, intense fires can harm the soil, waterways, and the land itself. Soil exposed to intense heat may lose its capability to absorb moisture and support life. Exposed soils erode quickly and enhance siltation of rivers and streams, thereby increasing flood potential, harming aquatic life, and degrading water quality. Lands stripped of vegetation are also subject to increased debris flow hazards, as described above.

5.2.12.2 History

Carson City Fire Department reported 155 local wildland fire starts but the State record maintained by BLM only indicates 87 starts for the same timeframe. The discrepancy is due to some fires only having a CCFD response and some remote fires only getting a BLM or USFS response and some get CCFD and a federal agency. This information was obtained from the Carson City Fire Department and Bureau of Land Management State record. Nevada had 87 (155) wildland fires between 2010 and 2014, that consumed over 1,289,147 acres. Of 1,588.73 acres burned, there were large fires totaling 543 acres consuming a total of 42% of the total acres burned.

As shown in **Table 5-13** and **Table 5-14** there have been a number of significant wildland fires recorded in Carson City over the past fifteen years. During the last five years, approximately 10 percent of these fires were due to lightning, while humans and unknown causes make up the remaining 90 percent of ignition sources.

Figure 5-15 Carson City Fire History Map (2010-2014)
(Eight total fires = 543 acres)

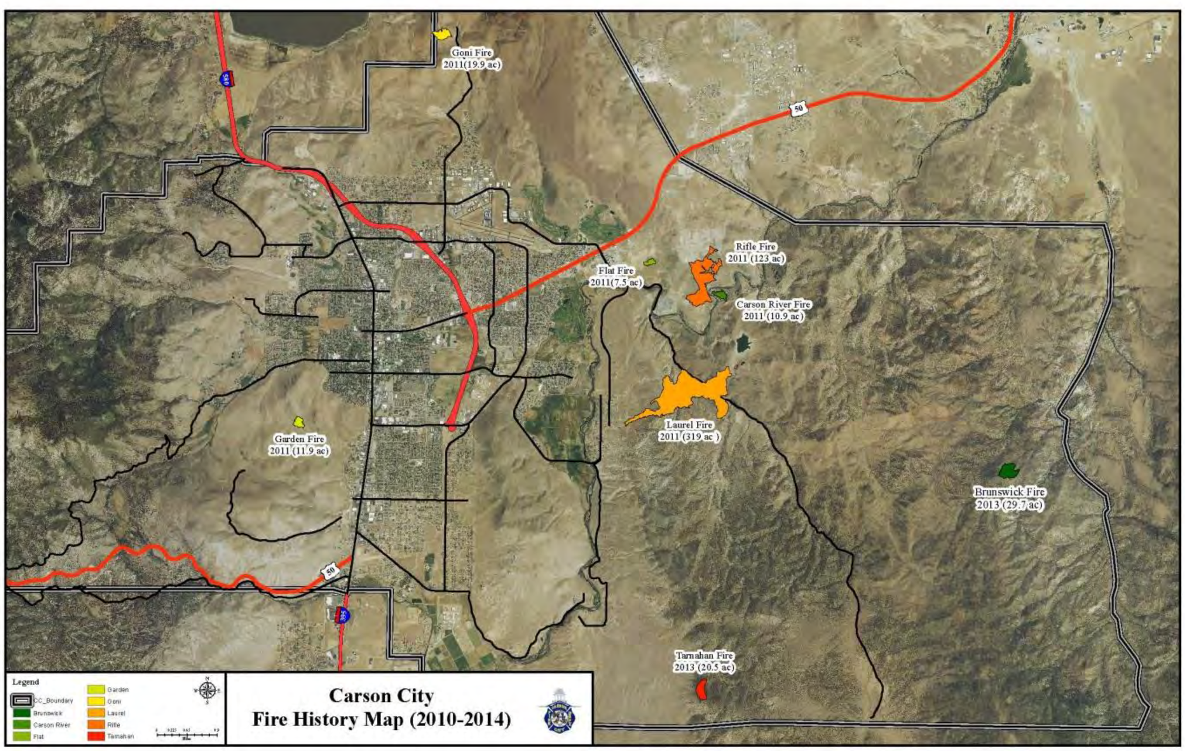


Table 5-13 Nevada & Carson Summary of Fire History Data, 1999-2014

Year	Number of Wildland Fire Ignitions Carson City	Carson City Total Wildland Fire Acreage	NV Total Wildland Fire Acreage
1999	**59**	**Not Available**	**1,575,956**
2000	**48**	**Not Available**	**699,210**
2001	**35**	**Not Available**	**654,253**
2002	**52**	**2,000**	**77,551**
2003	**41**	**200**	**17,546**
2004	**43**	**10,000 (Total) Waterfall Fire* 8,799**	**40,950 (Total) - Waterfall Fire 8,799**
2005	**44**	**6,500**	**1,032,104**
2006	**49**	**250**	**1,348,871**
2007	**57**	**150**	**900,498**
2008	**32**	**<50**	**71,930**
2009	**15**	**<50**	**33,365**
2010	*1*	*<50*	*23,867*
2011	*6*	*<492*	*430,061*
2012	*3*	*<50*	*613,126*
2013	*4*	*<50*	*162,841*
2014	*12*	*<50*	*59,252*
2010	*1*	*<50*	*23,867*

Source: Nevada Division of Forestry, Carson City Fire Department
Source: Nevada Division of Forestry, May 27, 2015

Table 5-14
Local Carson City Summary of Significant Fire History Data, 2010 – 2014

Year	Number of Incidents*	Acres
2010	13	4.03
2011	44	509.34
2012	29	803.99
2013	31	77.31
2014	38	194.06
Total:	**155**	**1,588.73 acres**

**Cause of Incidents are combined and defined as Other; Natural sources; equipment; smoking; open/outdoor fire; debris/vegetation burn; structure exposure Incendiary; misuse of fire; and undetermined.*

Source: Carson City Fire Department, June 3, 2015.

5.2.12.3 Location, Extent, Probability of Future Events

Communities in Carson City have a varying degree of risk from wildfire. This risk is varied, largely due to past fire activity and the type of moisture received during the winter months. Lengthy rainy seasons tend to increase the production of grasses which can create fast moving fires in the brush and grass areas of Carson City. Drought seasons tend to decrease the fuel moisture in the large fuels (trees and large brush) and create high output BTU fires that are difficult to control and can extend for days.

Climate Change

Numerous studies indicate that warmer weather coupled with lengthening of the fire season, could lead to an increase both in fire occurrence and in the areas burned. The effects of climate change, depending upon the type and amount of moisture received, can increase the risk to a given community in Carson City which can change from season to season. These effects can range from poor air quality due to smoke from wildland fires and fuel sources grown during the rainy seasons, turning to extreme dry brush (fuels for fire.) Carson City has developed a Community Wildfire Protection Plan (July 2009) to help guide the community and its residents on where and how to focus fuel reduction efforts. The Community Wildfire Protection Plan (July 2009) generally speaks to protecting the built environment from the threats of wildland fire.

Based on the last five year historical record, Carson City can anticipate nearly 31 wildland fire starts per year. While a very small percentage of these (less than 2%) will exceed 100 acres, the potential for destructive fires is evident every fire season. Within the 2014 fire season alone, there were 38 incidents, totaling 194.06 acres. Of these fires only one fire burned over 185 acres, caused by natural sources, such as lightning (Carson Street and the Spooner Junction). The remainder fires were less than one acre, caused by a range of sources such as equipment, smoking, open/outdoor fire, debris/burning vegetation, structure exposure and misuse of fire. This information was obtained from the Carson City Fire Department. See Appendix B, Figure B-6.

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A vulnerability analysis predicts the extent of exposure that may result from a hazard event of a given intensity in a given area. The analysis provides quantitative data that may be used to identify and prioritize potential mitigation measures by allowing communities to focus attention on areas with the greatest risk of damage. A vulnerability analysis consists of the following six steps: assets inventory, methodology, data limitations, exposure analysis, and summary of impacts. Land use and development trends are not discussed in this version of the HMP.

6.1 ASSET INVENTORY

Asset inventory is the first step of a vulnerability analysis. Assets within each community that may be affected by hazard events include population, residential and non-residential buildings, critical facilities and infrastructure. Assets and insured values throughout the City are identified and discussed in detail below.

6.1.1 Population and Building Stock

Population data for the City was obtained from the Nevada State Demographer and verified from the 2010 U.S. Census and shown in Table 6-1. The Nevada State Demographer's Office maintains annual population estimates by county. Estimated numbers and replacement values for residential and nonresidential buildings, as shown in Table 6-1, were obtained from the City Assessor's office and were verified by photo and by parcel data. To achieve a value, the net assessed value was increased by 20% to get current market value.

The residential buildings considered in this analysis include single-family dwellings, mobile homes, multi-family dwellings, temporary lodgings, institutional dormitory facilities, and nursing homes. Nonresidential buildings were also analyzed including commercial, industrial, agricultural, government, educational, and religious centers.

Although the building count or value may not be precise, whether residential or nonresidential, this analysis will meet the intention of DMA 2000 by providing Carson City residents with an accurate visual representation of their community's risk by hazard. This data is the most complete dataset available at the time and will be updated in future versions of the HMP.

Table 6-1 Estimated Population and Building Inventory

Population		Residential Buildings		Nonresidential Buildings	
2010 Census Population Count	NV Demographer Projected 2015 Population	Dwelling Unit Count	Total Value of Buildings (in millions)	Non-Dwelling Count	Total Value of Buildings (in millions)
55,274	54,169	22,928	$842.0	2,632	$588.0

Source: *U.S. Census 2010 population data, http://censtats.census.gov/data/NV/05032510.pdf , State of Nevada Demographer, Carson City Assessor's Office, Carson City Public Works*

6.1.2 Critical Facilities and Infrastructure

A critical facility is defined as a public or private facility that provides essential products and services to the general public, such as preserving the quality of life in the City and fulfilling important public safety, emergency response, and disaster recovery functions. They include:

- 1 sheriff station

- 4 fire stations (includes ambulance facilities & local EOC)
- 1 emergency operation centers (EOCs)
- 12 public primary and secondary schools (3 schools designated as shelters)
- 5 hospital w/emergency room & urgent care
- 4 urgent care facilities
- 12 City municipal buildings
- 15 communication facilities
- 60 state owned facilities (capital buildings)
- 1 state military government facility (national guard)

Similar to critical facilities, critical infrastructure is defined as infrastructure that is essential to preserving the quality of life and safety in the City. Critical infrastructure includes:

- 31 miles of State and Federal highways
- 1 airport facilities
- 34 bridges
- 1,714 miles of pipe (utilities)

The City's critical facilities are listed in Table 6-2 and shown in Appendix B, Figure B-7, Critical Facilities; NV State buildings are not included.

Table 6-2 Critical Facilities and Infrastructure

Category	Type	Number	Estimated Total (millions of $)
Critical Facilities	Sherriff Stations	1	36
	Fire Stations	4	32.5
	EOCs	1	10.5
	Municipal Buildings	12	55.5
	Public Primary and Secondary Schools	12	169
	Hospital w/Emergency Room	1	130
	Urgent Care Facilities	4	41.2
	Ambulance Facilities	4	Included in fire station
	Communication Facilities	15	70.2
	State Owned Critical Buildings	60	447
Critical Infrastructure	State and Federal Highways (miles)	31	192.30
	Airport Facilities	1	39.80
	Bridges	34	3.9
	Utilities (Water, Waste Water, Gas, Electrical)	n/a	106.90

Source: FEMA HAZUS-MH, Carson City Fire Department, NV Division of Emergency Management, Carson-Tahoe Regional Healthcare, CC School District, NV State Dept of Risk Mgmt.

6.2 METHODOLOGY

A conservative exposure-level analysis was conducted to assess the risks of the identified hazards. Hazard areas were determined using information provided by the U.S. Seasonal Drought Monitor, EPA, HAZUS, Nevada Bureau of Mines and Geology, and NWS. This analysis is a simplified assessment of the potential effects of the hazard on values at risk without consideration of probability or level of damage.

Using GIS, the building footprints of critical facilities were compared to locations where hazards are likely to occur. If any portion of the critical facility fell within a hazard area, it was counted as impacted. Using census block level information, a spatial proportion was used to determine the percentage of the population and residential and nonresidential structures located where hazards are likely to occur. Census blocks that are completely within the boundary of the hazard area were determined to be vulnerable and were totaled by count. A spatial proportion was also used to determine the amount of linear assets, such as highways and pipelines, within a hazard area. The exposure analysis for linear assets was measured in miles. For drought, population was the only asset analyzed, as drought mainly affects people and agricultural lands (which were not considered in this version of the HMP).

Replacement values or insurance coverage were developed for physical assets. These values were obtained from the City's Assessor's Office, Public Works, NV State Risk Management and HAZUS-MH run (for earthquake). For facilities that did not have specific values per building in a multi-building scenario (e.g., schools), the buildings were grouped together and assigned one value. For each physical asset located within a hazard area, exposure was calculated by assuming the worst-case scenario (that is, the asset would be completely destroyed and would have to be replaced). Finally, the aggregate exposure, in terms of replacement value or insurance coverage, for each category of structure or facility was calculated. A similar analysis was used to evaluate the proportion of the population at risk. However, the analysis simply represents the number of people at risk; no estimate of the number of potential injuries or deaths was prepared.

6.3 DATA LIMITATIONS & FUTURE DEVELOPMENT

The vulnerability estimates provided herein use the best data currently available, and the methodologies applied result in an approximation of risk. These estimates may be used to understand relative risk from hazards and potential losses. However, uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning hazards and their effects on the built environment, as well as approximations and simplifications that are necessary for a comprehensive analysis.

The resulting analysis was compiled to the highest degree possible with the hardware, software and data availability limitations discovered during plan preparation. HAZUS was able to determine the population and critical facilities within a given hazard area and from there a limited assessment was derived. In the situation of Drought & Epidemic, where structures would not usually be affected the term N/A (not applicable) is used.

It is also important to note that the quantitative vulnerability assessment results are limited to the exposure of people, buildings, and critical facilities and infrastructure to a hazard. It was beyond the scope of this HMP to develop a more detailed or comprehensive assessment of risk (including annualized losses, people injured or killed, shelter requirements, loss of facility/system function, and economic losses). Such impacts may be addressed with future updates of the HMP.

6.3.1 Future Development

Carson City has historically low growth with an average of 1% per year for population. As discussed in at the end of Section 3 – Community Description there are several ranches which have growth potential. The majority of the City is already developed with infill being the primary future development. The City has approximately 1,200 approved single family residence parcels within the City for future development. The infill will trend towards higher density in residential development and multi-story office buildings for commercial development.

There are four recently approved projects including the Downtown Capital Mall (a mix of office, hotel, and commercial/residential), Mountain Street Assisted Living, Carson City Animal Services, and the Boys and Girls Club Teen Center. Additionally, several projects are currently under construction including the United Federal Credit Union, Carson Dermatology, and the Carson City Multi-Purpose Athletic Center (MAC). For critical infrastructure, Highway 395 is currently under construction to extend from Fairview Drive and connect with Highway 50. This will include two bridges for overpass. All of these projects will incorporate existing or future building codes and regulations that include mitigation measures and do not pose a significant vulnerability.

6.4 EXPOSURE ANALYSIS

The requirements for a risk assessment, as stipulated in the DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Assessing Vulnerability, Overview

Assessing Vulnerability: Overview
Requirement §201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.
Element
- Does the new or updated plan include an overall summary description of the jurisdiction's vulnerability to each hazard?
- Does the new or updated plan address the impact of each hazard on the jurisdiction?

Source: FEMA 2008.

DMA 2000 Recommendations: Assessing Vulnerability, Identifying Structures

Assessing Vulnerability: Identifying Structures
Requirement §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.
Element
- Does the new or updated plan describe vulnerability in terms of the types and numbers of existing buildings, infrastructure, and critical facilities located in the identified hazard areas?
- Does the new or updated plan describe vulnerability in terms of the types and numbers of future buildings, infrastructure, and critical facilities located in the identified hazard areas?

Source: FEMA 2008.

DMA 2000 Recommendations: Assessing Vulnerability, Estimating Potential Losses

Assessing Vulnerability: Estimating Potential Losses
Requirement §201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate.
Element
- Does the new or updated plan estimate potential dollar losses to vulnerable structures?
- Does the new or updated plan reflect changes in development in loss estimates?
- Does the new or updated plan describe the methodology used to prepare the estimate?

Source: FEMA 2008.

The results of the exposure analysis are summarized in Tables 6-3 and 6-4 and in the discussion below. The results in this exposure analysis were greatly affected by the hardware, software and data availability limitations described above.

Table 6-3 Potential Hazard Vulnerability Assessment – Population and Buildings

Hazard	Population[4]	Buildings			
		Residential		Nonresidential	
	Number	Number[3]	Value ($)[1]	Number[3]	Value ($)[1]
Total for Carson City	54,169	22,928	$842,025,452	3,231	$588,022,055
Drought	54,169	0	$0	0	$0
Earthquake – 100yr Magnitude 6.5[2]	54,169*	N/A*	N/A*	N/A*	N/A*
Flood - 100-Year Flood Zone	53,654	1,944	$65,583,930	674	$231,394,909
Hazardous Materials Event – 1-mile radius EHS facilities 10% of 95%	5146	2059.79	$66,677,423	243.295	$54,873,132
Hazardous Materials Event – 1-mile radius hazardous facilities 5% of 95%	2,523	1,030	$27,782,260	122	$22,863,805
Hazardous Materials Event – 1-mile buffer transport corridors 5% of 95%	2,237	896	$23,309,509	92	$18,887,085
Infectious Disease	54,169	0	$0	0	$0
Severe Weather – High – 25% of population & .5% buildings	13,542	115	$4,210,127	16	$29,401,102
Seiche	0	0	$0	0	$0
Utility Loss	54,169	22,928	$842,025,452	3,231	$588,022,055
Wildland Fires - Extreme	4,393	675	$47,407,698	781	$52,602,598
Volcano/Ash	54,169	22,928	$2,526,076	3,231	$1,764,066

[1] Value = buildings only. Data acquired from Carson City Assessor's Office N/A = Not Applicable

[2] Data acquired from Nevada Bureau of Mines and Geology Open-file Report 09-8, HAZUS-MH [4] Data source Nevada State Demographer

[3]Data acquired from Carson City Assessor's Office.

*Due to loss of use of buildings and critical infrastructure, it is anticipated that the entire population will be effected by an earthquake with a magnitude of 6.0 or higher. A comprehensive vulnerability assessment was performed by the Nevada Bureau of Mines and Geology using HAZUS. Please see Section 6.4.2 for building loss and values.

Table 6-4 Potential Hazard Vulnerability Assessment – Critical Facilities

	Police Stations (1)		Fire Station/EOC Ambulance (4)		Hospital/Urgent Care Facilities (5)		Other City Municipal Buildings (12)		Schools (12)		Communication Facilities (15)		Water/ Sewer Facilities (123)	
Hazard	**Number**	**Value ($)[1]**	**Number**	**Value ($)[1]**	**Number**	**Value ($)[1]**	**Number**	**Value ($)[1]**	**Number**	**Value ($)[1]**	**Number**	**Value ($)[1]**	**Number**	**Value ($)[1]**
Drought	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0
Earthquake - 100yr Magnitude 6.5[2]	1	$36	4	$32.5	5	$136.9	12	$55.5	12	$169	15	$70.3	123	$73.2
Flood - 100-Year Flood Zone	0	$0	0	$0	0	$0	1	$12.9	2	$28.2	1	$1.4	13	$16.5
Hazardous Materials Event – 1-mile radius EHS facilities	1	$36	3	$24.4	5	$136.9	11	$46.7	11	$154.9	12	$70.2	88	$70.6
Hazardous Materials Event – 1-mile buffer transport corridors	1	$36	3	$24.4	4	$136.5	8	$37.9	7	$98.6	12	$66.2	75	$43.1
Infectious Disease	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0
Seiche	0	$0	0	$0	0	$0	0	$0	0	$0	0	0	0	0
Severe Weather	1	$.18	1	$.04	5	$.005	1	$.02	1	$.07	1	$.02	1	$.003
Utility Loss	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0
Wildland Fire	0	$0	0	$0	1	$100.0	0	$0	1	$50.0	1	$1.0	1	$23.0
Volcano/Ash	1	$.11	4	$.98	5	$.041	12	$.17	12	$.51	15	$.21	123	$.22
Total	**1**		**4**		**5**		**12**		**12**		**6**		**123**	

[1] Value = in millions/buildings only.

[2] Data acquired from Nevada Bureau of Mines and Geology HAZUS-MH with additions estimated by Planning Committee, Carson City School District, and Carson Tahoe Hospital.

N/A = Not Applicable

6.4.1 Drought

According to the U.S. Seasonal Drought Monitor, the entire area of the City is at equal risk to a drought event. The entire population of Carson City, 54,169, may be affected by the drought however building and critical facilities would just be limited in their use but would not be damaged.

6.4.2 Earthquakes

Carson City has a substantial earthquake hazard and has experienced strong ground motion several times historically. Although modern building codes are adopted and enforced, there are many buildings and infrastructure in Carson City that were built prior to code enforced, and some of these structures are seismically vulnerable. These include unreinforced masonry buildings (URM) and non-ductile concrete buildings. Original estimates based on assessor data and some rough sorting parameters generated a list of 734 possible unreinforced masonry buildings in Carson City, most of these being commercial and public buildings (Price and others, 2012). A refinement of this list using a visual survey has reduced the number of unreinforced structures down to a little over 100 buildings, mostly located along the major transportation routes. This still represents a substantial seismic risk, however. Once a certain level of confidence is gained for this URM building inventory and it is prioritized with respect to risk, a strategy for approaching the rehabilitation of these buildings should be considered, which includes as many incentives to do so as possible to help offset costs.

Several scenario earthquakes were modeled for Carson City using the HAZUS-MH loss-estimation program. Two areas of persistent small earthquakes in Carson City were modeled considering earthquakes of magnitude 6. These events caused projected severe damage to over 850- 1000 buildings, moderate damage to over 2800 buildings, and cost estimates of $390 million to $500 million to Carson City. The larger range-bounding earthquakes have estimated magnitudes of 6.9 to 7.2. These events are projected to cause severe damage to 1600 to 2700 buildings in Carson City, with moderate damage to over 4,900 buildings, and damage cost estimates in the $500 million to $1 billion range. Any of these scenario events would have a substantial impact on Carson City and Nevada. Table 6-5 shows a suite of HAZUS scenarios with different magnitudes, centered on the State Capitol. All of these are plausible earthquakes that could strike in Carson City.

Table 6-5 Cost Estimates for a Capitol Suite of Scenario Earthquakes for Nevada Counties

Earthquake Magnitude	Building Damage ($M)	Transportation Damage ($M)	Utility Damage ($M)	Total Cost ($M)
5.0	1.3	1.5	5.4	8.2
5.5	38.9	3.2	7.6	50
6.0	214.3	6.1	17.3	237
6.5	649.9	11.1	27.1	688
7.0	1,246	16.9	49.6	1,310

The magnitude 7 scenario earthquake in Table 6-5 can be used to help visualize some of the potential earthquake effects and vulnerabilities in Carson City. A magnitude 7 centered on the State Capitol would likely be along the Kings Canyon fault zone and would produce a 3 to 6 foot high scarp along the western side of Eagle Valley. HAZUS modeling of this event estimates that 2,325 buildings would have severe damage and 3,121 buildings would have moderate damage, including one hospital. Estimations of injuries for a 2 pm earthquake (the maximum estimate) include 120 people requiring hospitalization, 383 people requiring medical attention that do not need to be hospitalized and 32 casualties. Shelter requirements are estimated at 269 people. Fifteen schools have moderate damage. Five damaged electrical facilities hamper the restoration of power to 14,500 customers. There are many breaks in pipelines, including 312 breaks in water lines, 157 leaks and breaks in sewer lines, three natural gas line breaks and an additional 13 natural gas leaks. Transportation in some parts of the city and out of town would be difficult. Four highway bridges are damaged. These are the largest effects modeled from the scenario earthquakes considered. Such an event would require a large emergency response effort, an interim support network, and a substantial recovery effort for the county.

Fortunately, education and mitigation can reduce earthquake losses. The more people that can successfully Drop, Cover, and Hold On, the fewer injuries there will be. The more that seismically vulnerable buildings are rehabilitated, re-purposed, or taken down, the less loss there will be. Seismic resiliency can help reduce earthquake risk in Carson City.

6.4.3 Floods

Digital FIRMs were used for the Carson City area to estimate at risk population and buildings. Within the 100-year floodplain area, the population at risk is 53,654. In 2014, new flood insurance rate map (FIRM) became effective in Carson City. The new mapping reduced the number of residences, buildings and critical facilities within the floodplain. Within Carson City, the risk posed by the 100-year flood is high with 1,944 homes within or immediately adjacent to the 100-year floodplain. The exposure to the 1,944 residential buildings are $65.5 million, exposure to the 674 nonresidential buildings is $231 million, which includes exposure to the following critical facilities – two schools ($28.2 million), one communications facility ($1.4 million) and thirteen water/sewer facilities ($16.5 million). The affected population, building inventories, and values were calculated from the State Demographer and Carson City Assessor's office. There are no repetitive losses or severe repetitive loss structures (as defined by NFIP) within the 100-year flood plain.

6.4.4 Hazardous Materials Events

Due to the small size of Carson City, ninety-five percent (95%) of the buildings and population reside within the 1-mile buffer around the identified hazardous sites, see Figure B-8 and may overstate the exposure since the probability of multiple adjacent facilities having an event simultaneously is very low. Therefore, the City Public Works and Fire Department, estimated that 10% of the population (5,149) and buildings (residential $66.7 million and non-residential $54.8 million) which are within the 1-mile buffer may be affected for EHS but only 5% would be affected for other hazardous waste facilities and the transportation corridor.

Within the 1-mile buffer around the transportation corridors are 2,237 people and 896 residential buildings (worth $23.3 million), 92 nonresidential buildings (worth $18.9 million) within the affected area. Critical facilities include 1 police station ($36 million), three fire stations ($24.4 million), 4 hospital/urgent care facilities ($136.5 million), eight city municipal buildings ($37.9 million), seven schools ($98.6 million), twelve communication facilities ($66.2 million) and 75 water/wastewater facilities ($43.1 million). The affected population, building inventories, and values were calculated from the City's Assessors Office and Planning Committee information using GIS mapping for the percentage affected.

6.4.5 Infectious Disease

Epidemic was changed to Infectious Disease and was included as a possible hazard to the citizens of the City. The entire population of Carson City 54,169 may be affected by the illness however buildings and critical facilities would just be limited in their use but would not be damaged.

6.4.6 Severe Weather

Using winter storm data provided by the NWS, risk posed by winter storms were calculated for the City. All population and buildings are within the severe winter storm hazard area however homes and buildings within Carson City are built to withstand a degree of severe weather. The Planning Committee determined that a severe winter storm or wind event may affect 25% of population (due to road closures) and .5% of the buildings which are 13,542 people, 115 residential buildings (worth $4.2 million) and 16 nonresidential buildings (worth $29 million). The affected population, building inventories, and values were calculated from the Nevada State Demographer and the City's Assessors office.

6.4.7 Utilities

Utility loss was included as a possible hazard to the citizens of the City. The entire population of Carson City, 54,169 persons, would be affected by the loss however buildings and critical facilities would just be limited in their use not damaged. The hospital has backup generators along with some of the state buildings including the EOC and National Guard buildings.

6.4.8 Wildland Fires

According to the Nevada Community Wildfire –Risk/Hazard Assessment Project for Carson City, the risk posed by wildland fire is rated high. The smaller neighborhood of Clear Creek is categorized as high hazard if evaluated separately. Exposed within this moderate, high and extreme wildland fire hazard area, are 4,393 people, 675residential buildings, and 781 nonresidential buildings (worth $100,044,995). The critical facilities are one hospital ($100 million), one school ($50 million), one communication facility ($1 million) and one water facility ($23 million). The affected population, building inventories, and values were calculated from the Nevada State Demographer, the City Assessor's office and the census tract for Carson City. The Census Tract information may only touch the hazard boundary or, frequently, extend beyond the hazard area. Please refer to Appendix B Figure B-6 Wildland Fire Fuel Map. Taking this conservative approach to evaluating the Wildland Fire hazard, the values may be high because of the census tract data provided.

6.4.9 Volcano

The volcano risk is mainly due to ash fall out from a volcano in the Mammoth, California area to the south. Although the total population (54,169) is at risk to illness from ash in the air, the damage to buildings is limited to ventilation systems which may be contaminated from the ash and need replacement. It was estimated that all residential and non-residential buildings, including critical facilities may have damage to their HVAC systems. The Planning Committee conservatively estimated these costs to be .03 percent of the building total replacement values. The affected population, building inventories, and values were calculated from the Nevada State Demographer, the City Assessor's office and Carson Tahoe Hospital.

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While not required by the DMA 2000, an important component of a hazard mitigation plan is a review of the City's resources to identify, evaluate, and enhance the capacity of those resources to mitigate the effects of hazards. This section evaluates Carson City's resources in three areas: Legal and regulatory; Administrative and technical; Financial; and assesses the capabilities to implement current and future hazard mitigation actions.

7.1 LEGAL AND REGULATORY CAPABILITIES

The City currently supports hazard mitigation through its regulations, plans, and programs. The Carson City Building Code outlines hazard mitigation-related ordinances. Additionally, the Carson City Master Plan identifies goals, objectives, and actions for natural hazards, including floods, drought, and earthquakes. In addition to policies and regulations, the City carries out hazard mitigation activities by participating in the National Flood Insurance Program (NFIP) see section 7.4.1.

The following **Table 7-1** summarizes the City's hazard mitigation legal and regulatory capabilities.

Table 7-1 Legal and Regulatory Resources Available for Hazard Mitigation

Regulatory Tool	Title	Effect on Hazard Mitigation
Plans	Master Plan	Updated 2006. Lists goals for coordination, neighborhood design, public awareness, floodplain & hazard area development, and geologic hazards to guide land use planning.
	Capital Improvements Plan	Provides earthquake & flood identification.
	Economic Development Plan	Business Development.
	Emergency Response Plan	Provides emergency response.
	Community Wildfire Protection Plan	Provides Wildfire hazards. Enables Carson City to mitigate fuel loads.
	Hazmat Plan	Provides emergency response to reduce impact of HAZMAT spill.
	Post-Disaster Recovery Plan	Provide directives to reduce future hazard impact.
	Habitat Management Plan	Provides flood & wildfire hazard identification, remediation, and education.
	Master Drainage, Sewer, Water & Reclaimed Water	Provides flood hazard identification, regulation, remediation, and education to Carson City residents about floods and flood hazards. Enables Carson City to prioritize flood control and infrastructure needs.
	King Street Sandbagging Plan	Updated in 2007, plan provides guidance & locations which benefit from sand bagging prior to flood and during flood.
	Bomb Threat Procedures, Suspicious Substances Procedure & Active Shooter Plan	Provides terrorist identification, containment and response.

Table 7-1 Legal and Regulatory Resources Available for Hazard Mitigation

Regulatory Tool	Title	Effect on Hazard Mitigation
Programs	National Flood Insurance Program	Carson City adopts and enforces a floodplain management ordinance to reduce future flood damage. In exchange, the NFIP makes Federally backed flood insurance available to homeowners, renters, and business owners.
Ordinances and Policies	Building Code Title 12, 14 15 & 18 (IBC 2012)	Master Plan, Land Use Plan Element. Provides regulations to reduce hazard impact.
	Zoning Ordinances	
	Subdivision ordinance or regulations	
	Development Standards	
	Growth management ordinances	
	Special purpose ordinances	Floodplain management, storm water management, hillside or steep slope ordinances, wildfire ordinances, hazard set back requirements.

7.2 ADMINISTRATIVE AND TECHNICAL CAPABILITIES

The administrative and technical capability assessment identifies the staff and personnel resources available within the City to engage in mitigation planning and carry out mitigation projects. The administrative and technical capabilities of the City are listed in **Table 7-2.**

Table 7-2 Administrative and Technical Resources for Hazard Mitigation

Staff/Personnel Resources	Department / Agency
Planner(s) or engineer(s) with knowledge of land development and land management practices	Public Works
Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure	Building & Safety
Planner(s) or engineer(s) with an understanding of manmade or natural hazards	Building & Safety, Planning, Fire Dept.
Staff with education or expertise to assess the community's vulnerability to hazards	Building, Fire, Public Works
Floodplain manager	Public Works
Personnel skilled in GIS and/or HAZUS-MH	GIS Program, Public Works
Scientist familiar with the hazards of the community	UNR, Bureau of Mines & Geology for Earthquakes
Emergency Services	Fire Department Emergency Management
Finance (purchasing) – Fiscal Management	Carson City Finance
Public Information Officers, Planner(s)	Sheriff's Office, Fire Dept., Carson City Executive Staff

7.3 FINANCIAL CAPABILITIES

The fiscal capability assessment lists the specific financial and budgetary tools that are available to the City for hazard mitigation activities. These capabilities, which are listed in **Table 7-3**, include both local and Federal entitlements.

Table 7-3 Financial Resources for Hazard Mitigation

Financial Resources	Effect on Hazard Mitigation
Local	
Authority to levy taxes for specific purposes	Yes. Upon approval of the Carson City Board of Supervisors, staying within the stipulations set forth in the Nevada Revised Statues.
Capital Improvement Plans and Impact Fees	Assigns impact development fees to finance fire and flood control capital improvement programs.
Community Development Block Grants	Yes. Subject to grant from Fed/State.
Incur debt through general obligation bonds	Yes. Upon voter approval, staying within the stipulations set forth in the Nevada Revised Statues.
Incur debt through special tax and revenue bonds	Yes. Upon voter approval, staying within the stipulations set forth in the Nevada Revised Statues.
Incur debt through private activity bonds	Yes. Upon voter approval, staying within the stipulations set forth in the Nevada Revised Statues.
Withhold spending in hazard-prone areas	Yes.
State	
Question #1 State Bond	Funding for Parks which can include re-vegetation.
Federal	
FEMA Hazard Mitigation Project Grants (HMPG) and Pre-Disaster Mitigation (PDM) grants	Provides technical and financial assistance for cost-effective pre-disaster and post-disaster mitigation activities that reduce injuries, loss of life, and damage and destruction of property.
FEMA Flood Mitigation Grant Program (FMA)	Mitigate repetitively flooded structures and infrastructure.
USFA Assistance to Firefighters Grant (AFG) Program	Provide equipment, protective gear, emergency vehicles, training, and other resources needed to protect the public and emergency personnel from fire.
FEMA/DHA Homeland Security Preparedness Technical Assistance Program (HSPTAP)	Build and sustain preparedness technical assistance activities in support of the four homeland security mission areas (prevention, protection, response, recovery) and homeland security program management.
US HUD Community Block Grant Program Entitlement Communities Grants	Acquisition of real property, relocation and demolition, rehabilitation of residential and non-residential structures, construction of public facilities and improvements, such as water and sewer facilities, streets, neighborhood centers, and the conversion of school buildings for eligible purposes.
EPA Community Action for a Renewed Environment (CARE)	Through financial and technical assistance offers an innovative way for a community to organize and take action to reduce toxic pollution (i.e., storm water) in its local environment. Through CARE, a community creates a partnership that implements solutions to reduce releases of toxic pollutants and minimize people's exposure to them.
EPA Clean Water State Revolving Fund (CWSRF)	A loan program that provides low-cost financing to eligible entities within state and tribal lands for water quality projects, including all types of non-point source, watershed protection or restoration, estuary management projects, and more traditional municipal wastewater treatment projects.

Table 7-3 Financial Resources for Hazard Mitigation

Financial Resources	Effect on Hazard Mitigation
CDC Public Health Emergency Preparedness (PHEP) Cooperative Agreement.	Funds are intended to upgrade state and local public health jurisdictions' preparedness and response to bioterrorism, outbreaks of infectious diseases, and other public health threats and emergencies.

7.4 CURRENT MITIGATION CAPABILITIES & ANALYSIS

Carson City's current mitigation programs, projects, and plans, as shown in **Table 7-4**, are listed as follows:

Table 7-4 Carson City Local Mitigation Capability Assessment

Agency Name (Mission/Function)	Programs, Plans Policies, Regulations, Funding, or Practices	Point of Contact Name and Phone	Effect on Loss Reduction			
			Support	*Facilitate*	*Hinder*	*Comments*
Building & Planning Dept. Public Works	Code Enforcement, Economic Development, Roads, water, flood plain management, sewer, capital projects, building maintenance, parks, pool	Lee Plemel 775-887-2180	√	√		Engineering and planning support Engineering,
		Robb Fellows 775-283-7370	√	√		Detailed knowledge of infrastructure
Fire Department	Emergency Mt., Fuels mitigation, public education, mitigation plan	Robert Schreihans 775-887-2210	√	√		Familiar w/fire grants; detailed knowledge of vulnerability
School District	Identify and implement mitigation actions for school property	Mark Korinek 283-2181	√	√		Facilities and engineering.
Sheriff's Office	Public Safety	Ken Sandage 775 887-2500	√	√		Sheriff's office support and information
Health/Human Services	Health and Animal Control	Niki Aaker 775-887-2190	√	√		Familiar with/ infectious disease and CDC grants, health capability

The programs, plan, policies and regulations listed above provide a basic framework for mitigation projects. These programs cover the City's infrastructure and program needs and are effective however; the funding for mitigation projects may not always be available.

Carson City has strong legal, administrative and financial capabilities in relation to other counties within Nevada. Carson City has a fuels reduction and chipping program, is able to enforce the International Building Code & International Fire Code, Building Code Title 12.09 and 15.05 which restrict building within a floodway, and is a member of the NFIP, in addition to programs for public safety, health and human services, public works and the school district. These programs are run by trained Carson City staff, who are provided the resources to implement and promote the programs. Future implementation may be constrained by budget reduction.

The following provides an overview of the four-step process for preparing a mitigation strategy: developing mitigation goals and objectives, identifying and analyzing potential actions, prioritizing mitigation actions, and implementing an action plan.

8.1 MITIGATION GOALS AND OBJECTIVES

The requirements for the local hazard mitigation goals, as stipulated in the DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Mitigation Strategy

Local Hazard Mitigation Goals

Requirement §201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

Element

- Does the new or updated plan include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards?

Source: FEMA, March 2008.

Mitigation goals are defined as general guidelines that explain what a community wants to achieve in terms of hazard and loss prevention. Goal statements are typically long-range, policy-oriented statements representing community-wide visions. The Planning Committee reviewed the 11 previously developed goals which will reduce or avoid long-term vulnerabilities to the identified hazards (**Table 8-1**). All hazards identified by the City have a specific goal except for avalanche, seiche, volcano, and utility loss. Since these hazards, all rated low or moderate with no previous occurrence, the Planning Committee agreed the benefit versus the cost would be prohibitive for project actions. However, actions under current Goals 1 and 2 can be used to advance hazard mitigation for these hazards as well as all the hazards profiled in Section Five.

Table 8-1 Mitigation Goals

Goal Number	Goal
1	Promote increased and ongoing Carson City involvement in hazard-mitigation planning and projects
2	Build and support local capacity to enable the public to prepare for, respond to, and recover from disasters
3	Reduce the possibility of damage and losses due to earthquakes
4	Reduce the possibility of threat to life and losses due to infectious disease
5	Reduce the possibility of damage and losses due to floods
6	Reduce the possibility of damage and losses due to severe weather
7	Reduce the possibility of damage and losses due to acts of violence
8	Reduce the possibility of damage and losses due to wildland fires
9	Reduce the possibility of damage and losses due to drought
10	Reduce the possibility of damage and losses due to landslide
11	Reduce the possibility of damage and losses due to hazardous materials

8.2 IDENTIFYING MITIGATION ACTIONS

The requirements for the identification and analysis of mitigation actions, as stipulated in the DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Mitigation Strategy

Identification and Analysis of Mitigation Actions

Requirement §201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

Element

- Does the plan identify and analyze a comprehensive range of specific mitigation actions and projects for each hazard?
- Do the identified actions and projects address reducing the effects of hazards on new buildings and infrastructure?
- Do the identified actions and projects address reducing the effects of hazards on existing buildings and infrastructure?
- Does the mitigation strategy identify actions related to the participation in and continued compliance with the NFIP?

Source: FEMA, March 2008.

Mitigation actions are usually grouped into six broad categories: prevention, property protection, public education and awareness, natural resource protection, emergency services, and structural projects. The Planning Committee worked together as a group to review the 2010 HMP and compiled information from the annual maintenance table top exercises, and provided the status as shown in Appendix G. Then the members were tasked to provide new mitigation actions. As such, **Table 8-2** lists the goals and potential actions selected for this HMP. As stated above the Planning Committee felt that actions under Goals One and Two were sufficient to address avalanche, seiche, volcano, and utility loss, specifically 1.A-F, and 2.A-F.

Table 8-2 Mitigation Goals and Potential Actions

Goals	Action	New or Existing	Description
Goal 1: Promote increased and ongoing Carson City involvement in hazard-mitigation planning and projects	1.A	N/E	Update the Master Plan to be consistent with the hazard area maps and implementation strategies developed in the HMP every 10 years. Review & update ordinances & code every 3 years.
	1.B	N/E	Identify & educate Carson City personnel on high hazard areas.
	1.C	N/E	Coordinate existing Geographic Information Systems (GIS) capabilities to identify hazards through the City.
	1.D	N/E	Develop the data sets that are necessary to test hazard scenarios and mitigation tools, including HAZUS MH.
	1.E	N/E	Utilize the Internet as a communication tool, as well as an education tool.
	1.F	N/ E	Develop city building codes and ordinances that protect people and structures from drought, earthquake, flood, landslide, severe weather & wildfire.
	1.G	N	Continue to update the Community Wildfire Plan.
Goal 2: Build and support local capacity to enable the public to prepare for, respond to, and recover from disasters	2.A	E	Develop emergency evacuation programs for neighborhoods in flood prone areas and wildland fire areas.
	2.B	N/E	Annually review the City's Emergency Operations Plan and identify needed plan updates.
	2.C	E	Conduct a minimum of one disaster exercise each year.
	2.D	E	Establish a budget and identify funding sources for mitigation outreach.
	2.E	E	Work with school districts to develop a public outreach campaign that teaches children how to avoid danger and behave during an emergency.
	2.F	N/E	Utilize Business for Innovative Climate Change (BICEP) to increase awareness and knowledge of hazard mitigation and encourage businesses to develop/implement hazard mitigation actions.
	2.G	N/E	Prepare, develop, & distribute appropriate public information about hazard mitigation programs and projects at Carson City-sponsored events and on the Carson City's/Fire Department's website.

Table 8-2 Mitigation Goals and Potential Actions

Goals	Action	New or Existing	Description
Goal 3: ***Reduce the possibility of damage and losses due to earthquakes***	3.A	N/E	Continue to enforce the International Building Code (IBC) provisions pertaining to grading and construction relative to seismic hazards. Update Carson City Codes to IBC2018 when it is released.
	3.B	E	Completed the Unreinforced Masonry (URM) building program that determines the structural safety of critical infrastructure, and retrofit buildings, if necessary.
	3.C	E	Identify hazard-prone structures through GIS modeling.
	3.D	E	Acquire and install clean agent systems for the City Hall and Public Safety computer rooms to reduce damage to computer.
	3.A	N/E	Continue to enforce the International Building Code (IBC) provisions pertaining to grading and construction relative to seismic hazards. Update Carson City Codes to IBC2018 when it is released.
Goal 4: ***Reduce the possibility of threat to life and losses due to Infectious Disease***	4.A	E	Update Mass Illness Plan and integrate with local Hazard Mitigation Plan.
	4.B	E	Continuation of training and exercise program relative to epidemics.
	4.C	E	Prepare by acquiring/storing needed medical equipment.
	4.D	N	Maintain a public program for information and education.
Goal 5: ***Reduce the possibility of damage and losses due to floods***	5.A	N/E	Identify flood-prone areas using GIS. Identify those community areas that have recurring losses and conduct detailed analysis of the hydrographic basins for planning, update storm water system plans, including erosion/sediment transport, and develop project proposals to improve storm water facilities and reduce flooding.
	5.B	N	Continue to update policies that discourage growth in flood-prone areas.
	5.C	N/E	Review and update flood plans that would include coordination with adjacent counties, cities, and special districts supporting a regional approach to flood control.
	5.D	E	Update and expand Sandbagging Plan.

Table 8-2 Mitigation Goals and Potential Actions

	Action	New or Existing	Description
	5.E	E	Install new flood facilities to include, upgrade the existing storm drain system to current standards including culverts and channel improvements.
	5.F	N	Upon completion of land transfers associated with the Lands Bill which includes land trading with Carson City, BLM, US Forestry, and Washoe Tribe; identify/implement projects within transferred lands and other areas within Carson City that need slope stabilization for flood and landslide.
	5.G	E	Design and install facilities to capture debris/sediment within Eagle Valley.
	5.H	E	Develop a Flood Management Plan for the New Empire Area and install a new flood control facility for the area.
	5.I	E	Protect and enhance existing municipal water conveyance structures, storage, and treatment facilities to reduce impact from flood.
	5.J	E	Install a storm water retention facility at Goni Canyon Creek & Channel D & construct a new storm drainage system further downstream along Goni Creek.
	5.K	E	Design & install facilities to capture debris/sediment within Eagle Valley.
	5.L.	N	Installation of back-up generators for critical infrastructure and facilities.
	5.M	E	Land acquisition of buildings with recurring loss or of land which could be used as catch basins for flood control projects.
Goal 6: ***Reduce the possibility of damage and losses due to Severe Weather***	6.A	E	In areas at risk to severe weather, retrofit public buildings to withstand snow loads and severe winds to prevent roof collapse/damage.
	6.B	N/E	Continue the storm water management plan for snow melt.
Goal 7: ***Reduce the possibility of damage and***	7.A	N	Develop standards for public buildings and high risk buildings to mitigate impacts from terrorist events.
	7.B	N/E	Develop planning procedures to cover terrorist events and exercises.

Table 8-2 Mitigation Goals and Potential Actions

Goals	Action	New or Existing	Description
losses due to terrorist events	7.C	E	Retrofit public and high risk buildings to increase safety and reduce the impact of terrorist events.
Goal 8: Reduce the possibility of damage and losses due to wildland fires	8.A	N/E	Continue to identify areas and update and enforce the most current versions of the Urban-Wildland Interface Code.
	8.B*	N/E	Update the Carson City Fire Code and model weed abatement and fuel modification ordinances.
	8.C	E	Continue to conduct current fuel management programs (i.e., weed abatement programs) and investigate and apply new and emerging fuel management techniques.
	8.D	E	Develop a public outreach campaign of the extreme wildland fire dangers and steps that can be taken to reduce these dangers.
	8.E	E	Develop partnerships for a community based vegetation management program including chipping programs.
	8.F	N/E	Utilize GIS and the internet as information tools.
	8.G	E	Establish a continuing wildland fire technical working group.
	8.H	N/E	Protect municipal water recharge zones from wildfires and flooding by stabilizing upper watershed slopes.
	8.I	E	Retrofit buildings (public and private) to reduce the risk of wild fire in Lakeview, Pinyon Hills, Kings Canyon, Voltaire Canyon and Timberlake Canyon.
Goal 9 Reduce the possibility of damage and losses due to drought	9.A	N/E	Watershed stabilization and recharge program to maximize the use of surface sources when available and preserving the groundwater sources for system peaking needs and times of drought.
	9.B	N/E	Encourage public participation in drought strategies through public information programs on water conservation and drought resistant landscaping and through building code ordinances.

Table 8-2 Mitigation Goals and Potential Actions

Goals	Action	New or Existing	Description
Goal 10: ***Reduce the possibility of damage and losses due to landslide***	10.A	N/E	Evaluate natural slopes to determine if there are slope stabilization treatments that would be appropriate to prevent landslides.
	10.B	N/E	Conduct slope stabilization projects to prevent landslides.
Goal 11: ***Reduce the possibility of damage and losses due to hazardous materials***	11.A	N/E	Review building codes and zoning ordinances to reduce public health risks from hazardous materials releases.

Reduce Hazard Effect on N = New Buildings, E = Existing Buildings, N/E = New and Existing Buildings

8.3 NATIONAL FLOOD INSURANCE PROGRAM (NFIP) COMPLIANCE

DMA 2000 Requirements: Mitigation Strategy – National Flood Insurance Program

National Flood Insurance Program (NFIP) Compliance)
Requirement: §201.6(c)(3)(iii): [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program (NFIP), and continued compliance with NFIP requirements, as appropriate.

Element

- Does the updated plan document how the planning team reviewed and analyzed this section of the plan and whether this section was revised as part of the update process?
- Does the new or updated plan describe the jurisdiction(s) participation in the NFIP?)
- Does the mitigation strategy identify, analyze and prioritize actions related to continued compliance with the NFIP?

Source: FEMA, March 2008.

Carson City has identified special flood-hazard areas and entered the NFIP 29 years ago in 1986. The City has participated in the Community Rating System (CRS) since 1986. Participation in both programs has been continuous since initiation. The CRS is a voluntary program for the NFIP-participating communities. The goals of the CRS are to reduce flood losses, to facilitate accurate insurance rating, and to promote the awareness of flood insurance. Carson City is a

CRS Class 6 community, one of only two counties in Nevada to have this rating. To support its continued voluntary participation in the CRS of the NFIP, Carson City outlined mitigation actions listed under goals 5 and 6 in Table 8-3, Mitigation Goals and Potential Actions. There are no repetitive loss or severe repetitive loss properties (as defined by the NFIP) within Carson City. Building Code Title 12.09 and 15.05 restricts future building within a floodway.

8.4 EVALUATING AND PRIORITIZING MITIGATION ACTIONS

The requirements for the evaluation and implementation of mitigation actions, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Mitigation Strategy - Implementation of Mitigation Actions

Implementation of Mitigation Actions
Requirement: §201.6(c)(3)(iii): [The mitigation strategy section shall include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

Element

- Does the mitigation strategy include how the actions are prioritized? (For example, is there a discussion of the process and criteria used?)
- Does the mitigation strategy address how the actions will be implemented and administered? (For example, does it identify the responsible department, existing and potential resources, and timeframe?)
- Does the prioritization process include an emphasis on the use of a cost-benefit review (see page 3-36 of *Multi-Hazard Mitigation Planning Guidance*) to maximize benefits?

Source: FEMA, March 2008.

The mitigation actions were finalized during the Planning Committee meeting on October 7, 2015. At this time the Planning Committee evaluated and prioritized each of the actions. To complete this task, the Planning Committee completed the STAPLE+E evaluation criteria using rankings of one for lowest and five for highest priority, acceptance, feasibility etc. The rankings for each action were totaled and used as a starting point by the committee. See Table 8-3 for the evaluation criteria.

Table 8-3 STAPLE+E Evaluation Criteria for Mitigation Actions

Evaluation Category	Discussion "It is important to consider…"	Considerations
Social	The public Support for the overall mitigation strategy and specific mitigation actions	Community acceptance; adversely affects population
Technical	If the mitigation action is technically feasible and if it is the whole or partial solution	Technical feasibility; Long-term solutions; Secondary impacts
Administrative	If the community has the personnel and administrative capabilities necessary to implement the action or whether outside help will be necessary	Staffing: Funding allocation; Maintenance/operations
Political	What the community and its members feel about issues related to the environment, economic development, safety, and emergency management	Political support; Local champion; Public support
Legal	Whether the community has the legal authority to implement the action, or whether the community must pass new regulations	Local, State, and Federal authority; Potential legal challenge
Economic	If the action can be funded with current or future internal and external sources, if the costs seem reasonable for the size of the project, and if enough information is available to complete a FEMA Benefit Cost Analysis	Benefit/cost of action; Contributes to other economic goals; Outside funding required; FEMA Benefit Cost Analysis
Environmental	The impact on the environment because of public desire for a sustainable and environmentally healthy community	Effect on local flora and fauna; Consistent with community environmental goals; Consistent with local, State and Federal laws

Upon review by the Planning Committee, mitigation actions were selected for Carson City that best fulfill the goals of the HMP and were appropriate and feasible to implement during the 5-year lifespan of this update to the HMP. In reviewing the actions the Planning Committee considered the following:

- Actions that strengthen, elevate, relocate, or otherwise improve buildings, infrastructure, or other facilities to enhance their ability to withstand the damaging impacts of future disasters
- Actions in which the benefits (which are the reduction in expected future damages and losses) are greater than the costs considered as necessary to implement the specific action
- Actions that either address multi-hazard scenarios or address a hazard that present the greatest risk to the jurisdiction

The lead committee used the Staple+E results (see Appendix E) as a starting point and then through discussion and consensus made adjustments to include actions that were considered a high, moderate and low priority to the City. These are shown in Table 8-4.

8.5 IMPLEMENTING A MITIGATION ACTION PLAN

A Mitigation Action Plan Matrix was prepared for the City detailing the priority of the mitigation actions, how the overall benefit-cost were taken into consideration, and how each mitigation action will be implemented and administered. This matrix can be found in Table 8-4.

Table 8-4 Action Plan Matrix

Action Number	Action Item	Department / Division	Potential Funding Source	Implementation Timeline	Economic Justification	Priority Level
1.A	Update the Master Plan to be consistent with the hazard area maps and implementation strategies developed in the HMP every 10 years. Review & update ordinances & code every 3 years.	Planning	Local Gen. Fund	2 Years	Protection of lives due to better infrastructure and building codes.	High
1.B	Identify & educate Carson City personnel on high hazard areas.	Planning Committee/ Emergency Mgmt.	Local Gen. Fund	18 months	Provide information for planning & Public Works projects to protect lives and property.	High
1.C	Coordinate existing Geographic Information Systems (GIS) capabilities to identify hazards through the City.	Public Works	Local Gen. Fund	Ongoing	Provide information to agencies in their efforts to protect lives and property.	High
1.D	Develop the data sets that are necessary to test hazard scenarios and mitigation tools, including HAZUS MH.	Emergency Management	UNR, HMGP	Ongoing	Provide information to agencies in their efforts to protect lives and property.	Moderate
1.E	Utilize the Internet as a communication tool, as well as an education tool.	City PIO, Emergency Management	Local Gen. Funds	Ongoing	Provide information to the community in their effort to protect lives and property.	High
1.F	Develop city building codes and ordinances that protect people and structures from drought, earthquake, flood, landslide, severe weather & wildfire.	Building Dept.	Local Gen. Fund	Ongoing	Protection of lives due to better infrastructure and building codes.	Moderate
1.G	Continue to update the Community Wildfire Plan.	Fire Dept.	National Fire monies, USFS, BLM, NDF	Ongoing	Ensure a greater number of residential structures and critical facilities and infrastructure benefit from actions to protect lives and property from wildfire.	High
2.A.	Develop emergency evacuation	Public Works –	EMPG, SERC,	18-24 months	Protection of lives due to pre-planning.	High

Table 8-4 Action Plan Matrix

Action Number	Action Item	Department / Division	Potential Funding Source	Implementation Timeline	Economic Justification	Priority Level
	programs for neighborhoods in flood prone & wildland areas.	Flood Plan Mgr. Fire Dept.	USEPA, NDEP, NDCNR, Utility Service Charge			
2.B	Annually review the City's EOP & update & integrate w/local Hazard Mitigation Plan.	Emergency Mgr. Fire Dept.	HMGP, PDM, SERC, EMPG, USEPA, NDEP, NDCNR; DHS, Local Gen. Fund	Ongoing	Protection of lives and property due to pre-planning.	High
2.C	Conduct minimum of one disaster exercise/year.	Emergency Mgr. Fire Dept.	EMPG, SERC, USEPA, NDEP, NDCNR, Local Gen Fund	Ongoing	Protection of lives and property due to pre-planning.	Moderate
2.D	Establish a budget and identify funding sources for mitigation outreach.	Emergency Management	EMPG, HMGP, NV Health & Human Services, CDC, USFS	18-24 Months	Protection of lives & property due to awareness.	Moderate
2.E	Work with school districts to develop a public outreach campaign that teaches children how to avoid danger and behave during an emergency.	Emergency Management	EMPG, HMGP, NV Health & Human Services, CDC, USFS	18-24 Months	Protection of lives & property due to awareness.	Moderate
2.F	Utilize Business for Innovative Climate Change (BICEP) to increase awareness and knowledge of hazard mitigation and encourage businesses to develop/implement hazard mitigation actions.	Emergency Management	EMPG, HMGP, NOAA, USFS	18-24 Months	Protection of lives & property due to awareness.	Low
2.G	Prepare, develop, & distribute appropriate public information about hazard mitigation programs and projects at Carson City-sponsored events and on the Carson City's/Fire Department's website.	Emergency Management	EMPG, HMGP, NV Health & Human Services, CDC, USFS	18-24 Months	Protection of lives & property due to awareness.	Moderate
3.A	Continue to enforce the International Building Code (IBC) provisions pertaining to grading and construction	Planning & Building Dept.	Local Gen. Fund,	Ongoing	Protection of lives and property through improved infrastructure.	High

Table 8-4 Action Plan Matrix

Action Number	Action Item	Department / Division	Potential Funding Source	Implementation Timeline	Economic Justification	Priority Level
	relative to seismic hazards and update Carson City Codes to IBC 2018 when it is released.					
3.B	Completed the Unreinforced Masonry (URM) building program that determines the structural safety of critical infrastructure, and retrofit buildings, if necessary.	Building Maintenance, Building Dept.	Local Gen. Fund, HMGP, PDM	24-48 Months	Protection of lives and property through improved infrastructure.	High
3.C	Identify hazard-prone structures through GIS modeling.	Public Works	Local Gen. Fund	Ongoing	Protection of lives and property through improved infrastructure.	High
3.D	Acquire and install a clean agent systems for the City Hall and Public Safety computer rooms to reduce damage to computer equipment.	Building Maintenance	Local Gen. Fund	2 Months	Public Safety.	Moderate
4.A	Update Mass Illness Plan & integrate with local Hazard Mitigation Plan.	Health Dept.	NV Health & Human Services, CDC	6-12 months	Protection of lives due to pre-planning.	High
4.B	Continuation of training and exercise program relative to infectious disease.	Health Dept.	NV Health & Human Services, CDC	6-12 months	Protection of lives due to pre-planning.	High
4.C	Prepare by acquiring/storing needed medical equipment.	Health Dept.	NV Health & Human Services, CDC, Carson Hospital	6-12 months	Protection of lives due to pre-planning.	Moderate
4.D	Maintain a public program for information and education.	Health Dept.	NV Health & Human Services, CDC	6-12 months	Protection of lives due to pre-planning.	High
5.A	Identify flood prone areas w GIS. Update storm water system plans. Develop project proposals to improve storm water facilities.	Public Works	PDM, HMGP, FMA, RFC, USDA, NDEP, USEPA, NDCNR, 319(h) grants (Clean Water Act), USGS, CC PW	24-36 months	Protection of homes, businesses, infrastructure, and critical facilities.	High
5.B	Continue to update policies that discourage growth in flood-prone	Public Works	Local Gen Fund	Ongoing	Protection of homes, businesses, infrastructure, and critical facilities.	High

Table 8-4 Action Plan Matrix

Action Number	Action Item	Department / Division	Potential Funding Source	Implementation Timeline	Economic Justification	Priority Level
	areas.					
5.C	Review & update flood plans for coordination w/adjacent counties, cities, and special districts supporting a regional approach to flood.	Public Works	PDM, HMGP, FMA, RFC, USDA, NDEP, USEPA, NDRCS, Local, CC PW	24-36 months	Protection of homes, businesses, infrastructure, and critical facilities while strengthening regional coordination.	High
5.D	Update and expand Sandbagging Plan.	Public Works	Local Gen. Fund, EMGP	24 months	Protection of homes, businesses, infrastructure, and critical facilities.	Moderate
5.E	Install new flood facilities & update storm drain system.	Public Works	PDM, HMGP, FMA, RFC, USDA, NDEP, USEPA, NRCS, Local, CC PW	24-36 months	Protection of homes, businesses, infrastructure, and critical facilities.	Moderate
5.F	Upon completion of land transfers associated with the Lands Bill which includes land trading with Carson City, BLM, US Forestry, and Washoe Tribe; identify/implement projects within transferred lands and other areas within Carson City that need slope stabilization for flood and landslide.	Public Works	PDM, HMGP, USFS, BLM, Local Gen. Fund	24-36 months	Protection of homes, businesses, infrastructure, and critical facilities.	Moderate
5.G	Design and install facilities to capture debris/sediment within Eagle Valley.	Public Works	PDM, HMGP, FMA, RFC, USDA, NDEP, USEPA, NRCS, Local, CC PW	24-36 months	Protection of homes, businesses, infrastructure, and critical facilities.	Moderate
5.H	Develop a Flood Management Plan for the New Empire Area and install a new flood control facility for the area.	Public Works	PDM, HMGP, FMA, RFC, USDA, NDEP, USEPA, NRCS, Local, CC PW	24-36 months	Protection of homes, businesses, infrastructure, and critical facilities.	Moderate
5.I	Protect & enhance existing municipal water conveyance structures, storage & treatment facilities.	Public Works	PDM, HMGP, FMA, RFC, USDA, NDEP, USEPA, NRCS, FEMA, 319(h) grants (Clean Water Act), CC	24-36 months	Protection of homes, businesses, infrastructure, and critical facilities.	High

Table 8-4 Action Plan Matrix

Action Number	Action Item	Department / Division	Potential Funding Source	Implementation Timeline	Economic Justification	Priority Level
			PW			
5.J	Install a storm water retention facility at Goni Canyon & storm drain system at Goni Creek.	Public Works	PDM, HMGP, FMA, RFC, USDA, NDEP, USEPA, NRCS, FEMA, 319(h) grants (Clean Water Act), CC PW	24-36 months	Protection of homes, businesses, infrastructure, and critical facilities.	Moderate
5.K	Design & install facilities to capture debris/sediment within Eagle Valley.	Public Works	PDM, HMGP, FMA, RFC, USDA, NDEP, USEPA, NRCS, FEMA, 319(h) grants (Clean Water Act), USGS, CC PW	18-24 Months	Protection of homes, businesses, infrastructure, and critical facilities.	Moderate
5.L	Installation of back-up generators for critical infrastructure and facilities.	Public Works	PDM, HMGP, Local Gen.	6-12 months	Protection of critical infrastructures and facilities.	Moderate
5.M	Land acquisition of buildings with recurring loss or of land which could be used as catch basins for flood control projects.	Public Works	PDM, HMGP, FMA, RFC, USDA, NDEP, USEPA, NRCS, FEMA, 319(h) grants (Clean Water Act), USGS, CC PW	Ongoing	Protection of homes, businesses, infrastructure, and stopping the cycle of loss.	Low
6.A	In areas at risk to severe weather, retrofit public buildings to withstand snow loads and sever winds to prevent roof collapse/damage.	Public Works	PDM, HMGP, Local Gen. Fund	Ongoing	Protection of homes, businesses, infrastructure, and critical facilities.	Moderate
6.B	Continue the Storm Water Management Plan for snow melt.	Public Works	PDM, HMGP, FMA, RFC, USDA, NDEP, USEPA, NRCS, FEMA, 319(h) grants (Clean Water Act), USGS, CC PW	12-14 months	Protection of homes, businesses, infrastructure, and critical facilities.	High
7.A	Develop standards for public buildings and high risk buildings to	Planning, Building Dept.	Local Gen. Fund	6-12 months	Protection of critical facilities.	Moderate

Table 8-4 Action Plan Matrix

Action Number	Action Item	Department / Division	Potential Funding Source	Implementation Timeline	Economic Justification	Priority Level
	mitigate impacts from terrorist events.					
7.B	Develop planning procedures to cover terrorist events and exercises.	Emergency Management/ Sherriff Dept.	EMPG, Local Gen Fund	6-12 months	Protection of lives and property.	Moderate
7.C	Retrofit public and high risk buildings to increase safety and reduce the impact of terrorist events.	Public Works, Building Maintenance	EMPG, Local Gen Fund	Ongoing	Protection of critical facilities.	Moderate
8.A	ID areas & update & enforce Urban Wildland Interface Code (UWIC).	NV Div. of Forestry, CC Fire Dept.	NDF, BLM, National Fire Monies, Local Gen Fund	6-12 Months	Ensure a greater number of residential structures and critical facilities and infrastructure benefit from actions to protect lives and property from wildfire.	High
8.B	Update the CC Fire code and model weed abatement and fuel modification ordinances.	Fire Dept.	National Fire monies, USFS, BLM, NDF	Ongoing	Ensure a greater number of residential structures and critical facilities and infrastructure benefit from actions to protect lives and property from wildfire.	High
8.C	Continue conducting Fuel Management Programs.	NV Div. of Forestry, CC Fire Dept.	HMGP, PDM, NDF, BLM, National Fire Monies, Stimulus , funds, USFS, Local General Fund	6-12 Months	Ensure a greater number of residential structures and critical facilities and infrastructure benefit from actions to protect lives and property from wildfire.	High
8.D	Develop a public outreach campaign of the extreme wildland fire dangers and steps that can be taken to reduce these dangers.	CC Fire Dept.	HMGP, PDM, Local General Fund, National Fire Monies	12-24 Months	Ensure a greater number of residential structures and critical facilities and infrastructure benefit from actions to protect lives and property from wildfire.	Moderate
8.E	Develop partnerships for a community based vegetation management program including chipping programs.	CC Fire Dept.	HMGP, PDM, Local General Fund, National Fire Monies	12-24 Months	Ensure a greater number of residential structures and critical facilities and infrastructure benefit from actions to protect lives and property from wildfire.	Moderate
8.F	Utilize GIS and the internet as information tools.	CC Fire Dept.	HMGP, PDM, Local General Fund, National Fire Monies	Ongoing	Ensure a greater number of residential structures and critical facilities and infrastructure benefit from actions to	High

Table 8-4 Action Plan Matrix

Action Number	Action Item	Department / Division	Potential Funding Source	Implementation Timeline	Economic Justification	Priority Level
					protect lives and property from wildfire.	
8.G	Establish a continuing wildland fire technical working group.	CC Fire Dept.	HMGP, PDM, Local General Fund, National Fire Monies	12-24 Months	Ensure a greater number of residential structures and critical facilities and infrastructure benefit from actions to protect lives and property from wildfire.	Moderate
8.H	Protect municipal water recharge zones from wildfires and flooding by stabilizing upper watershed slopes.	CC Fire Dept.	HMGP, PDM, Local General Fund, National Fire Monies	12-24 Months	Ensure a greater number of residential structures and critical facilities and infrastructure benefit from actions to protect lives and property from wildfire.	High
8.I	Retrofit buildings (public and private) to reduce the risk of wild fire in Lakeview, Pinyon Hills, Kings Canyon, Voltaire Canyon and Timberlake Canyon.	CC Fire Dept.	HMGP, PDM, Local General Fund, National Fire Monies	12-24 Months	Ensure a greater number of residential structures and critical facilities and infrastructure benefit from actions to protect lives and property from wildfire.	Moderate
9.A	Watershed stabilization and recharge program to maximize the use of surface sources when available and preserving the groundwater sources for system peaking needs and times of drought.	Public Works	NDEP, USEPA, NRCS, FEMA, 319(h) grants (Clean Water Act), USGS, CC PW	24-36 months	Protection of available water.	Moderate
9.B	Encourage public participation in drought strategies through public information programs on water conservation and drought resistant landscaping and through building code ordinances.	Public Works	NDEP, USEPA, NRCS, FEMA, 319(h) grants (Clean Water Act), USGS, CC PW	Ongoing	Protection of available water.	Moderate
10.A	Evaluate natural slopes to determine if there are slope stabilization treatments that would be appropriate to prevent landslides.	Public Works	PDM, HMGP, BLM, USFS, Local Gen Fund	24-36 Months	Protection of lives, property and water availability.	Low
10.B	Conduct slope stabilization projects to prevent landslides.	Public Works	PDM, HMGP, BLM, USFS, Local Gen Fund	24-36 Months	Protection of lives, property and water availability.	Moderate

Table 8-4 Action Plan Matrix

Action Number	Action Item	Department / Division	Potential Funding Source	Implementation Timeline	Economic Justification	Priority Level
11.A	Review building codes and zoning ordinances to reduce public health risks from hazardous materials releases.	Planning, Building Dept.	Local Gen. Fund	6-12 Months	Protection of lives & property from exposure and contamination.	Moderate

BLM= Bureau of Land Management
CC PW = Carson City Public Works
DHS= Dept. of Homeland Security
EMPG = Emergency Management Performance Grant

HMGP = Hazard Mitigation Grant Program
NDEP = Nevada Division of Environmental Protection
NDF = Nevada Department of Forestry
PDM = Pre-Disaster Mitigation

SERC = State Emergency Response Commission
USDA = U.S. Department of Agriculture
USEPA = U.S. Environmental Protection Agency
USFS = U.S. Forest Service
USGS = U.S. Geological Survey

This section describes a formal plan maintenance process to ensure that the HMP remains an active and applicable document. It includes an explanation of how the City and the Planning Committee intend to organize its efforts to ensure that improvements and revisions to the HMP occur in a well-managed, efficient, and coordinated manner.

The following three process steps are addressed in detail below:

- Monitoring, evaluating, and updating the HMP
- Implementation through existing planning mechanisms
- Continued public involvement

9.1 MONITORING, EVALUATING, AND UPDATING THE HMP

The requirements for monitoring, evaluating, and updating the HMP, as stipulated in the DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Plan Maintenance Process - Monitoring, Evaluating, and Updating the Plan
Monitoring, Evaluating and Updating the Plan Requirement §201.6(c)(4)(i): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle. **Element** ▪ Does the new or updated plan describe the method and schedule for monitoring the plan? (For example, does it identify the party responsible for monitoring and include a schedule for reports, site visits, phone calls, and meetings?) ▪ Does the new or updated plan describe the method and schedule for evaluating the plan? (For example, does it identify the party responsible for evaluating the plan and include the criteria used to evaluate the plan?) ▪ Does the new or updated plan describe the method and schedule for updating the plan within the five-year cycle? *Source: FEMA 2008.*

Maintenance on the previous plan was conducted annually. The committee annually completed maintenance table top exercises, which compiled information on plan integration, hazards, new events, collecting data and the mitigation actions were reviewed and progress was documented.

The Planning Committee recognizes the need for plan maintenance and wanted to include tools into the plan for improved maintenance. The HMP was prepared as a collaborative effort between the Planning Committee and Nevada Division of Emergency Management. To maintain momentum and build upon this hazard mitigation planning effort and successes, the Planning Committee will monitor, evaluate, and update the HMP. The Planning Committee will be responsible for implementing the Mitigation Action Plan. The Carson City Emergency Manager and Deputy Emergency Manager together, will serve as the primary points of contact and will coordinate all local efforts to monitor, evaluate, and revise the HMP.

The Planning Committee will conduct an annual review of the progress in implementing the HMP, particularly the Mitigation Action Plan. As shown in Appendix F, the Annual Review Questionnaire and Mitigation Action Progress Report will provide the basis for possible changes in the overall Mitigation Action Plan by refocusing on new or more threatening hazards, adjusting to changes to or increases in resource allocations, and engaging additional support for the HMP implementation. The Carson City Emergency Manager and Deputy Emergency Manager will initiate the annual review one month prior to the date of adoption. The findings from this review will be presented annually to the City Manager. The review will include an evaluation of the following:

- Participation of Carson City agencies and others in the HMP implementation.
- Notable changes in the City's risk of natural or human-caused hazards.
- Impacts of land development activities and related programs on hazard mitigation.
- Progress made implementing the Mitigation Action Plan (identify problems and suggest improvements as necessary).
- The adequacy of resources for implementation of the HMP.

The process of reviewing the progress on achieving the mitigation goals and implementing the Mitigation Action Plan activities and projects will also be accomplished during the annual review process. During each annual review, a Mitigation Action Progress Report will be submitted to the Planning Committee and provide a brief overview of mitigation projects completed or in progress since the last review. As shown in Appendix F, the report will include the current status of the mitigation project, including any changes made to the project, the identification of implementation problems and appropriate strategies to overcome them, and whether or not the project has helped achieve the appropriate goals identified in the plan.

In addition to the annual review, the Planning Committee will update the HMP every five years. To ensure that this occurs, in the third year following adoption of the HMP, the Planning Committee will undertake the following activities:

- Thoroughly analyze and update the City's risk of natural and man-made hazards.
- Provide a new annual review (as noted above), plus a review of the three previous annual reports.
- Provide a detailed review and revision of the mitigation strategy.
- Prepare a new action plan with prioritized actions, responsible parties, and resources.
- Prepare a new draft HMP and submit it to the Board of Supervisors for adoption.
- Submit an updated HMP to the Nevada State Hazard Mitigation Officer and FEMA for approval.

9.2 IMPLEMENTATION THROUGH EXISTING PLANNING MECHANISMS

The requirements for implementation through existing planning mechanisms, as stipulated in the DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Plan Maintenance Process - Incorporation into Existing Planning Mechanisms
Incorporation into Existing Planning Mechanisms Requirement §201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate. **Element**

DMA 2000 Requirements: Plan Maintenance Process - Incorporation into Existing Planning Mechanisms
■ Does the new or updated plan identify other local planning mechanisms available for incorporating the requirements of the mitigation plan? ■ Does the new or updated plan include a process by which the local government will incorporate the requirements in other plans, when appropriate?
Source: FEMA 2008.

Since the 2010 HMP update, the City and Committee has successfully utilized and intergraded hazard profiles, vulnerability and mitigation actions into other planning mechanisms and documents including the following:

- ***Carson City Municipal Code (2012) Title 14 - Fire Code:*** Incorporates mitigation actions.
- ***Carson City Municipal Code (2012) Title 15 – Building Code:*** Incorporates mitigation actions.
- ***Carson City Municipal Code (2012) Title 17 – Division of Land, Subdivision of Land:*** Incorporates mitigation actions.
- ***Carson City Municipal Code (2012) Title 18 – Zoning, Development Standards:*** Incorporates mitigation actions.
- ***Carson City Hazardous Materials Emergency Response Plan (2015):*** Refers to the Hazard Mitigation Plan and incorporates mitigation actions.
- ***Carson City Health Department, Carson City Mass Illness Plan (2014):*** Incorporates mitigation actions.
- ***State of Nevada Enhanced Hazard Mitigation Plan (2013)****:* This plan, prepared by NDEM, utilizes the City's HMP for hazard profile and historical data to include in State's Plan.

The City and Committee will continue to ensure that the HMP, in particular the Mitigation Action Plan is incorporated into existing planning mechanisms such as the Carson City Master Plan – Land Use Element and the Carson City Emergency Operations Plan, where mitigation actions are already a part of these City documents and refers readers to the HMP updates.

Each member of the Planning Committee will achieve this incorporation by undertaking the following activities:

- Conduct a review of the community-specific regulatory tools to assess the integration of the mitigation strategy. These regulatory tools are identified in Table 7-1.
- Work with pertinent divisions and departments to increase awareness of the HMP and provide assistance in integrating the mitigation strategy (including the action plan) into relevant planning mechanisms. Implementation of these requirements may require updating or amending specific planning mechanisms.

9.3 CONTINUED PUBLIC INVOLVEMENT

The requirements for continued public involvement, as stipulated in the DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Plan Maintenance Process - Continued Public Involvement

Continued Public Involvement

Requirement §201.6(c)(4)(iii): [The plan maintenance process **shall** include a] discussion on how the community will continue public participation in the plan maintenance process.

Element

- Does the new or updated plan explain how **continued public participation** will be obtained? (For example, will there be public notices, an ongoing mitigation plan committee, or annual review meetings with stakeholders?)

Source: FEMA 2008.

The City is dedicated to involving the public directly in the continual reshaping and updating of the HMP. Hard copies of the HMP will be provided to each department. In addition, a downloadable copy of the plan and any proposed changes will be posted on the City's Web site. This site will also contain an e-mail address and phone number to which interested parties may direct their comments or concerns.

The Planning Committee will also identify opportunities to raise community awareness about the HMP and the City's hazards. This could include attendance and provision of materials at Carson City-sponsored events. Any public comments received regarding the HMP will be collected by the Planning Committee leader, included in the annual report to the City Manager, and considered during future HMP updates. A press release and notice on the City's website will be issued each year before the annual maintenance meeting inviting the public to participate. A sample press release can be found in Appendix F.

The following websites or documents were accessed between March 2015 and October 2015.

Carson City Building Department 2012. *Carson City Municipal Code Title 14, 15, 17, 18.* https://www.municode.com/library/nv/carson_city/codes/code_of_ordinances.

Carson City Fire Department 2012. *Carson City Fire Code.* http://carson.org/index.aspx?page=266

Carson City Fire Department 2013. *Community Wildfire Protection Plan.* http://carson.org/index.aspx?page=2236

Carson City Fire Department. *Carson City Emergency Operations Plan* *http://carson.org/index.aspx?page=344*

Carson City Fire Department 2009. *Carson City Emergency Action Plan (*Brunswick Canyon Dam – Manhard Consult. Mar. 2005, Eagle Valley Dam - MacTec Jan. 2009, Shanandoah Heights Dam – Manhard Consult. Oct. 2006)

Carson City Health Department. *Carson City Mass Illness Plan* 2014.

Carson City Planning 2006. *Carson City Master Plan – Land Use Element.* http://www.carson.org/Index.aspx?page=809

Carson City Public Works Department 2007. *Carson City Sandbagging Plan.*

Carson Water Sub-conservancy District, 2013 (by Resolution 2013-R-40). *Carson River Watershed Regional Floodplain Management Plan*. http://www.cwsd.org/wp-content/uploads/2014/07/12-02-2013UpdateFinalFloodplainPlan_AppendicesG-L.pdf

dePolo, C., G. Johnson, J. Price and J Mauldin 2009. *Quaternary Faults in Nevada.* http://pubs.nbmg.unr.edu/Quaternary-faults-in-Nevada-p/m167.htm.

Hess R. and C. dePolo 2006. *Loss-Estimation Modeling of Earthquake Scenarios for Each Co. in Nevada Using HAZUS-MH.* *http://www.nbmg.unr.edu/dox/of061/of061.pdf* .

Price J, G. Johnson, C. Ballard, H. Armeno, I. Seeley, L. Goar, C. dePolo, J. Hastings. *Estimated Losses from Earthquakes near Nevada Communities.* http://pubs.nbmg.unr.edu/Est-losses-from-EQs-Web-only-p/of2009-08.htm

FEMA. 2009. *Flood Insurance Study: Carson City, Nevada.* FEMA. 2008. *How-To Guide: To Mitigate Potential Terrorist Attacks Against Buildings*. U.S. Department of Homeland Security, Federal Emergency Management Agency. FEMA 452. http://www.fema.gov/library/viewRecord.do?id=1938 .

FEMA. 2002a. 44 CFR Parts 201 and 206, RIN 3067-AD22, Hazard Mitigation Planning and Hazard Mitigation Grant Program, Interim Final Rule. In *Federal Register* 67, No. 38. U.S. Department of Homeland Security, Federal Emergency Management Agency. https://www.federalregister.gov/articles/2007/10/31/E7-21264/hazard-mitigation-planning-and-hazard-mitigation-grant-program

FEMA. 2002b. S*tate and Local Plan Interim Criteria Under the Disaster Mitigation Act of 2000 – Final Draft*. U.S. Department of Homeland Security, Federal Emergency Management Agency.

https://www.fema.gov/pdf/help/fr02-4321.pdf

FEMA. 2002c. *How-To Guide #1: Getting Started: Building Support For Mitigation Planning*. U.S. Department of Homeland Security, Federal Emergency Management Agency. FEMA 386-1. http://www.fema.gov/media-library-data/20130726-1521-20490-3966/howto1.pdf

FEMA. 2002d. *How-To Guide #7: Integrating Human-Caused Hazards Into Mitigation Planning.* U.S. Department of Homeland Security, Federal Emergency Management Agency. FEMA 386-7. http://www.fema.gov/media-library-data/20130726-1524-20490-3869/howto7.pdf

FEMA. 2002e. 44 CFR Parts 201 and 206, RIN 3067-AD22, Hazard Mitigation Planning and Hazard Mitigation Grant Program, Interim Final Rule. In *Federal Register* 67, no. 190. U.S. Department of Homeland Security, Federal Emergency Management Agency. http://www.fema.gov/media-library-data/20130726-1524-20490-9388/67fr61512.txt

FEMA. 2003a. *How-To Guide #3: Developing The Mitigation Plan; Identifying Mitigation Actions And Implementing Strategies.* U.S. Department of Homeland Security, Federal Emergency Management Agency. FEMA 386-3. http://www.fema.gov/media-library-data/20130726-1521-20490-5373/howto3.pdf

FEMA. 2003b. *How-To Guide #4: Bringing the Plan to Life: Implementing the Hazard Mitigation Plan*. U.S. Department of Homeland Security, Federal Emergency Management Agency. FEMA 386-4. http://www.fema.gov/media-library-data/20130726-1521-20490-9008/fema_386_4.pdf

Nevada Bureau of Mines and Geology. 2010. *Living With Earthquakes: (third edition)* http://pubs.nbmg.unr.edu/Living-with-earthquakes-in-NV-p/sp027.htm

Nevada Bureau of Mines and Geology. 2009. *Estimated Losses from Earthquakes near Nevada Communities.* http://pubs.nbmg.unr.edu/Est-losses-from-EQs-Web-only-p/of2009-08.htm

Nevada Bureau of Mines and Geology. Map. Earthquakes in Nevada 1852-2008 http://pubs.nbmg.unr.edu/Earthquakes-in-NV-1852-to-2008-p/m179.htm

Nevada Division of Emergency Management. *State of Nevada Multi-Hazard Mitigation Plan 2013.* http://dem.nv.gov/uploadedFiles/demnvgov/content/DEM/0_HazardMitigationPlan_FULL.pdf

1915 Pleasant Valley, Nevada Earthquake Centennial http://data.nbmg.unr.edu/Public/freedownloads/1915/1915Brochure.PDF

Nevada Seismological Laboratory. 2000. *The Potential Hazard from Tsunami and Seiche Waves Generated by Future large Earthquakes.* http://crack.seismo.unr.edu/htdocs/WGB/LakeTahoeTsunami/ .

Resource Concepts, Inc. 2005. *Nevada Community Wildfire Risk/Hazard Assessment Project: Carson City*. http://www.rci-nv.com/reports/carson.

United States Census Bureau. 2010. American Fact Finder Fact Sheet. http://factfinder.census.gov .

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Western Regional Climate Center. 2015. Historical Climate Information. http://www.wrcc.dri.edu/climate-summaries/.html .

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Appendix A

Adoption Resolution

Resolution No. 2016-R-________

WHEREAS *Carson City* has historically experienced severe damage from natural and human-caused hazards such as flooding, wildfire, drought, thunderstorms/high winds, and hazardous materials incidents on many occasions in the past century, resulting in loss of property and life, economic hardship, and threats to public health and safety;

WHEREAS the *Carson City* Hazard Mitigation Plan (the Plan) has been developed after more than one year of research and work by the *Fire Department's* Office of Emergency Management in association and cooperation with a multi-jurisdictional and multi-agency Planning Team for the reduction of hazard risk to the community;

WHEREAS the Plan specifically addresses hazard mitigation strategies and plan maintenance procedures for *Carson City;*

WHEREAS the Plan recommends several hazard mitigation actions/projects that will provide mitigation for specific natural and human caused hazards that impact *our community* with the effect of protecting people and property from loss associated with those hazards;

WHEREAS, public input was gathered through meetings, the *Carson City Fire Department Emergency Management* website and media outlets to garner comments and collect input as required by law;

NOW THEREFORE BE IT RESOLVED that:

1. The Plan is hereby Adopted as an official plan of *Carson City.*

2. The respective officials identified in the mitigation strategy of the Plan are hereby directed to pursue implementation of the recommended actions based upon availability of resources.

3. Future revisions and Plan maintenance required by the Disaster Mitigation Act of 2000 and FEMA, are hereby adopted as a part of this resolution for a period of five (5) years from the date of this resolution.

4. An annual report on the progress of the implementation elements of the Plan shall be presented to the*, City Board of Supervisors* by October 31st of each calendar year.

Upon motion by Supervisor ____________________, seconded by Supervisor ________________, the foregoing Resolution was passed and adopted this ____day of _____, 2016, by the following vote:

AYES:

NAYS:

ABSENT:

ABSTAIN:

____
Robert L. Crowell, Mayor
Carson City, Nevada

ATTEST:

____
Alan Glover, Clerk-Recorder
Carson City, NV

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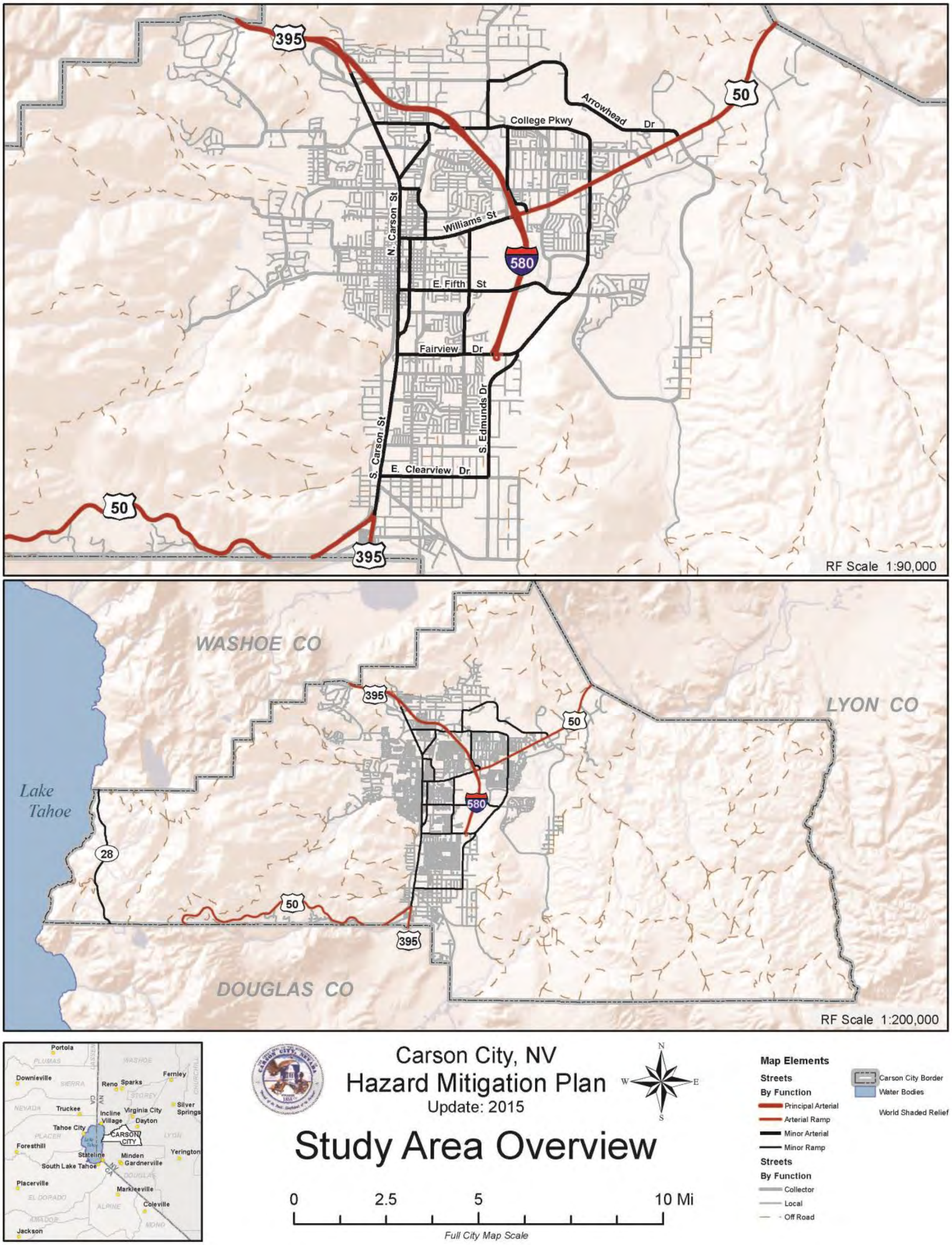
Appendix B

Figures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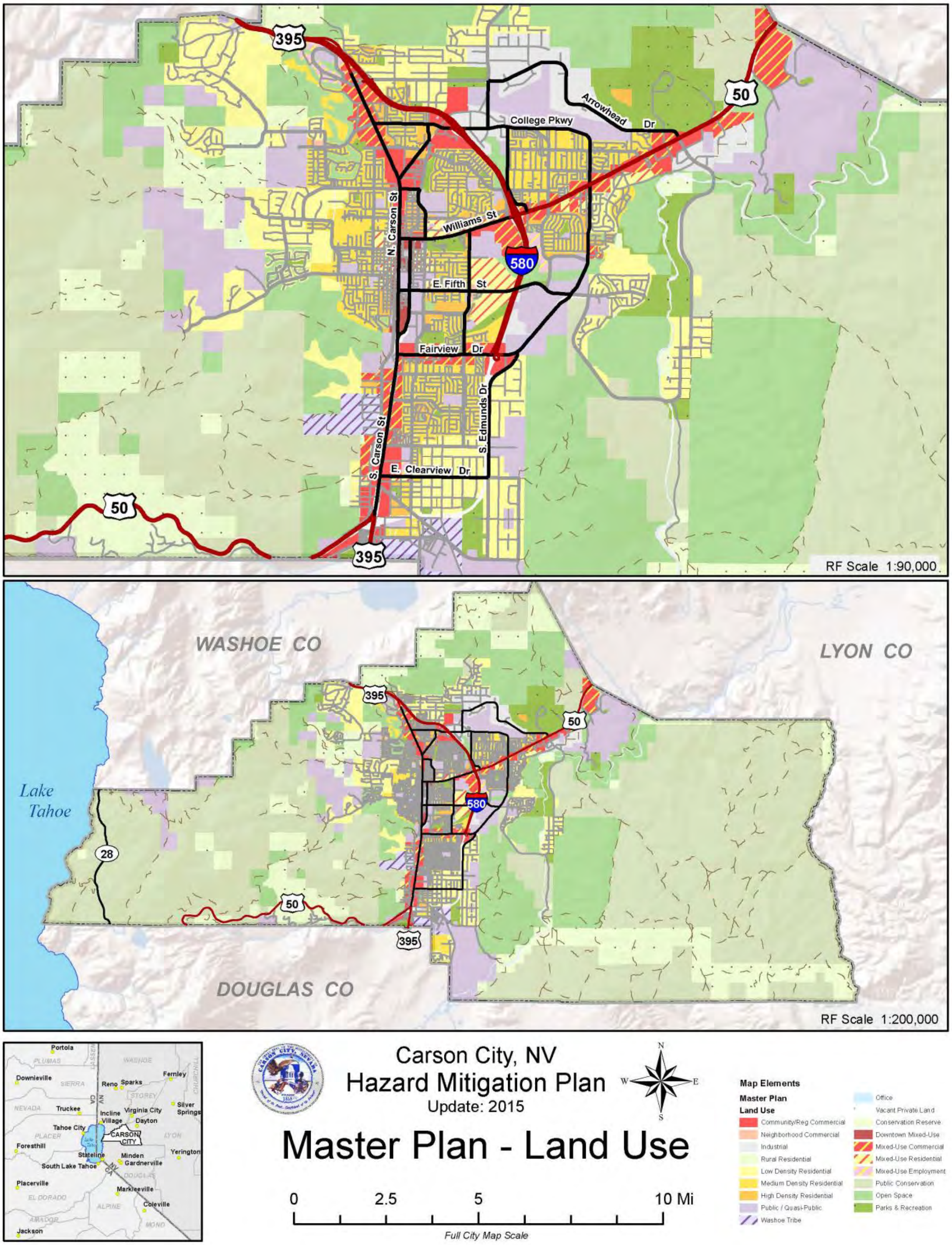
50
580
College Pkwy
Arrowhead Dr
Williams St
N. Carson St
E. Fifth St
Fairview Dr
S. Edmunds Dr
S. Carson St
E. Clearview Dr
RF Scale 1:90,000
WASHOE CO
LYON CO
DOUGLAS CO
Lake Tahoe
28
RF Scale 1:200,000
Carson City, NV
Hazard Mitigation Plan
Update: 2015
Study Area Overview
0
2.5
5
10 Mi
Full City Map Scale
Map Elements
Streets
By Function
Principal Arterial
Arterial Ramp
Minor Arterial
Minor Ramp
Collector
Local
Off Road
Carson City Border
Water Bodies
World Shaded Relief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College Pkwy
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Fairview Dr
S. Edmunds Dr
S. Carson St
E. Clearview Dr
RF Scale 1:90,000
WASHOE CO
LYON CO
DOUGLAS CO
Lake Tahoe
28
RF Scale 1:200,000
Carson City, NV
Hazard Mitigation Plan
Update: 2015
Master Plan - Land Use
0
2.5
5
10 Mi
Full City Map Scale
Map Elements
Master Plan
Land Use
Community/Reg Commercial
Neighborhood Commercial
Industrial
Rural Residential
Low Density Residential
Medium Density Residential
High Density Residential
Public / Quasi-Public
Washoe Tribe
Office
Vacant Private Land
Conservation Reserve
Downtown Mixed-Use
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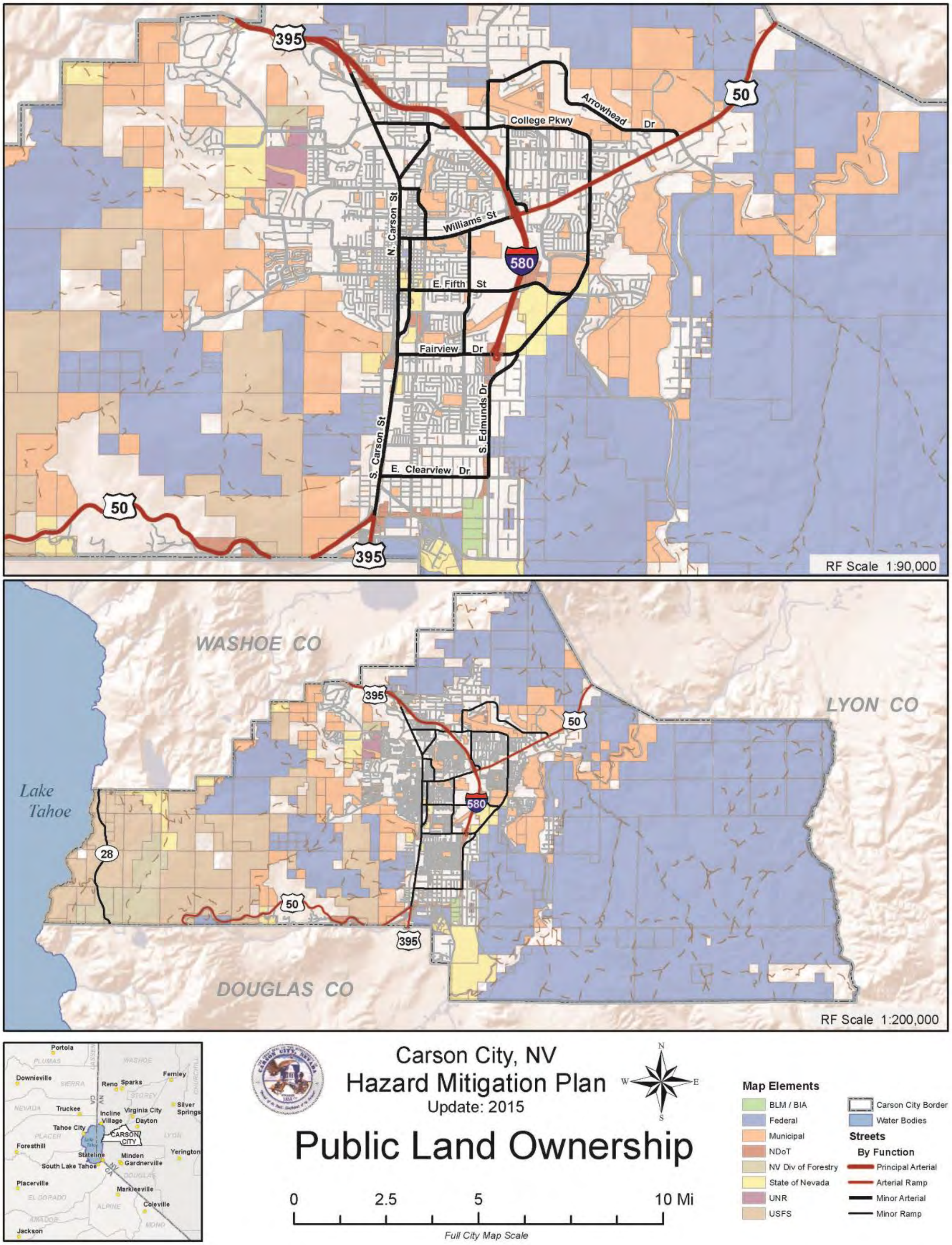
Mixed-Use Residential
Mixed-Use Employment
Public Conservation
Open Space
Parks & Recreation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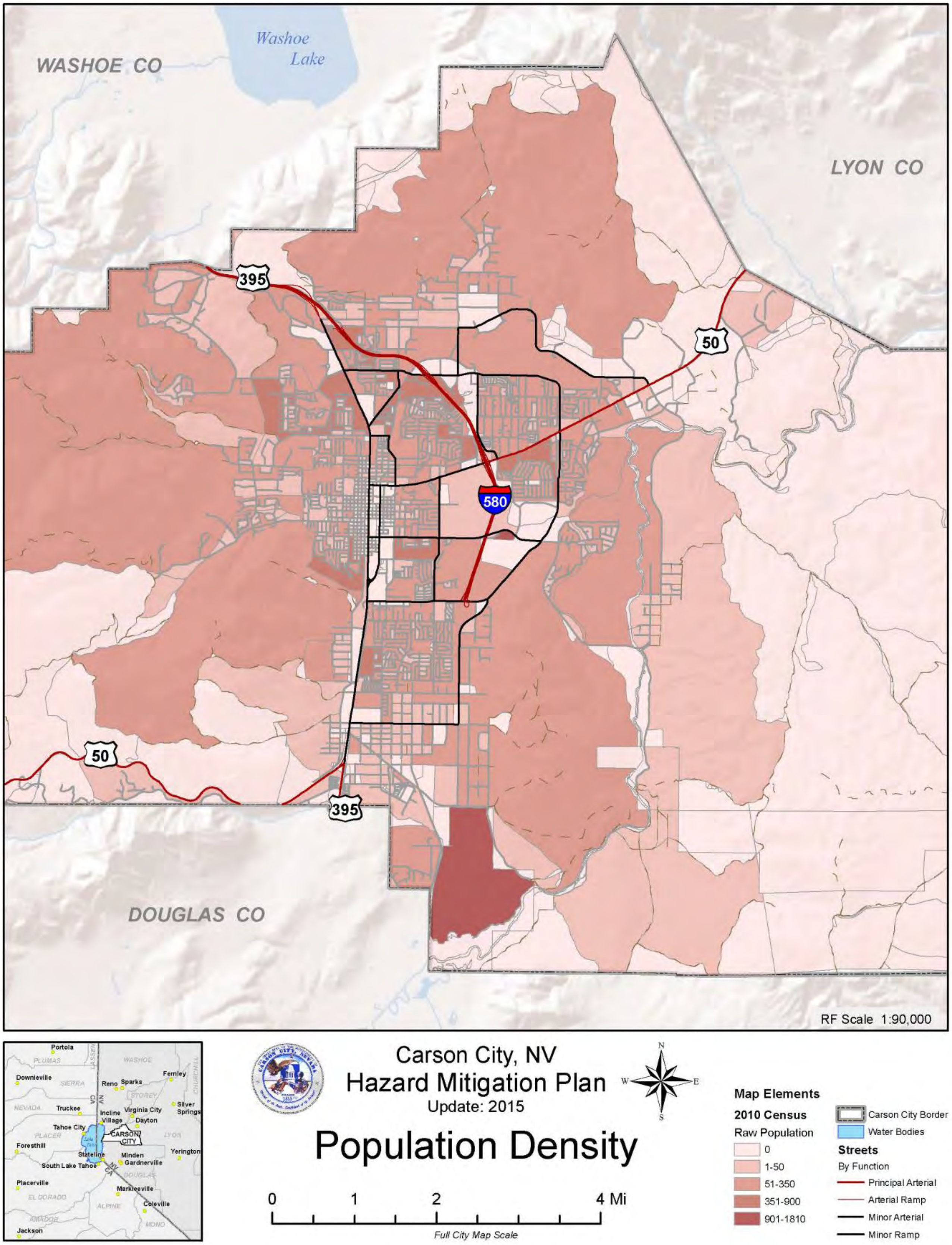
Fairview Dr
S. Edmunds Dr
S. Carson St
E. Clearview Dr
RF Scale 1:90,000
WASHOE CO
LYON CO
Lake Tahoe
28
DOUGLAS CO
RF Scale 1:200,000
Portola
Downieville
Reno
Sparks
Fernley
Truckee
Incline Village
Virginia City
Silver Springs
Dayton
Tahoe City
CARSON CITY
Foresthill
Stateline
Minden
Gardnerville
Yerington
South Lake Tahoe
Placerville
Markleeville
Coleville
Jackson
Carson City, NV
Hazard Mitigation Plan
Update: 2015
Public Land Ownership
0
2.5
5
10 Mi
Full City Map Scale
Map Elements
BLM / BIA
Federal
Municipal
NDoT
NV Div of Forestry
State of Nevada
UNR
USFS
Carson City Border
Water Bodies
Streets
By Function
Principal Arterial
Arterial Ramp
Minor Arterial
Minor Ramp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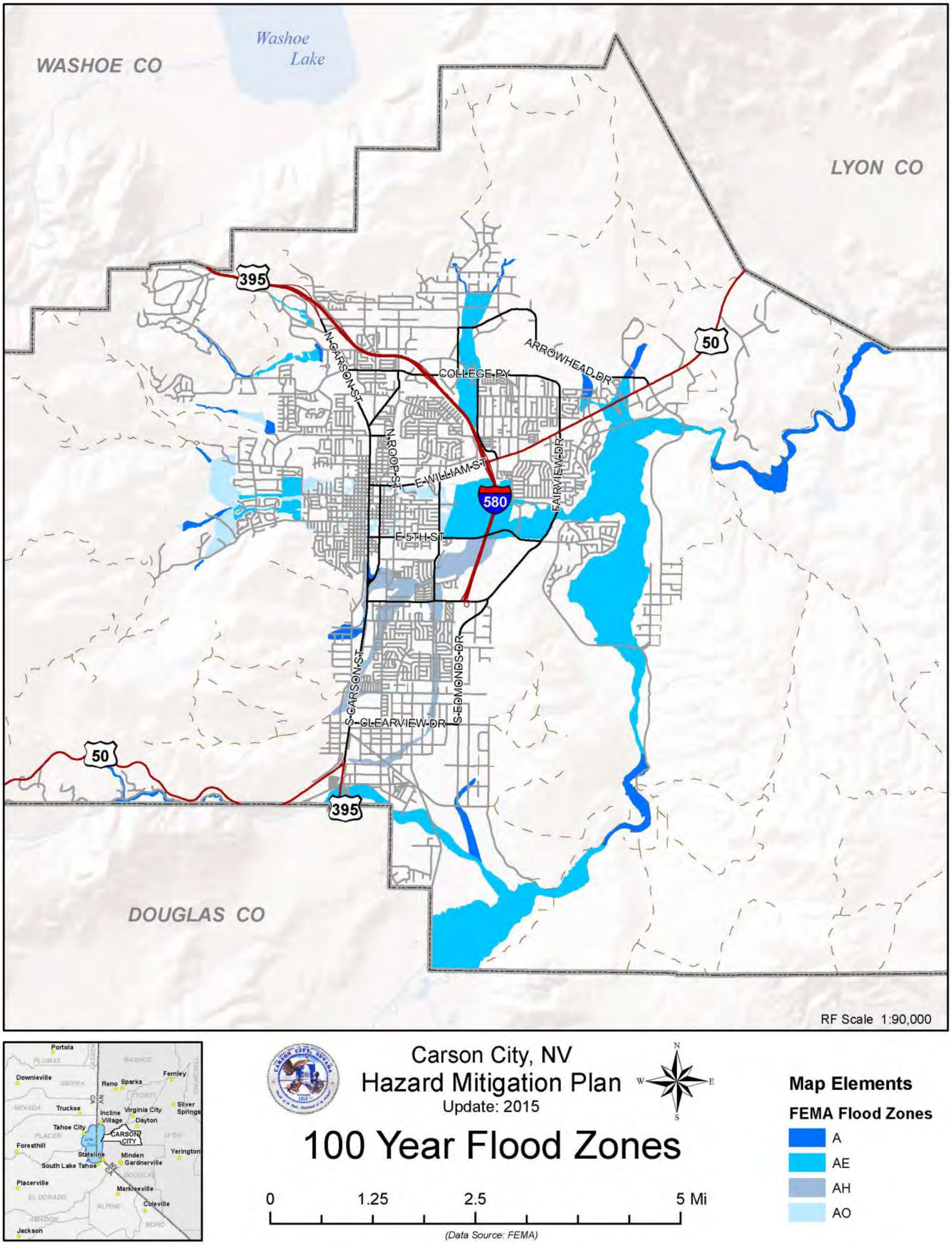
WASHOE CO
LYON CO
DOUGLAS CO
395
50
580
RF Scale 1:90,000
Carson City, NV
Hazard Mitigation Plan
Update: 2015
Population Density
0
1
2
4 Mi
Full City Map Scale
Map Elements
2010 Census
Raw Population
0
1-50
51-350
351-900
901-1810
Carson City Border
Water Bodies
Streets
By Function
Principal Arterial
Arterial Ramp
Minor Arterial
Minor Ramp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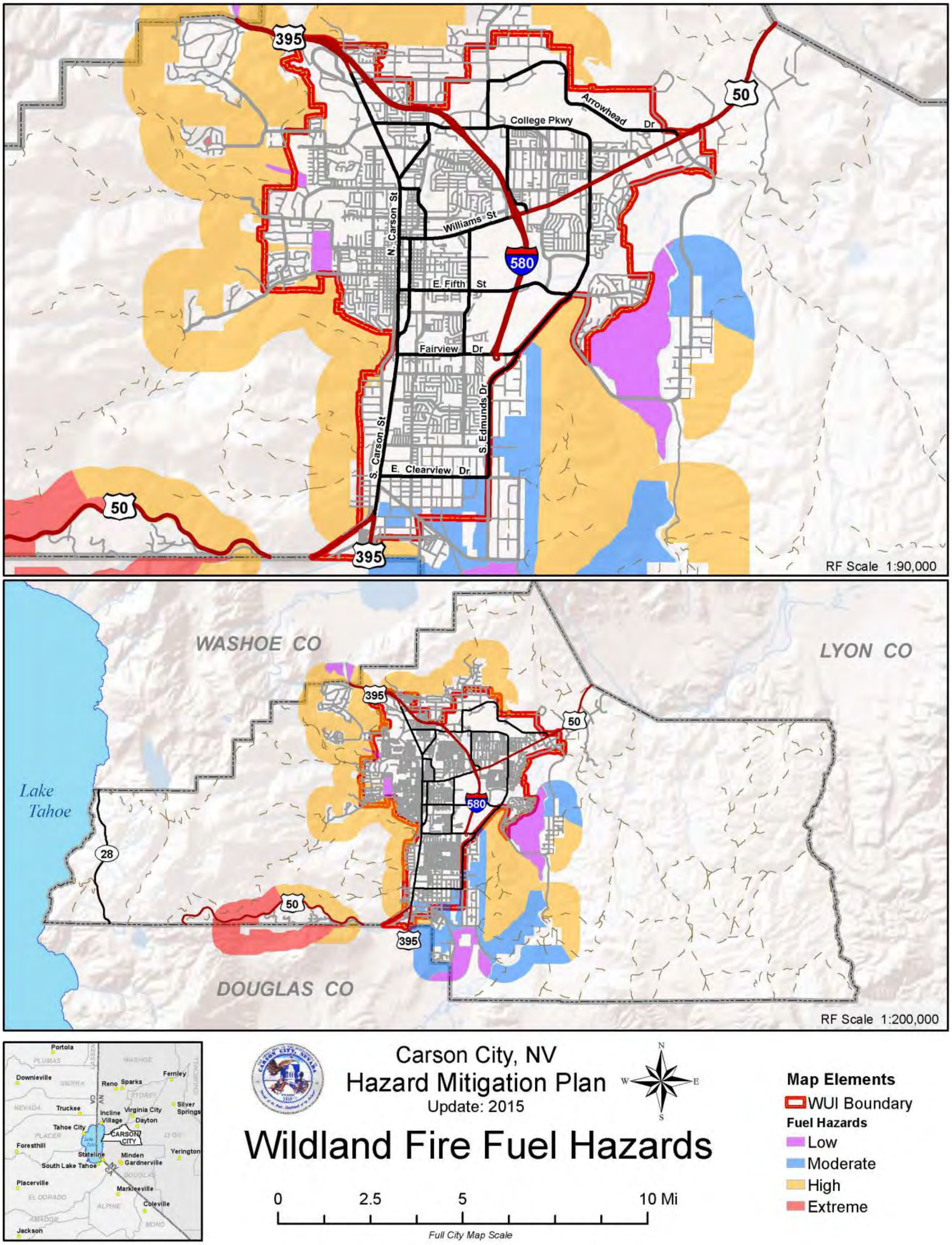
Washoe Lake
LYON CO
DOUGLAS CO
395
50
580
N-CARSON-ST
COLLEGE-PY
ARROWHEAD-DR
N-ROOP-ST
E-WILLIAM-ST
FAIRVIEW-DR
E-5TH-ST
S-CARSON-ST
S-EDMONDS-DR
CLEARVIEW-DR
RF Scale 1:90,000
Carson City, NV
Hazard Mitigation Plan
Update: 2015
100 Year Flood Zones
0
1.25
2.5
5 Mi
(Data Source: FEMA)
Map Elements
FEMA Flood Zones
A
AE
AH
AO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Arrowhead Dr
Williams St
N. Carson St
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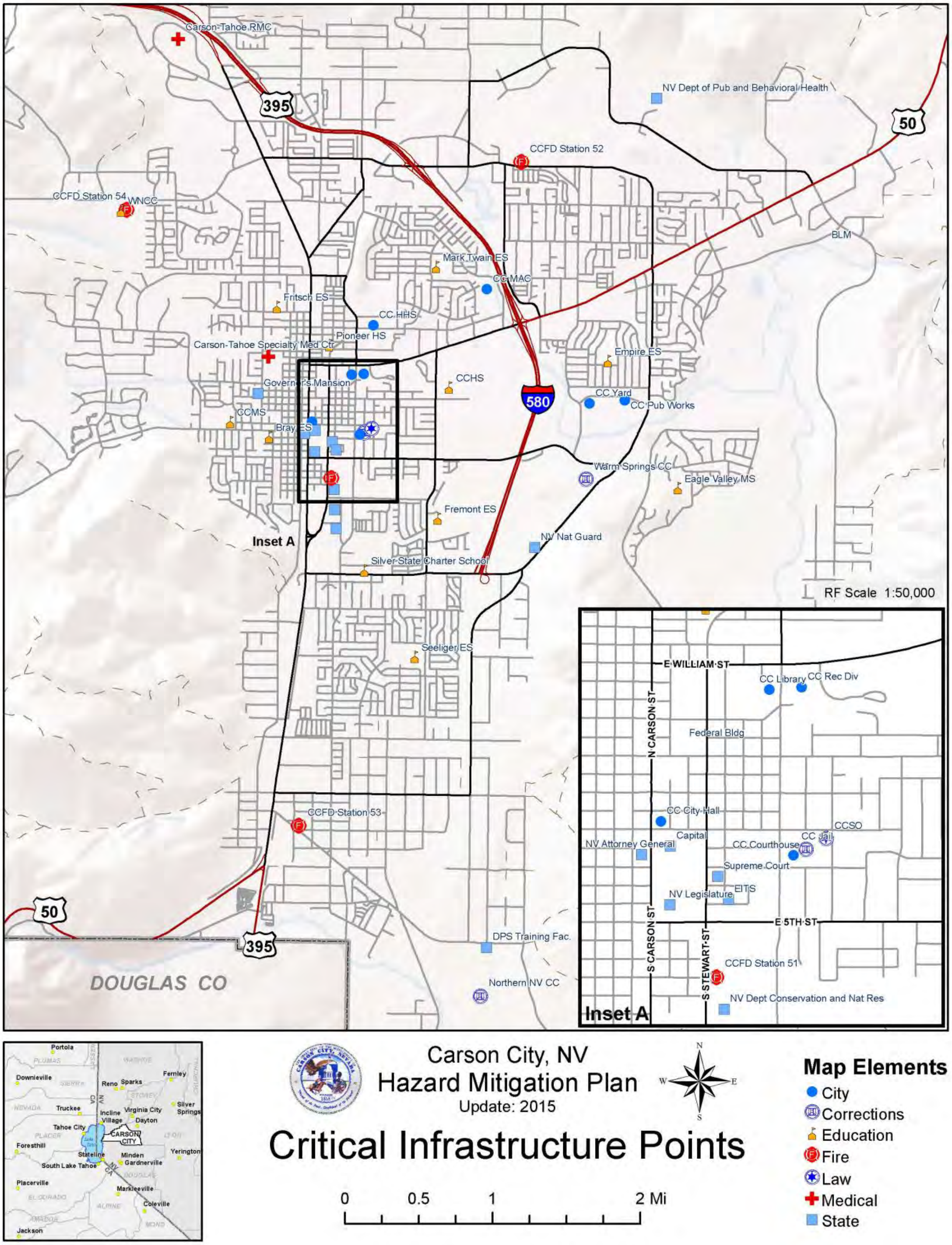
E. Fifth St
Fairview Dr
S. Edmunds Dr
S. Carson St
E. Clearview Dr
RF Scale 1:90,000
WASHOE CO
LYON CO
DOUGLAS CO
Lake Tahoe
28
RF Scale 1:200,000
Carson City, NV
Hazard Mitigation Plan
Update: 2015
Wildland Fire Fuel Hazards
0
2.5
5
10 Mi
Full City Map Scale
Map Elements
WUI Boundary
Fuel Hazards
Low
Moderate
High
Extreme


Carson-Tahoe RMC
NV Dept of Pub and Behavioral Health
CCFD Station 52
CCFD Station 54
WNCC
BLM
Mark Twain ES
CC MAC
Fritsch ES
CC HHS
Pioneer HS
Carson-Tahoe Specialty Med Ctr
Empire ES
Governor's Mansion
CCHS
CC Yard
CC Pub Works
GCMS
Bray ES
Warm Springs CC
Eagle Valley MS
Fremont ES
NV Nat Guard
Inset A
Silver State Charter School
RF Scale 1:50,000
Seeliger ES
CCFD Station 53
DPS Training Fac.
Northern NV CC
DOUGLAS CO
E WILLIAM ST
CC Library
CC Rec Div
N CARSON ST
Federal Bldg
CC City Hall
CCSO
Capital
NV Attorney General
CC Courthouse
CC Jail
Supreme Court
EITS
NV Legislature
E 5TH ST
S CARSON ST
S STEWART ST
CCFD Station 51
NV Dept Conservation and Nat Res
Inset A
Carson City, NV
Hazard Mitigation Plan
Update: 2015
Critical Infrastructure Points
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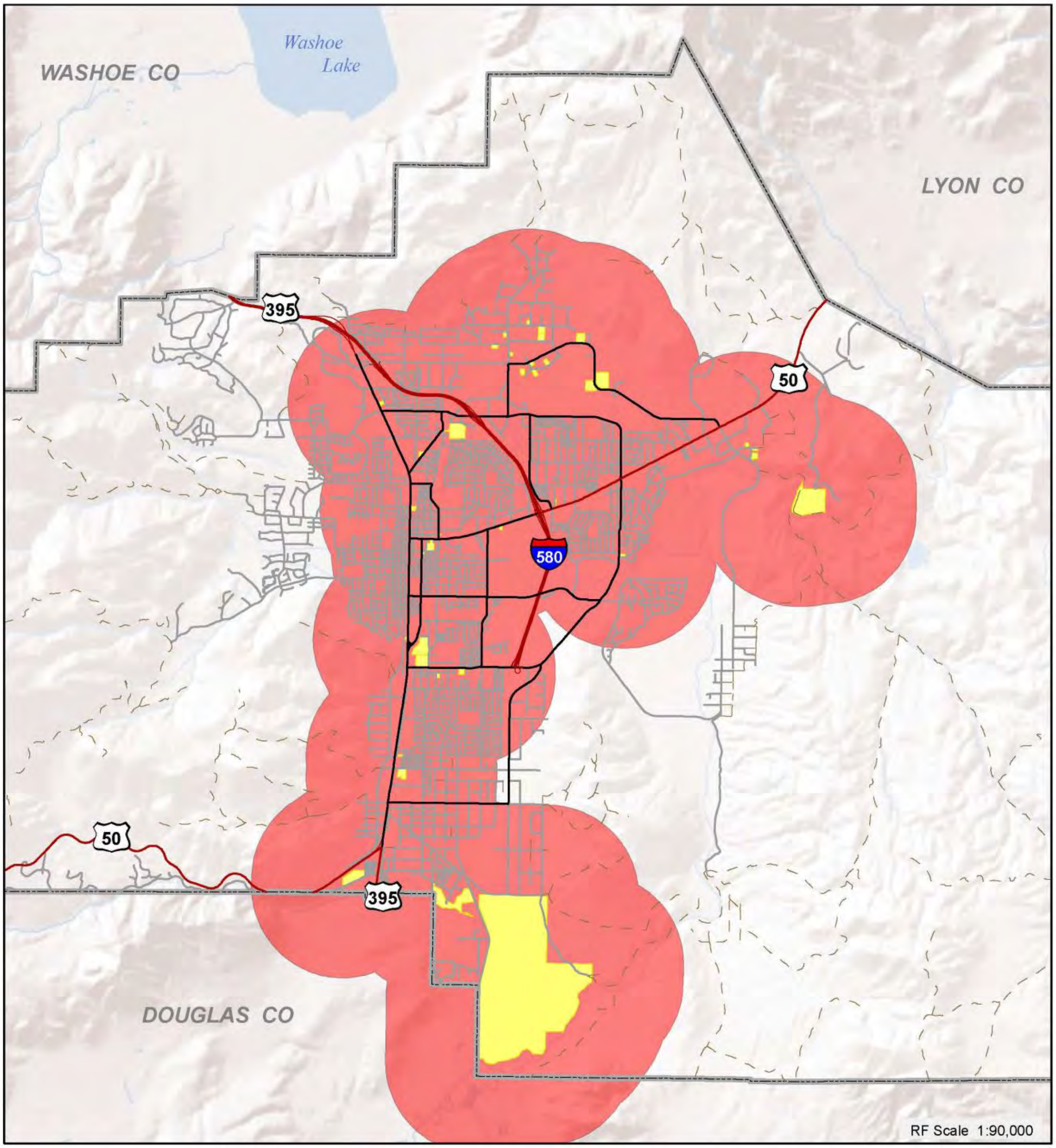
0.5
1
2 Mi
Map Elements
City
Corrections
Education
Fire
Law
Medical
State



Carson City, NV
Hazard Mitigation Plan
Update: 2015

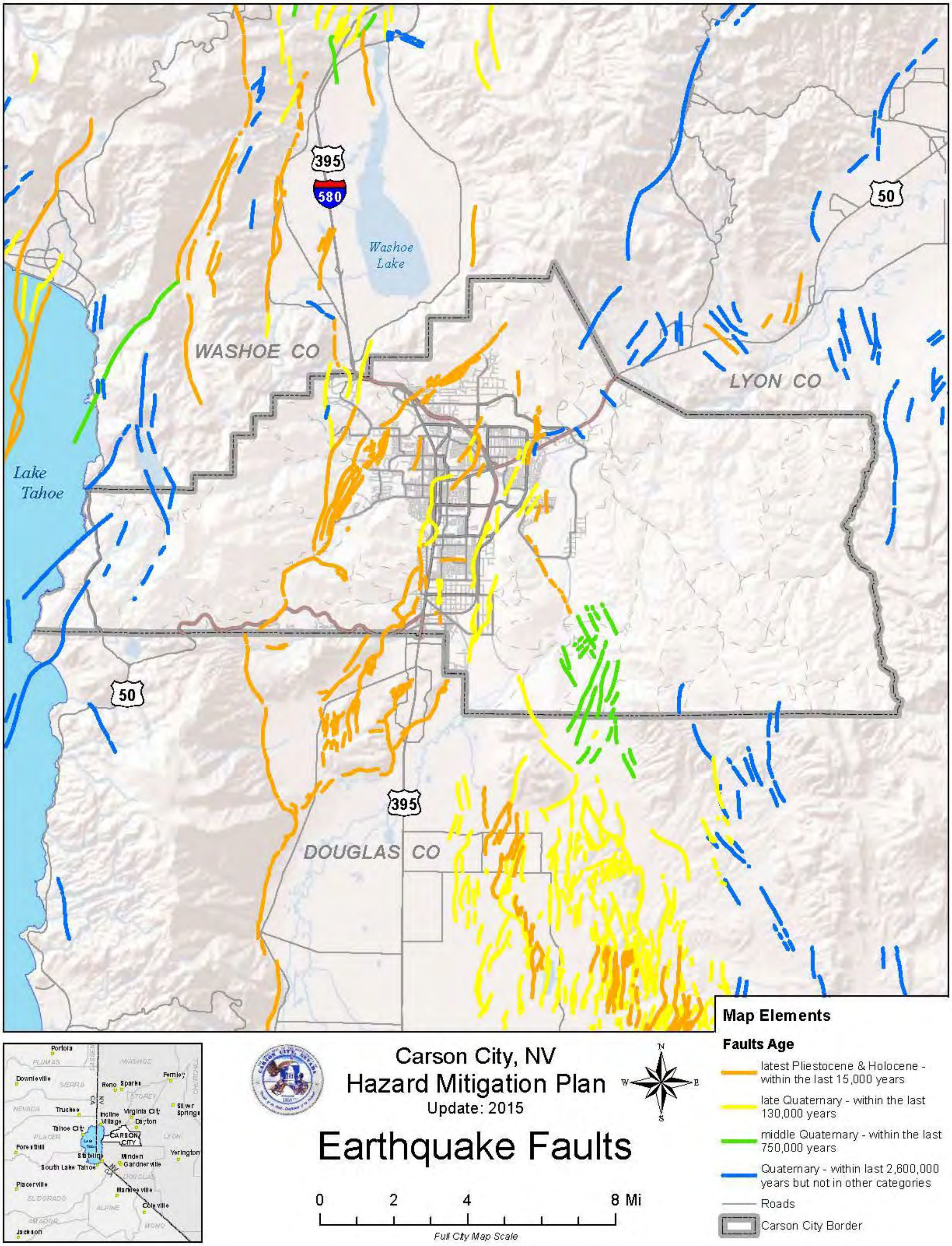
Hazardous Substance Facilities

Map Elements

- Facility Parcels
- 1 Mile Buffer
- Carson City Border

0 1 2 4 Mi

Full City Map Scale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LYON CO
Lake Tahoe
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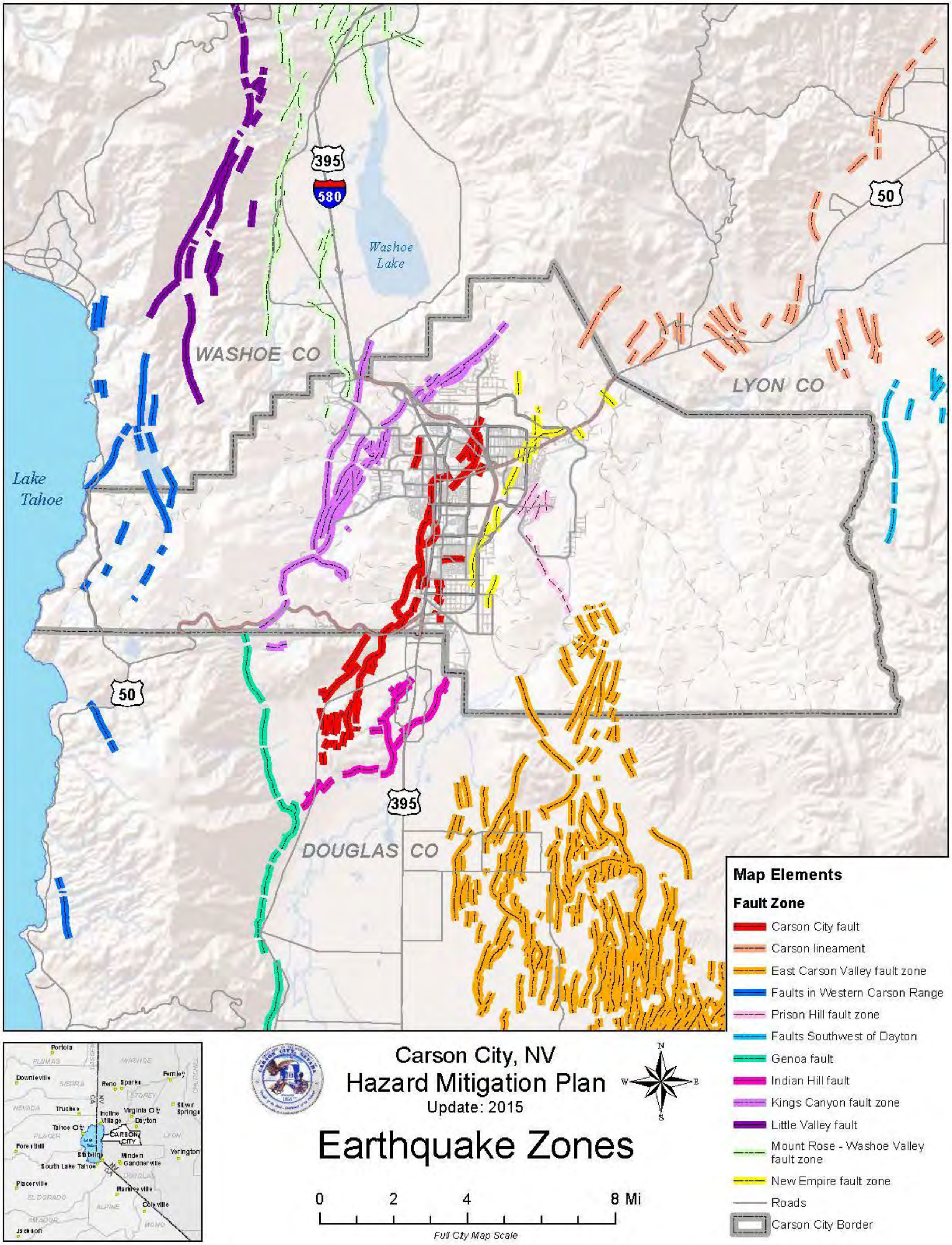
395
DOUGLAS CO
Carson City, NV
Hazard Mitigation Plan
Update: 2015
Earthquake Faults
0
2
4
8 Mi
Full City Map Scale
Map Elements
Faults Age
latest Pliestocene & Holocene - within the last 15,000 years
late Quaternary - within the last 130,000 years
middle Quaternary - within the last 750,000 years
Quaternary - within last 2,600,000 years but not in other categories
Roads
Carson City Border


WASHOE CO
LYON CO
DOUGLAS CO
Washoe Lake
Lake Tahoe
395
580
50
50
395
Map Elements
Fault Zone
Carson City fault
Carson lineament
East Carson Valley fault zone
Faults in Western Carson Range
Prison Hill fault zone
Faults Southwest of Dayton
Genoa fault
Indian Hill fault
Kings Canyon fault zone
Little Valley fault
Mount Rose - Washoe Valley fault zone
New Empire fault zone
Roads
Carson City Border
Carson City, NV
Hazard Mitigation Plan
Update: 2015
Earthquake Zones
0
2
4
8 Mi
Full City Map Scale

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Appendix C

Planning Team Meeting Minutes

- ***March 17, 2015***

During the kick-off meeting, held at Carson City Fire Station #1, R.O. Anderson presented to the Planning Committee, the objectives of the DMA 2000, the hazard mitigation planning process, Carson City Emergency Management/LEPC's role, the purpose of the plan, public participation, and the steps involved in updating the HMP and achieving the City's goals. Mitigation action items were reviewed from the 2014 annual review. The Hazard Identification Table and Hazard Ranking were reviewed and modifications to the hazards list were discussed and tallied for the 13 hazards in the plan. R.O. Anderson coordinated the formation of the Hazard Subcommittees for each hazard and future Planning Committee and Subcommittee meetings were discussed. See Appendix E for agenda, handouts and minutes.

- ***April 23, 2015***

R.O. Anderson and the Subcommittee members held a workshop, to discuss avalanche, drought, epidemic, earthquake, floods, landslide, seiche, severe weather and volcanic activity hazard profiles. Edits, changes and updates were gathered and discussed, specifically reviewing recent historical records based on number of events, climate change effects, and any community demographic changes within the last five years.

- ***April 29, 2015***

A hazard subcommittee workshop was held with the consultant to update the plan regarding hazardous materials events, terrorism, utility loss and wildland fire hazard profiles. Changes to the hazard profiles were discussed, specifically reviewing recent historical records based on number of events, climate change effects, and any community demographic changes within the last five years.

- ***June 10, 2015***

The Planning Committee met to review the hazard ranking results compiled by R.O. Anderson and from the March 17, 2015 meeting. The hazard profiles were edited based on information received from the subcommittee members. These included avalanche, drought, epidemic, floods, severe weather, utility loss and wildland fire hazard profiles. It was decided by the committee members that epidemic be renamed to infectious disease. Mitigation measures, goals and potential actions for the hazards were reviewed and evaluated with Table 8-2 Mitigation Goals and Potential Actions. Sections One through Four and the introduction of Section Five were also reviewed based on the information gathered by R.O. Anderson and the edits and input received from the subcommittee members. The next steps to updating the plan and future meetings were announced.

- ***July 22, 2015***

The Planning Committee met to review updates to the plan to date. The committee further discussed the hazard ranking results from the June 10, 2015 meeting. The Planning Committee discussed that all hazard sections, where applicable, needed to address the effects of "Climate Change." R. O. Anderson presented the public outreach questionnaire to the group and the format, and content was discussed. Additional discussion took place regarding hazardous materials events and terrorism hazard profiles. It was decided by the committee to change the hazard section terrorism to "acts of violence," with subheadings of terrorism, civil disorder and criminal acts. A mitigation action for back-up generators was added to Table 8-3 as Goal 5.L.

- ***August 26, 2015***

The consultant coordinated with Douglas County GIS, for updates to the figures and map exhibits of the Carson City plan, as well as the vulnerability analysis. The Planning Committee decided that Figure B-5 Potential Winter Storm Areas was not relevant to the plan update, since the entire area of Carson City has the potential of winter storms. All other figures in the Appendix B would be updated with current information.

Craig DePolo from the Nevada Bureau of Mines and Geology presented his revisions and edits to the volcanic activity, landslide, seiche and earthquake hazard sections of the plan. The consultant presented additional edits to Sections One through Five received from the Committee members. The Planning Committee reviewed Section 7 Capability Assessment, Section 8 Mitigation Strategies and Section 9 Plan Maintenance. The public workshop date was tentatively set for, Thursday, October 1, 2015 from 4:00 – 7:00 pm.

- ***October 1, 2015 Workshop***

The public workshop was held at the Carson City Fire Station #1, located at 777 S. Stewart St. Carson City, Nevada. Presentations were made regarding the progress of the 2015 Hazard Mitigation Plan update, the Carson City Fire Department fuels reduction program, information on the flood hazard for Carson City, and information on the earthquake hazards in Nevada and specifically for Carson City. Handouts on emergency preparedness, an information booklet on the 100 year anniversary of the 1915 earthquake in Nevada, and the mitigation questionnaire were provided to the public. Additionally, the public was notified of the website link to locate both the questionnaire online and the draft plan online.

- ***October 7, 2015***

The Planning Committee met to discuss the public workshop and public outreach questionnaire. The consultant presented Section 8, the initial results of the vulnerability analysis and the maps for the Appendix portion of the plan. Review of the draft plan was discussed and edits were made by the committee. The STAPLE+E was given to all committee members in attendance, with directions for filling out the STAPLE+E. The group spent time discussing the mitigation actions and evaluation of the actions to complete the STAPLE+E form. The consultant discussed the final steps for edits and review of the draft plan.

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Appendix D

Public Information

Community/Regional Letter

Tammy Kinsley

From:	Tammy Kinsley
Sent:	Friday, September 18, 2015 11:24 AM
To:	'akenneston@washoecounty.us'; 'tcarlini@co.douglas.nv.us'; 'rloveberg@lyon-county.org'; 'jcurtis@storeycounty.org'
Cc:	'Stacey Belt'; Robert Schreihans; Kristen Pradere; Stephanie Hicks
Subject:	Carson City Regional Hazard Mitigation Plan update workshop and meetings
Attachments:	Hazard Mitigation Flyer.pdf

Dear Neighboring Community,

We invite you to participate with Carson City in the update to the Regional Hazard Mitigation Plan.

Over the past few months, Carson City has been conducting a planning effort to update their Regional Hazard Mitigation Plan. This update plan is being developed to facilitate compliance with federal requirements and to provide a tool for local government, industry and private venues to help reduce the impact of these threats. Further, this update to the plan will help the community develop infrastructure to lessen potential damage.

One of the major components of the plan development is having a good cross-section of community input and participation with neighboring communities.

Our next public workshop is scheduled for Thursday, October 1, 2015 at 4:00 pm to 7:00 pm and will be held at the Carson City Fire Department, 777 South Stewart Street, Carson City, NV 89701. Also the next Planning Committee meeting will be held on October 7, 2015 at 9:00 am to 11:00 am at 777 South Stewart Street, Carson City, NV 89701

I hope that you can participate as a representative of your profession and community. If you are willing to join our group, please RSVP to me at tkinsley@roanderson.com or (775) 215-5013.

Cordially,

Tammy Kinsley
Associate Planner
direct line 775.215.5013
tkinsley@roanderson.com
www.ROAnderson.com
NEVADA
1603 Esmeralda Avenue
Minden, NV 89423
p 775.782.2322
f 775.782.7084 NEVADA
140 W. Huffaker Lane, Suite 507
Reno, NV 89511
p 775.215.5012
CALIFORNIA

PRESS RELEASE:

Media Release

FOR IMMEDIATE RELEASE

Subject: Hazard Mitigation Planning Workshop

Contact: Stacey Belt, Deputy Emergency Manager, 775-887-2210 or sbelt@carson.org

Date: September 28, 2015

What: Open House, Carson City Fire Department, Thursday, October 1, 2015, 4pm to 7pm

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Natural hazards have the potential to cause property loss, loss of life, economic hardship, and threats to public health and safety. While an important aspect of emergency management deals with disaster recovery (the actions that a community takes to repair damages), an equally important aspect of emergency management involves hazard mitigation - sustained actions taken to reduce long-term risk to life and property. They are things we do today to be more protected in the future.

The Federal Emergency Management Agency (FEMA) requires cities to update their plans every five years in order to frequently assess and address the changing threat of natural hazards. A planning group, comprised of City and State agencies, private organizations, other agencies, including utilities, has selected a list of potential hazards that could occur within the City. Some of the hazards include: Flooding, Severe Weather, Earthquakes, Wildfire.

October 1st marks the 100th anniversary of the historic 1915 Nevada earthquake and Carson City Emergency Management and the Carson City Fire Department are hosting a planning workshop to explain the community Hazard Mitigation Plan and review current maps. The open house begins at 4pm with special guest speakers addressing several of the key hazards identified. Earthquake expert Craig DePolo, from UNR will talk about past Earthquake events and future predictions.

Join us between 4pm and 7 pm, October 1, 2015 at Fire Station 51, 777 S. Stewart Street, Carson City and provide feedback to the planning team, helping to build a more resilient Carson City. Speakers begin at 5pm.

###

MITIGATION QUESTIONNAIRE

This questionnaire is designed to help the Carson City Hazard Mitigation Planning Committee identify the community's concerns about natural and human-caused hazards. The questionnaire should be completed by an adult, preferably the homeowner or the head of the household. All individual responses are strictly confidential and for research purposes only.

This questionnaire consists of 11 questions and will take approximately 5 minutes to complete

GENERAL HOUSEHOLD INFORMATION

The following requested demographic information will aid the Planning Committee in determining the hazard mitigation needs of our community. For example, indicating whether you own a house or are a tenant will help determine the needs for both renters and homeowners. The answers provided in this action will be treated as confidential, will be used solely for the preparation of this plan, and will not be provided to any other group or interest.

1. Please indicate your zip code: ______________________
2. Please check all that apply.

   Do you own a home in Carson City? ☐ Yes ☐ No

   If you do not own a home, do you rent a residence in Carson City? ☐ Yes ☐ No

   Do you own a business located in Carson City? ☐ Yes ☐ No

   Do you own a business outside of Carson City, but operate your business in the City? ☐ Yes ☐ No

   Do you own or operate a vehicle in Carson City? ☐ Yes ☐ No

NATURAL AND HUMAN-CAUSED HAZARD INFORMATION

The following requested demographic information will aid the Planning Committee in determining needs and desires for educating and preparing our community for natural and human-caused disasters. The answers provided in this action will be treated as confidential and will be used solely for the preparation of this plan and will not be provided to any other group or interest.

3. In the past 10 years which of the following types of natural and human-caused hazard events have you or someone in your household experienced within Carson City, and indicate your level of concern for the hazards impact on Carson City? (Please check all that apply.)

Natural and Human-caused Hazards	Have Experienced Y/N	Low Concern	Moderate Concern	High Concern
Acts of Violence				
Avalanche				
Drought				
Earthquake				
Epidemic				
Flood				
Hazardous Materials Events				
Landslides				
Seiche				
Severe Weather				
Utility Loss				

MITIGATION QUESTIONNAIRE

Volcanic Activity				
Wildland Fire				
Other ______________________				

4. Prior to receiving this questionnaire, were you aware of your City's Hazard Mitigation Plan (HMP)?
☐ Yes ☐ No

5. Prior to receiving this questionnaire, were you aware that the Federal Emergency Management Agency (FEMA) requires your City to update the HMP every five years in order for your City to be eligible for federal pre- and post-disaster hazard mitigation funds? ☐ Yes ☐ No

PREPAREDNESS ACTIVITIES IN YOUR HOUSEHOLD

Households can do many things to prepare for natural and human-caused disasters or emergencies. What you have on hand or are trained to do when a disaster strikes can make a big difference in your comfort and safety in the hours and days following natural and human-caused disasters or emergencies. Basic services, such as electricity, gas, water, and telephones, may be cut off, or you may have to evacuate at a moment's notice. The following questions focus on your household's preparedness for a disaster event.

6. The following questions focus on your household's preparedness for a disaster event.

In your household, have you or someone in your household:	Have Experienced	Plan To Do	Not Done	Unable To Do
Attended meetings or received written information on natural and human-caused disasters or emergency preparedness?				
Talked with members of your household about what to do in case of natural and human-caused disasters or emergency?				
Developed a "Household/Family Emergency Plan" in order to decide what everyone would do in the event of a disaster?				
Prepared a "Disaster Supply Kit" (stored extra food, water, batteries, or other emergency supplies)?				
In the last year, has anyone in your household been trained in First Aid, Cardio-Pulmonary Resuscitation (CPR) or Automated External Defibrillator (AED)?				

7. What steps, if any, have you or someone in your household taken to prepare for natural and human-caused disasters?

☐ Food
☐ Water
☐ Flashlight(s)
☐ Batteries
☐ Battery-Powered Radio
☐ Make a Fire Escape Plan
☐ Fire Extinguisher
☐ Prepared a Disaster Supply Kit
☐ Medical Supplies (First Aid Kit)
☐ Received First Aid/CPR/AED Training
☐ Developed a Reconnection Plan (Where to Go and Who to Call)
☐ Discussed Utility Shutoffs
☐ Smoke Detector on Each Level of the Home
☐ Other (please specify): ____________________

8. Have you ever received information about how to make your household and home safer from natural and human-caused disasters?

☐ Yes ☐ No (IF "NO" Skip to Question 10)

If "YES", how recently?

☐ Within the Last 6 Months ☐ Between 2 to 5 Years

MITIGATION QUESTIONNAIRE

- ☐ Between 6 to 12 Months
- ☐ 5 Years or More
- ☐ Between 1 to 2 Years

9. From whom did you receive information about how to make your household and home safer from natural and human-caused disasters? (Please check all that apply.)

- ☐ News Media
- ☐ University or Research Institution
- ☐ Insurance Agent or Company
- ☐ Utility Company
- ☐ American Red Cross
- ☐ Fire Department/Emergency Manager
- ☐ Health District
- ☐ Other Government Agency
- ☐ Not Sure
- ☐ Other : ________________

10. Who would you most trust to provide you with information about how to make your household and home safer from natural and human-caused disasters? (Please check all that apply.)

- ☐ News Media
- ☐ University or Research Institution
- ☐ Insurance Agent or Company
- ☐ Utility Company
- ☐ American Red Cross
- ☐ Fire Department/Emergency Manager
- ☐ Health District
- ☐ Other Government Agency
- ☐ Not Sure
- ☐ Other : ________________

11. What is the most effective way for you to receive information about how to make your household and home safer from natural and human-caused disasters? (Please check all that apply.)

Newspapers:
- ☐ Newspaper Stories
- ☐ Newspaper Ads

Television:
- ☐ Television Stories
- ☐ Television Ads

Radio:
- ☐ Radio Stories
- ☐ Radio Ads

Other Methods:
- ☐ Books
- ☐ Postal Mail
- ☐ Email

Other Methods (cont.):
- ☐ Magazines
- ☐ Internet
- ☐ Outdoor Advertisements (Billboards, etc.)
- ☐ Fact Sheet/Brochure
- ☐ School
- ☐ University or Research Institution
- ☐ Fire Department/Emergency Manager
- ☐ Chamber of Commerce
- ☐ Public Workshops/Meetings
- ☐ Other: __________________

Other Comments:

Please return this questionnaire to: Stacey Belt, Deputy Emergency Manager, Carson City Fire Department - Emergency Management, 777 S. Stewart Street, Carson City, Nevada 89701, (775) 283-7209 sbelt@carson.org

Carson City Hazard Mitigation Questionnaire

General Comments:

1. The Carson City Hazard Mitigation Questionnaire was designed to help the Carson City Hazard Mitigation Planning Committee identify the community's concerns about natural and human-caused hazards. The questionnaire was considered an essential development tool to the City's 2015 update to the current Hazard Mitigation Plan document.

2. It was decided by the committee to have the questionnaire available on the City's Emergency Management Website, and through Press release and hard copies of the questionnaire were available at the public workshop, held October 1, 2015. Approximately 121 questionnaire responses were returned via the workshop and online. Questionnaire responses were tallied and written comments were reviewed.

3. The concerns (rated at Low, Med, High) of citizens residing in the Municipality of Carson City are indicated below, highest to lowest:

    a. Drought
    b. Earthquake
    c. Severe Weather
    d. Flood
    e. Wildland Fire
    f. Utility Loss
    g. Acts of Violence
    h. Infectious Disease
    i. Hazardous Materials Events
    j. Landslide
    k. Volcanic Activity
    l. Avalanche
    m. Seiche

4. The questionnaire revealed that the majority of Carson City citizens wish to receive information about how to make their homes safer from natural disasters from the Fire Department/Emergency Management, the American Red Cross, utility companies, the Health District, University or Research Institute. Less effective was receiving information from the News Media, Insurance Agent or Company and other Government Agencies.

5. Developing or planning to develop a household/family Emergency Plan and First Aid kit was split 50/50 from the results received. Some have developed a plan and some plan to do so. In addition half of the responses received said that they have been trained in First Aid/CPR and AED. With half of the responses planning to do so.

6. The questionnaire provided excellent feedback from the community concerning hazard mitigation issues and was used during the update to the Carson City Hazard Mitigation Plan.

Questionnaire Responses

The tallying of the responses received are listed below. All questionnaire comments were provided to the Planning Committee and taken into consideration when developing and prioritizing actions.

Mitigation Questionnaire response results October, 27, 2015

Survey Question	#1 Participants zip code																				
Survey Source	89403	89410	89423	89509	89509	89511	89701	89703	89704	89705	89706	89711	89712	0	0	0	0	0	0	0	0
Total Online Survey	2	1	3	2	2	2	47	16	1	3	25	1	8	0	0	0	0	0	0	0	0
Total Hard Copy	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Overall	2	1	3	2	2	2	47	16	1	3	26	1	8	0	0	0	0	0	0	0	0

Survey Question		#2 Own/Rent/ Operate					#3 Natural disasters experienced													
		Residence		Business																
Survey Source	*Number of Participants*	Own	Rent	Own	Operate Only	Vehicle	Acts of Violence	Avalanche	Drought	Earthquake	Epidemic	Flood	Hazardous Materials Events	Landslide	Seiche	Severe Weather	Utility Loss	Volcanic Activity	Wildland Fire	Other
Total Online Survey		71	26	4	6	118	20	0	85	42	15	35	6	2	0	65	77	0	52	0
Total Hard Copy	*111*	1	0	0	0	1	0	0	1	1	0	1	0	0	0	1	1	0	1	0
Overall		72	26	4	6	119	20	0	86	43	15	36	6	2	0	66	78	0	53	0

Survey Question	#4 Hazards that impact Washoe County																																								#5 Were aware of the Plan		#6 Were aware of FEMA requirements	
	Acts of Violence			Avalanche			Drought			Earthquake			Epidemic			Flood			Hazardous Materials Events			Landslide			Seiche			Severe Weather			Utility Loss			Volcanic Activity			Wildland Fire			Other				
Survey Source	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High		Yes	No	Yes	No
Total Online Survey	0	1	0	1	0	0	0	0	1	0	0	1	0	1	0	0	0	1	0	1	0	1	0	0	0	1	0	0	0	1	0	0	1	1	0	0	0	0	1	0	0	1	0	1
Total Hard Copy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
Overall	0	1	0	1	0	0	0	0	1	0	0	1	0	1	0	0	0	1	0	1	0	1	0	0	0	1	0	0	0	1	0	0	1	1	0	0	0	0	1	0	1	1	1	1

Mitigation Questionnaire response results October, 27, 2015

Survey Question: #7 Disaster preparness actions

Survey Source	Attended Meetings on Disasters or Preparedness: Have Experienced	Plan to Do	Not Done	Unable to Do	Talked About What to Do: Have Experienced	Plan to Do	Not Done	Unable to Do	Developed a Plan: Have Experienced	Plan to Do	Not Done	Unable to Do	Prepares a Kit: Have Experienced	Plan to Do	Not Done	Unable to Do	Training: Have Experienced	Plan to Do	Not Done	Unable to Do	Other
Total Online Survey	1	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0
Total Hard Copy	1	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0
Overall	2	0	0	0	2	0	0	0	0	1	1	0	0	1	1	0	2	0	0	0	0

Survey Question: #8 Steps taken to prepare for a disaster

Survey Source	Food	Water	Flashlights	Batteries	Battery Powered Radio	Fire Escape Plan	Fire Extinguisher	Disaster Supply Kit	Medical Supply Kit	Received Training	Reconnection Plan	Utility Shutoffs	Smoke Detectors	Other
Total Online Survey	0	0	1	1	0	0	1	0	1	0	0	0	1	0
Total Hard Copy	0	0	1	0	0	0	1	0	1	1	0	0	1	0
Overall	0	0	2	1	0	0	2	0	2	1	0	0	2	0

Survey Question: #9 Safety information received from

Survey Source	Yes	No	If YES, how often: <6 Months	6-12 Months	1-2 Years	2-5 Years	5+ Years
Total Online Survey	0	1	0	1	0	0	0
Total Hard Copy	1	0	1	0	0	0	0
Overall	1	1	1	1	0	0	0

Survey Question: #10 Information sources / #11 Most trusted sources

Survey Source	#10: News	Institution	Insurance	Utility	Red Cross	Emergency Manager	Health District	Other Government Agencies	Not Sure	Other	#11: News	Institution	Insurance	Utility	Red Cross	Emergency Manager	Health District	Other Government Agencies	Not Sure	Other
Total Online Survey	1	0	0	1	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0
Total Hard Copy	0	0	0	0	0	0	1	0	0	0	0	1	1	1	1	1	1	0	0	0
Overall	1	0	0	1	0	1	1	0	0	0	0	1	1	1	2	2	1	0	0	0

Survey Question: #12 Most effective way to receive information

Survey Source	Newspaper: Stories	Ads	Television: Stories	Ads	Radio: Stories	Ads	Books	Postal Mail	Email	Magazines	Internet	Outdoor Ads	Fact Sheets	School	Institutions	Fire/Rescue	Emergency Manager	Chamber of Commerce	Workshops/Meetings	Other
Total Online Survey	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0
Total Hard Copy	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
Overall	1	0	0	0	0	0	0	1	0	0	1	0	1	0	0	1	1	0	0	0

Mitigation Questionnaire response results October, 27, 2015

so far, communication have been poor at best, there must be a more effective way to communicate.????????
10/16/2015 11:51 AM

Construction activities hitting utilities on State Property is a major concern. There have been serious utility breaches that only luck has kept from loss of life
10/13/2015 8:32 AM

When you receive $$ from the feds, it actually is from we taxpayers paying higher insurance rates even though we haven't had a disaster. Joke. Spend wisely
10/8/2015 11:46 AM

Thank you for this survey; it has made me more aware of the need for an emergency plan... I never thought about how unprepared I am...
10/8/2015 8:40 AM

Having a booklet to fill out that would have all the information on what needs to be done along with areas to fill-in what a person/family agreed to do/meet/call/etc. would be very helpful.
10/7/2015 3:16 PM

I have no TV, internet, or newspapers (too poor)...I do have a radio, what do I do?

At this time, I am renting my home but I work in Carson City
10/7/2015 3:12 PM

I think its great when the fire department and or sheriff's office comes to schools to educated the young ones on what to expect and how to help mom and dad and what their responsibility can be
10/7/2015 2:46 PM

How often is the flood zoning reviewed/updated?
10/7/2015 2:36 PM

none
10/7/2015 2:32 PM

Glad to help

Appendix E

Meeting Agendas & Handouts

Meeting #1 -AGENDA

Carson City Hazard Mitigation Plan Update

9:00 to 11:00 pm, Tuesday, March 17, 2015
Carson City Fire Department
777 South Stewart Street, Carson City, NV 89701

1. **WELCOME & INTRODUCTIONS** – *Stacey Belt*
2. **PLANNING PROCESS OVERVIEW** – *Debbie Tanaka, DEM*
   a. General Information
   b. Carson City Emergency Management/LEPC's Role
   c. Purpose of the Plan
   d. Public Participation
3. **MITIGATION ACTION ITEM REVIEW FROM 2014** – *Stephanie Hicks*
4. **INCORPORATION OF EXISTING PLANS** – *Stephanie Hicks*
5. **HAZARD IDENTIFICATION TABLE & HAZARD RANKING** – *All*
6. **FORMATION OF HAZARD SUBCOMMITTEES** – *Stephanie Hicks*
7. **ANNOUNCEMENT OF FUTURE MEETINGS** – *Stephanie Hicks*

   Future meetings are scheduled tentatively as follows:

   1. April 29, 2015 – Hazard Subcommittee Workshop
   2. June 10, 2015 – Planning Committee Meeting
   3. July 22, 2015 – Planning Committee Meeting
   4. August 19, 2015 – Planning Committee Meeting

Meeting No. 1 Sign-in-Sheet

Carson City HMP
March 17, 2015
Hazard Committee Meetings

Name	Firm/Agency	Phone Number	Email
STACEY BELT	CC EMERGENCY MGMT	283-7218	sbelt@carson.org
Stephanie Hicks	R.O. Anderson Eng	215-5042	shicks@roanderson.com
Robb Fellows	CC Public Works	283-7370	RFellows@carson.org
Bill Moline	NDF	720-0952	bmoline@forestry.nv.gov
Jim Walker	NDOT	888-7862	jwalker2@dot.state.nv.us
Justina Hillman	Red Cross	707.483.2300	Justina.Hillman@redcross.org
Craig dePolo	NV Bur Mines & Geology	775 322-7485	eqdude@sbcglobal.net
Jeff Melvin	Carson City. Sheriff	283-7885	jmelvin@carson.org
Angela Barosso	CCHHS	283-7217	
MARK KORINEK	CARSON City Schools	283-2181	mkorinek@carson.k12.nv.us
Dave Ruben	Fire	283-7153	druben@carson.org
Lee Plemel	Community Development	283-7075	LPLEMEL@CARSON.ORG

Carson City HMP
March 17, 2015
Hazard Committee Meetings

Name	Firm/Agency	Phone Number	Email
DANNY ROTTER	CCPW	283-7084	DROTTER@CARSON.ORG
TOM TAROLLI	CCFD	283-7159	ttarolli@carson.org
BRIAN CROWE	WNC	445-3327	CROWE@WNC.EDU
James Freed	CTH	445.8399	james.freed@carsontahoe.org
Karen Johnson	NDEM	687 0373	kijohnson@dps.state.nv.us
Bob Schnelhuns	CARSON FIRE	283-7209	RSchnelhuns@carson.org

Hazard Subcommittee Sign-up-Sheets

Carson City HMP Hazard Subcommittees

Avalanche	
Name	Agency/Department
Danny Rotter	CCPW
Robb Fellows	CCPW

Drought	
Name	Agency/Department
Curtis Horton	CCPW
Robb Fellows	CCPW

Earthquake	
Name	Agency/Department
Curtis Horton	CCPW
Danny Rotter	CCPW
Brian Crowe	WNC
Angela Barosso	Health
Craig dePolo	

Epidemic	
Name	Agency/Department
Angela Barosso	Health
James Freed	Carson Tahoe Hospital

Hazard Subcommittee Sign-up-Sheets

Flood	
Name	Agency/Department
Curtis Horton	CCPW
Danny Rotter	CCPW
Robb Fellows	CCPW

Hazardous Materials Events	
Name	Agency/Department
Dave Ruben	CCFD
Tom Tarulli	CCFD

Landslides	
Name	Agency/Department
Curtis Horton	CCPW
Robb Fellows	CCPW

Seiche	
Name	Agency/Department
Craig dePolo	NBMG

Hazard Subcommittee Sign-up-Sheets

Severe Weather	
Name	**Agency/Department**
Curtis Norton	CCPW
Robb Fellows	CCPW

Terrorism	
Name	**Agency/Department**
DANNY ROTTER	CCPW
TOM TARULLI	CCFD
JIM WALKER	NDOT

Utility Loss	
Name	**Agency/Department**
MARK KORINEK	CCSD - EVACUATE - site support

Volcanic Activity	
Name	**Agency/Department**
Craig dePolo	

Hazard Subcommittee Sign-up-Sheets

Wildland Fire	
Name	**Agency/Department**
MARK KORINEK CCSD	Site support
BRIAN CROWE	WNC
Dave Ruben	CCFD
TOM TARULLI	CCFD
Bill Moline	NDF

Meeting Number One Handouts

Incorporation of Existing Plans/Study Table

Hard/PDF/ WWW Copy	Plan / Study	Findings / Incorporation
WWW	*Carson City Building Code (January 2008)*	These regulations concern zoning districts, variances, and general development standards within Carson City and includes the 2006 US Building Codes & Carson City Municiple Code Title 14, 15, 17, 18 https://www.municode.com/library/nv/carson_city/codes/code_of_ordinances
	Carson City Fire Code (January 2008)	This document includes a wildland/urban interface section that delineates regulations for building and maintaining homes in wildland fire prone areas http://www.--------.
	Carson City Mass Illness Plan (In Draft)	This plan addresses the City's response to a pandemic/influenza outbreak http://www.--------.
PDF/WWW	*Carson City Master Plan – Land Use Element (Carson City Planning April 2006)*	Guiding principle includes a stewardship section which addresses Hazard Mitigation. http://carson.org/Index.aspx?page=809
	Carson City Sandbagging Plan 2007	This document includes a plan in case of flood for sand bagging specific identified areas.
PDF/WWW	*Carson River Watershed Regional Floodplain Management Plan (Carson Water Sub conservancy District, 2008)*	This plan provides strategies for floodplain management that can be applied regionally as well as locally http://www.cwsd.org/carson-river-watershed-regional-floodplain-management-plan/
PDF/WWW	*Carson City Community Wildfire Protection Plan (August 2009)*	This document includes findings and recommendations for mitigating the threat to property from wildland fires http://www.carson.org/index.aspx?page=2236
	Emergency Operations Plan	This document is the main reference source for managing disasters and large scale emergencies in Carson City.
PDF/WWW	*Carson River Geographic Response Plan*	This is a regional plan covering five counties in two states. The plan was developed to protect the health, safety, environment, and property (both public and private) from the effects of hazardous materials incidents in or near the Carson River. http://ndep.nv.gov/bca/docs/CRGRP/crgrp%20april%202006.pdf
	Carson City Hazardous Materials Response Plan	This plan provides guidance to emergency response personnel on the general plan of action for a response to a hazardous materials emergency and provides for a resource directory.

Incorporation of Existing Plans/Study Table

Hard/PDF/ WWW Copy	Plan / Study	Findings / Incorporation
	Carson City Emergency Action Plan (Brunswick Canyon Dam – Manhard Consult. Mar. 2005, Eagle Valley Dam - MacTec Jan. 2009, Shanandoah Heights Dam – Manhard Consult. Oct. 2006)	This plan provides a tool for development service personnel and public safety agencies to ensure public safety and minimize property damage.
PDF/WWW	*State of Nevada Multi-Hazard Mitigation Plan*	This plan, prepared by NDEM, was used to ensure that the City's HMP was consistent with the State's Plan http://dem.nv.gov/uploadedFiles/demnvgov/content/DEM/0_HazardMitigationPlan_FULL.pdf
	FEMA Flood Insurance Study for Carson City, NV (FEMA 2009)	This outlined the principal flood problems and floodplains within the City.
PDF/WWW	*Washoe Tribe of NV & CA Hazard Mitigation Plan 2005*	http://emilms.fema.gov/IS318/assets/MP0402-171_mitigation_TG_washoe.pdf
PDF/WWW	*How-To Guide #1: Getting Started: Building Support For Mitigation Planning (FEMA 2002c)*	http://www.fema.gov/media-library-data/20130726-1521-20490-3966/howto1.pdf
PDF/WWW	*How-To Guide #2: Understanding Your Risks – Identifying Hazards and Estimating Loss Potential (FEMA 2001)*	http://www.fema.gov/media-library-data/20130726-1521-20490-4917/howto2.pdf
PDF/WWW	*How-To Guide #3: Developing the Mitigation Plan: Identifying Mitigation Actions and Implementing Strategies (FEMA 2003a)*	http://www.fema.gov/media-library-data/20130726-1521-20490-5373/howto3.pdf
PDF/WWW	*How-To Guide #4: Bringing the Plan to Life: Implementing the Hazard Mitigation Plan (FEMA 2003b)*	http://www.fema.gov/media-library-data/20130726-1521-20490-9008/fema_386_4.pdf

Meeting Number One Handouts

Incorporation of Existing Plans/Study Table		
Hard/PDF/ WWW Copy	**Plan / Study**	**Findings / Incorporation**
PDF/WWW	*Hazard Mitigation Planning and Hazard Mitigation Grant Program, Interim Final Rule. In Federal Register 67, No. 38. U.S. Department of Homeland Security, Federal Emergency Management Agency. (FEMA. 2002a. 44 CFR Parts 201 and 206, RIN 3067-AD22,)*	https://www.fema.gov/pdf/help/fr02-4321.pdf
PDF/WWW	*Carson City Hazardous Materials Transportation Commodities Study, 2005*	http://www.carson.org/Modules/ShowDocument.aspx?documentid=11333

Risk Categories for State of Nevada Hazards		
High Risk	**Medium/Significant Risk**	**Low Risk**
Earthquake	Terrorism/ WMD	Tsunami/ Seiche
Flood	Hazardous Materials	Hail and thunderstorm
Wildfire	Drought	Avalanche
	Severe winter storm and extreme snowfall	Epidemic
		Windstorm
		Landslide
		Heat, extreme
		Tornado
		Infestation
		Land Subsidence
		Volcano
		Expansive Soil

Meeting Number One Handouts

State Enhanced Hazard Mitigation Plan 2013 Update

HAZARD PRIORITIZATION CRITERIA			
Criterion	Value	Category	Description
Probability/Frequency	1	Very Low	Occurs less than once in 1000 years.
	2	Low	Occurs less than once in 100 to once in 1000 years.
	3	Medium	Occurs less than once in 10 to once in 100 years.
	4	High	Occurs less than once in 5 to once in 100 years.
	5	Very High	Occurs more frequently than once in 5 years.
Magnitude/Severity (includes Economic Impact, Area Affected and Vulnerability)	1	Very Low	• Negligible property damages (less than 5% of all buildings and infrastructure). • No deaths and injuries/illnesses treatable with first aid and do not require hospitalization. • Negligible loss of quality of life. • Economic and geographic effects are localized.
	2	Low	• Slight property damages (5% to 15%) of all buildings and infrastructure). • No deaths and few injuries/illnesses require hospitalization. • Slight loss of quality of life. • Economic and geographic effects felt at the city or community.
	3	Medium	• Moderate property damages (15% to 30% of all buildings and infrastructure). • Fewer than 5 deaths and multiple injuries/illnesses require hospitalization. • Some loss of quality of life. • Economic and geographic effects felt countywide.
	4	High	• Moderate property damages (30% to 50% of all buildings and infrastructure). • More than 5 deaths and considerable injuries/illnesses require hospitalization in multiple facilities with some resulting in permanent disability. • Moderate loss of quality of life. • Economic and geographic effects felt statewide.
	5	Very High	• Moderate property damages (30% to 50% of all buildings and infrastructure). • Significant number of deaths and injuries/illnesses requiring hospitalization in multiple facilities with some resulting in permanent disability. • Significant loss of quality of life. • Economic and geographic effects felt at the Region IX level.
Warning Time	1	Very Low	Greater than 48 hrs
	2	Low	24 to 48 hrs
	3	Medium	12 to 24 hrs
	4	High	6 to 12 hrs
	5	Very High	Less than 6 hrs
Duration of Loss of Critical Facilities and Services	1	Very Low	1 to 3 days
	2	Low	4 to 7 days
	3	Medium	8 to 14 days
	4	High	15 to 20 days
	5	Very High	More than 20 days

Meeting Number One Handouts

Name:______________________________ Date: ______________

Agency:____________________________ Specialty: ______________

Hazard Profiling Worksheet

Legend: 1 = lowest; 5 = highest

Hazard Type	Probability/ Frequency	Magnitude/ Severity	Warning Time	Duration of loss of critical facilities and services	Total
Natural Hazards					
Avalanche					
Drought					
Earthquakes					
Epidemic					
Floods					
Hazardous Materials Events					
Landslides					
Seiche					
Severe Weather					
Terrorism					
Utility Loss					
Volcanic Activity					
Wildland Fire					

Page 1 Hazard Screening Worksheet (DDL).xls

Meeting Number One Handouts

CARSON CITY FIRE DEPARTMENT
"Service with Pride. Commitment. Compassion"

PRESS RELEASE
For
Local Media and Website
July 27, 2009

In recent years nature has been restless in Nevada. There has been a swarm of earthquakes rattling the western portion of the State immediately adjacent to Carson City as well as the Truckee levee breech just north of Carson City. There have also been ravaging wildland fires throughout the State, including fires surrounding the Reno area. All of these emergency events have demonstrated that Carson City can be vulnerable to disasters, including earthquakes, floods, severe winter storms, and wildland fires. The risks posed by these hazards will continue to increase as the City's population continues to grow.

Carson City, Nevada, has launched a planning effort, known as the *Carson City Hazard Mitigation Plan*, to assess risks posed by natural and manmade disasters and identify ways to reduce those risks. This plan is required under the Federal Disaster Mitigation Act of 2000 as a prerequisite for receiving certain forms of Federal disaster assistance.

Carson City began this planning process in July 2009 and is sending out a questionnaire with the August utility bill for public input. The City anticipates submittal of the draft plan to the Board of Supervisors for adoption during early spring and then expects to submit the final version of this plan to FEMA by next summer.

Public comments and participation are welcomed. For additional information, to request to participate, or to submit comments, please contact Gary Dunn, Carson City Emergency Management, at (775) 887-2210 or gdunn@ci.carson-city.nv.us .

777 S. Stewart Street, Carson City, Nevada 89701
Business Phone (775) 887-2210 • Fax (775) 887-2209 • www.carsonfire.org

Meeting Number One Handouts

the hazard mitigation planning process

Hazard mitigation planning is the process of determining how to reduce or eliminate the loss of life and property damage resulting from natural and human-caused hazards. Four basic phases are described for the hazard mitigation planning process as shown in this diagram.

For illustration purposes, this diagram portrays a process that appears to proceed sequentially. However, the mitigation planning process is rarely a linear process. It is not unusual that ideas developed while assessing risks should need revision and additional information while developing the mitigation plan, or that implementing the plan may result in new goals or additional risk assessment.

organize resources

From the start, communities should focus on the resources needed for a successful mitigation planning process. Essential steps include identifying and organizing interested members of the community as well as the technical expertise required during the planning process.

assess risks

Next, communities need to identify the characteristics and potential consequences of hazards. It is important to understand how much of the community can be affected by specific hazards and what the impacts would be on important community assets.

develop a mitigation plan

Armed with an understanding of the risks posed by hazards, communities need to determine what their priorities should be and then look at possible ways to avoid or minimize the undesired effects. The result is a hazard mitigation plan and strategy for implementation.

implement the plan and monitor progress

Communities can bring the plan to life in a variety of ways ranging from implementing specific mitigation projects to changes in the day-to-day operation of the local government. To ensure the success of an on-going program, it is critical that the plan remains relevant. Thus, it is important to conduct periodic evaluations and make revisions as needed.

foreword

STATE AND LOCAL MITIGATION PLANNING how-to guide: **Getting Started**

Funding Impacted by the Plan

Individual Assistance After a disaster, Federal funds are provided to qualified individuals to facilitate recovery. Assistance comes in the form of low interest loans (SBA), housing assistance, cash grants etc.	Not impacted by plan
Public Assistance Categories A&B: Emergency measures and debris removal	Not impacted by plan
Categories C-G: Reconstruction of public facilities and infrastructure to current codes and standards.	An approved State or Tribal plan is required in order to receive funding.
Mitigation Hazard Mitigation Grant Program (HMGP): Up to 15% (20% for States with an approved Enhanced Mitigation Plan) of the total disaster grants awarded by FEMA to implement long-term hazard mitigation measures after a major disaster declaration. Pre-Disaster Mitigation Program (PDM): An annual competitive grant not tied to disaster.	An approved State or Tribal and Local, Multi-jurisdictional or Local Tribal plan is required in order to received funding for projects. Funding support for planning remains available.
Wildfire Fire Management Assistance Grants (FMAG): Financial assistance in the form of grants to the state for firefighting costs.	An approved State or Tribal and Local, Multi-jurisdictional or Local Tribal plan is required in order to received funding for projects. Funding support for planning remains available.
Flood Management Assistance Grants Flood Management Assistance program (FMA), Repetitive Flood Claim program (RFC), Severe Repetitive Loss Claim program (SRL): An annual competitive grant program.	An approved State or Tribal and Local, Multi-jurisdictional or Local Tribal plan is required in order to received funding for projects. Funding support for planning remains available.

FEMA

Subcommittee Workshop Agenda One

Carson City HMP Subcommittee Workshop

12:30 – 5:00 pm, Thursday, April 23, 2015
Carson City Fire Department
777 South Stewart Street, Carson City, NV 89701

Agenda

12:30 pm Epidemic
Angela Barosso
James Freed

1:00 pm Earthquake/ Seiche
Curtis Horton
Danny Rotter
Brian Crowe
Angela Barosso
Craig dePolo

2:00 pm Avalanche/ Landslide/Volcano
Curtis Horton
Robb Fellows
Danny Rotter
Craig dePolo

2:45 pm Floods
Curtis Horton
Robb Fellows
Danny Rotter
Chris Smallcomb

3:45 pm Drought
Curtis Horton
Robb Fellows
Chris Smallcomb

4:30 pm Severe Weather
Curtis Horton
Robb Fellows
Chris Smallcomb

Future meetings are scheduled as follows:

April 29, 2015 – Hazard Subcommittee Workshop
June 10, 2015 – Planning Committee Meeting
July 22, 2015 – Planning Committee Meeting
August 19, 2015 – Planning Committee Meeting

Subcommittee Workshop Sign-in-Sheet

Carson City HMP Subcommittee Workshop
April 23, 2015
Sign-in-Sheet

Name	Firm/Agency	Phone Number	Email
Robert Schreihans	CCFD	887-2210	RSchreihans@CARSON.ORG.
Angela Barosso	CCHHS	283-7217	abarosso@carson.org
Stacey Bell	CCEM	283.7218	sbell@carson.org
JAMES FREED	CARSON Tahoe Hosp.	445.8339	james.freed@carsontahoe.org
BRIAN CROWE	WNC	445-3327	CROWE7@WNC.EDU
Craig dePolo	NBMG/UNR	322-7485	eq_dude@sbcglobal.net
DANNY ROTTER	CCPW	283-7084	DROTTER@CARSON.ORG
Curtis Horton	CCPW	230-7228	Chorton@carson.org
Robb Fellows	CCPW	230-7370	Rfellows@carson.org
Chris Smallcomb	NOAA NWS	673-8100 x223	chris.smallcomb@noaa.gov
TAMMY KINSLEY	ROANDERSON, INC.	215-5013	tkinsley@ROANDERSON.COM
Stephanie Hicks	ROAnderson	215-5042	shicks@roanderson.com

Subcommittee Workshop Handouts

Hazard Profile Review Check Sheet

Carson City Hazard Mitigation Plan Update

Hazard Reviewed: ______________________________

Name of Department/Jurisdiction: ______________________________

Prepared by: ______________________________

Phone: ______________________ Email: ______________________

- ☐ Is the definition of the hazard under ***Nature*** correct?
- ☐ Did you read the section?
- ☐ Are there any other existing plans that contain data we should incorporate into this hazard profile? If so, please bring a copy to subcommittee meeting or email to shicks@roanderson.com.
- ☐ Please fill out *Historic Hazard Event Worksheet* for any events that have occurred since the 2010 plan update.
- ☐ Please provide photographs or any newspaper articles for any events that have occurred since the 2010 plan update.
- ☐ Are updated maps available? Accurate?
- ☐ Is the frequency (probability of future events) accurate?
- ☐ Are there any other inaccuracies or corrections that need to be made?

Please Note: *The subcommittees will discuss, as a group, the new hazard rankings based on the March 17, 2015 Planning Committee meeting.*

R|O Anderson

Subcommittee Workshop Handouts

Historic Hazard Event Worksheet

Carson City Hazard Mitigation Plan Update

Name of Department/Jurisdiction: ______________________________

Prepared by: ______________________________

Phone: ____________________ Email: ____________________

Please fill out one sheet for each significant hazard event with as much detail as possible. Attach supporting documentation, photocopies of newspaper articles, or any other original sources.

Type of event	
Nature and magnitude of event	
Location	
Date of event	
Injuries	
Deaths	
Property damage	
Infrastructure damage	
Crop damage	
Business/economic impacts	
Road/school/other closures	
Other damage	
Insured losses	
Federal/state disaster relief funding	
Opinion on likelihood of occurring again	
Source of information	
Comments	

R O Anderson

Please return worksheets to:
Stephanie Hicks, AICP, CFM
Email: shicks@roanderson.com

Subcommittee Workshop Handouts

Carson City HMP Comparison

HAZARD	2010 Hazard Mitigation Plan	Assessment from 03.17.15 Mtg
5.2.1 AVALANCHE	LOW	**MOD**
5.2.2 DROUGHT	MOD	MOD
5.2.3 EARTHQUAKE	HIGH	HIGH
5.2.4 EPIDEMIC	HIGH	**MOD**
5.2.5 FLOOD	HIGH	HIGH
5.2.6 HAZARDOUS MATERIALS EVENTS	HIGH	**MOD**
5.2.7 LANDSLIDES	LOW	**MOD**
5.2.8 SEICHE	LOW	**MOD**
5.2.9 SEVRE WEATHER	HIGH	**MOD**
5.2.10 TERRORISM	HIGH	**MOD**
5.2.11 UTILITY LOSS	MOD	MOD
5.2.12 VOLCANIC ACTIVITY	MOD	**LOW**
5.2.13 WILDLAND FIRE	HIGH	HIGH

Subcommittee Workshop Agenda Two

Carson City HMP Subcommittee Workshop

8:30 – 12:30 pm, Wednesday, April 29, 2015
Carson City Fire Department
777 South Stewart Street, Carson City, NV 89701

Agenda

8:30 am Utility Loss
Mark Korinek

9:15 am Wildland Fire
Mark Korinek
Brian Crowe
Dave Ruben
Tom Tarulli
Bill Moline

10:30 am Hazardous Materials Events
Dave Ruben
Tom Tarulli

11:30 am Terrorism
Danny Rotter
Tom Tarulli
Jim Walker

Future meetings are scheduled as follows:

June 10, 2015 – Planning Committee Meeting
July 22, 2015 – Planning Committee Meeting
August 19, 2015 – Planning Committee Meeting

Subcommittee Workshop Sign-in-Sheet

Carson City HMP Subcommittee Workshop
April 29, 2015
Sign-in-Sheet

Name	Firm/Agency	Phone Number	Email
Debbie Tanaka	NDEM	775-687-0314	Debbie.tanaka@dps.state.nv.us
Connor Long	NDEM	775-687-0307	clong@dps.state.nv.us
Stacey Belt	CCEM	775283-7218	sbelt@carson.org
Mark Korinek	CCSD	283-2181	mkorinek@carson.k12.nv.us
Tom Tarulli	CCFD	887-2210	ttarulli@carson.org
Bill Moline	NDF	775-720-0952	bmoline@forestry.nv.gov
Paul Carmichael	NDF	775-684-9984	pcarmichael@forestry.nv.gov
Jim Walker	NDOT	775-888-7862	jwalker2@dot.state.nv.us
Tammy Kinsley	RO Anderson	215-5013	tkinsley@roanderson.com
Stephanie Hicks	RO Anderson	215-5042	shicks@roanderson.com

Subcommittee Workshop Handouts

Hazard Profile Review Check Sheet

Carson City Hazard Mitigation Plan Update

Hazard Reviewed: ______________________________

Name of Department/Jurisdiction: ______________________________

Prepared by: ______________________________

Phone: ______________________ Email: ______________________

☐ Is the definition of the hazard under ***Nature*** correct?

☐ Did you read the section?

☐ Are there any other existing plans that contain data we should incorporate into this hazard profile? If so, please bring a copy to subcommittee meeting or email to shicks@roanderson.com.

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☐ Please provide photographs or any newspaper articles for any events that have occurred since the 2010 plan update.

☐ Are updated maps available? Accurate?

☐ Is the frequency (probability of future events) accurate?

☐ Are there any other inaccuracies or corrections that need to be made?

Please Note: *The subcommittees will discuss, as a group, the new hazard rankings based on the March 17, 2015 Planning Committee meeting.*

R O Anderson

Subcommittee Workshop Handouts

Historic Hazard Event Worksheet

Carson City Hazard Mitigation Plan Update

Name of Department/Jurisdiction: ______________________________

Prepared by: ______________________________

Phone: ____________________ Email: ____________________

Please fill out one sheet for each significant hazard event with as much detail as possible. Attach supporting documentation, photocopies of newspaper articles, or any other original sources.

Type of event	
Nature and magnitude of event	
Location	
Date of event	
Injuries	
Deaths	
Property damage	
Infrastructure damage	
Crop damage	
Business/economic impacts	
Road/school/other closures	
Other damage	
Insured losses	
Federal/state disaster relief funding	
Opinion on likelihood of occurring again	
Source of information	
Comments	

R|O|Anderson

Please return worksheets to:
Stephanie Hicks, AICP, CFM
Email: shicks@roanderson.com

Subcommittee Workshop Handouts

Carson City HMP Comparison

HAZARD	2010 Hazard Mitigation Plan	Assessment from 03.17.15 Mtg
5.2.1 AVALANCHE	LOW	**MOD**
5.2.2 DROUGHT	MOD	MOD
5.2.3 EARTHQUAKE	HIGH	HIGH
5.2.4 EPIDEMIC	HIGH	**MOD**
5.2.5 FLOOD	HIGH	HIGH
5.2.6 HAZARDOUS MATERIALS EVENTS	HIGH	**MOD**
5.2.7 LANDSLIDES	LOW	**MOD**
5.2.8 SEICHE	LOW	**MOD**
5.2.9 SEVRE WEATHER	HIGH	**MOD**
5.2.10 TERRORISM	HIGH	**MOD**
5.2.11 UTILITY LOSS	MOD	MOD
5.2.12 VOLCANIC ACTIVITY	MOD	**LOW**
5.2.13 WILDLAND FIRE	HIGH	HIGH

Meeting Number Two Agenda

Carson City Hazard Mitigation Plan Update

9:00 to 11:00 am, Wednesday, June 10, 2015
Carson City Fire Department
777 South Stewart Street, Carson City, NV 89701

AGENDA

Meeting Two

• ***Welcome & Introduction***	*Stacey Belt*
• ***Hazard Ranking Results***	*Tammy Kinsley*
• ***Hazard Profile Review***	*Stephanie Hicks*
○ *Avalanche*	*Danny Rotter*
○ *Drought*	*Curtis Horton*
○ *Epidemic*	*Angela Barosso*
○ *Floods*	*Robb Fellows*
○ *Severe Weather*	*Chris Smallcomb*
○ *Utility Loss*	*Danny Rotter*
○ *Wildland Fire*	*Tom Tarillo*
• ***Review Mitigation Measures for Hazards*** *(Refer to Table 8-3: Mitigation Goals and Potential Actions)*	*Stephanie Hicks*
• ***Review of Sections 1 – 4***	*Tammy Kinsley*
• ***What are the next Steps?***	*Stephanie Hicks*
• ***Announcement of Future Meetings:***	*Stephanie Hicks*

Future meetings are scheduled tentatively as follows:

July 22, 2015 – Planning Committee Meeting

August 26, 2015 – Planning Committee Meeting

October 7, 2015 – Planning Committee Meeting

October 2015 – Public Workshop

Meeting Number Two Sign-in-Sheet

Carson City Planning Committee
Hazard Mitigation Plan Update – Meeting Two
June 10, 2015
Sign-in Sheet

Name	Firm/Agency	Phone Number	Email
Craig dePolo	NBMG/UNR	775.322.7485	eq-dude@sbcglobal.net
Shawn Keating	Building Division	887-2310	Skeating@carson.org
Mark Cyr	The Salvation Army	721-6900	mark.cyr@usw.salvationarmy.org
JOHN WILKINSON	CARSONCITY IT	775-283-7676	JWILKINSON@CARSON.ORG
MATTHEW RICHARDSON	GIS		mrichardson@douglasnv.us
CURTIS HORTON	CCPW	230-7228	Chorton@carson.org
Angela Barosso	CCHHS	283-7217	abarosso@yahoo.com
JIM WALKER	NDOT	888-7862	jwalker2@dot.state.nv.us
Robert Schnieders	CCFD	283-7209	R.Schnieders@carson.org
TOM TARULLI	CCFD	283-7159	ttarulli@carson.org
Dave Ruben	CCFD	283-7153	druben@carson.org

Carson City Planning Committee
Hazard Mitigation Plan Update – Meeting Two
June 10, 2015
Sign-in Sheet

Name	Firm/Agency	Phone Number	Email
DANNY ROTTER	CCPW	283-7084	DROTTER@CARSON.ORG
Ken Sandage	CCSO	720-0126	KSandage@carson.org
TAMMY KINSLEY	ROANDERSON	215-5013	tkinsley@roanderson.com
Stephanie Hicks	RO Anderson	215-5042	shicks@roanderson.com
Stacey Belt	CCEM	283-7218	sbelt@carson.org

Meeting Number Two Handouts

Carson City HMP Hazard Ranking Comparison

HAZARD	2010 Hazard Mitigation Plan	Assessment from 03.17.15 Mtg	As of Subcommittee discussions 04.34.15 & 04.29.15
5.2.1 AVALANCHE	LOW	**MOD**	**Keep as Low**
5.2.2 DROUGHT	MOD	MOD	OK
5.2.3 EARTHQUAKE	HIGH	HIGH	OK
5.2.4 EPIDEMIC	HIGH	**MOD**	**Keep as High**
5.2.5 FLOOD	HIGH	HIGH	OK
5.2.6 HAZARDOUS MATERIALS EVENTS	HIGH	**MOD**	OK
5.2.7 LANDSLIDES	LOW	**MOD**	OK
5.2.8 SEICHE	LOW	**MOD**	OK
5.2.9 SEVRE WEATHER	HIGH	**MOD**	OK
5.2.10 TERRORISM	HIGH	**MOD**	**Keep as High**
5.2.11 UTILITY LOSS	MOD	MOD	OK
5.2.12 VOLCANIC ACTIVITY	MOD	**LOW**	OK
5.2.13 WILDLAND FIRE	HIGH	HIGH	OK

Meeting Number Two Handouts

Table 8-3: Mitigation Goals and Potential Actions

Goals	Action	New or Existing Buildings	Description
Goal 1: ***Promote increased and ongoing Carson City involvement in hazard-mitigation planning and projects***	1.A	N	Update the Master Plan to be consistent with the hazard area maps and implementation strategies developed in the HMP every 10 years. Review & update ordinances & code every 3 years.
	1.B	N/E	Identify & educate Carson City personnel on high hazard areas
	1.C	N/E	Coordinate existing Geographic Information Systems (GIS) capabilities to identify hazards through the City
	1.D	N/E	Develop the data sets that are necessary to test hazard scenarios and mitigation tools, including HAZUS MH
	1.E	N/E	Utilize the Internet as a communication tool, as well as an education tool
	1.F	N	Develop city building codes and ordinances that protect people and structures from drought, earthquake, flood, landslide, severe weather & wildfire
Goal 2: ***Build and support local capacity to enable the public to prepare for, respond to, and recover from disasters***	2.A	E	Develop emergency evacuation programs for neighborhoods in flood prone areas and wildland fire areas
	2.B	N/E	Annually review the City's Emergency Operations Plan and identify needed plan updates
	2.C	E	Conduct a minimum of one disaster exercise each year
	2.D		Establish a budget and identify funding sources for mitigation outreach
	2.E		Work with school districts to develop a public outreach campaign that teaches children how to avoid danger and behave during an emergency
	2.F	N/E	Utilize Business for Innovative Climate Change (BICEP) to increase awareness and knowledge of hazard mitigation and encourage businesses to develop/implement hazard mitigation actions
	2.G	N/E	Prepare, develop, & distribute appropriate public information about hazard mitigation programs and projects at Carson City-sponsored events and on the Carson City's/Fire Department's website
Goal 3: ***Reduce the possibility of damage and losses due to earthquakes***	3.A	N	Continue to enforce the International Building Code (IBC) provisions pertaining to grading and construction relative to seismic hazards. Update Carson City Codes to IBC 2012 when it is released.
	3.B	E	Implement an Unreinforced Masonry (URM) building program that determines the structural safety of critical infrastructure, and retrofit buildings, if necessary
	3.C	E	Identify hazard-prone structures through GIS modeling
	3.D	E	Acquire and install a foam fire suppression systems for the City Hall and Public Safety computer rooms to reduce damage to computer

Table 8-3: Mitigation Goals and Potential Actions

Goals	Action	New or Existing Buildings	Description
			equipment
Goal 4: ***Reduce the possibility of threat to life and losses due to epidemic***	4.A		Update Mass Illness Plan and integrate with local Hazard Mitigation Plan
	4.B		Create & implement a training and exercise program relative to epidemics
	4.C		Prepare by acquiring/storing needed medical equipment
Goal 5: ***Reduce the possibility of damage and losses due to floods***	5.A	N/E	Identify flood-prone areas using GIS. Identify those community areas that have recurring losses and conduct detailed analysis of the hydro graphic basins for planning, update storm water system plans, including erosion/sediment transport, and develop project proposals to improve storm water facilities and reduce flooding
	5.B	N	Adopt or update policies that discourage growth in flood-prone areas
	5.C	N/E	Review and update flood plans that would include coordination with adjacent counties, cities, and special districts supporting a regional approach to flood control
	5.D	E	Update and expand Sandbagging Plan
	5.E	E	Install new flood facilities to include, upgrade the existing storm drain system to current standards including culverts and channel improvements
	5.F	N	Upon completion of land transfers associated with the Lands Bill which includes land trading with Carson City, BLM, US Forestry, and Washoe Tribe; identify/implement projects within transferred lands and other areas within Carson City that need slope stabilization for flood and landslide
	5.G	E	Design and install facilities to capture debris/sediment within Eagle Valley
	5.H	E	Develop a Flood Management Plan for the New Empire Area and install a new flood control facility for the area
	5.I	E	Protect and enhance existing municipal water conveyance structures, storage, and treatment facilities to reduce impact from flood
	5.J	E	Install a storm water retention facility at Goni Canyon Creek & Channel D & construct a new storm drainage system further downstream along Goni Creek
	5.K	E	Design & install facilities to capture debris/sediment within Eagle Valley

Table 8-3: Mitigation Goals and Potential Actions

Goals	Action	New or Existing Buildings	Description
	5.L	E	Land acquisition of buildings with recurring loss or of land which could be used as catch basins for flood control projects.
Goal 6: ***Reduce the possibility of damage and losses due to Severe Weather***	6.A	E	In areas at risk to severe weather, retrofit public buildings to withstand snow loads and sever winds to prevent roof collapse/damage
	6.B	N/E	Develop a storm water management plan for snow melt
Goal 7: ***Reduce the possibility of damage and losses due to terrorist events***	7.A	N	Develop building codes for public buildings to mitigate impacts from terrorist events
	7.B	N/E	Develop a planning document to cover terrorist events and exercises
	7.C	E	Retrofit public buildings to increase safety and reduce the impact of terrorist events.
Goal 8: ***Reduce the possibility of damage and losses due to wildland fires***	8.A	N/E	Continue to identify areas and update and enforce the most current versions of the Urban-Wildland Interface Code
	8.B*	N/E	Update the Carson City Fire Code and model weed abatement and fuel modification ordinances
	8.C	E	Continue to conduct current fuel management programs (i.e., weed abatement programs) and investigate and apply new and emerging fuel management techniques
	8.D	E	Develop a public outreach campaign of the extreme wildland fire dangers and steps that can be taken to reduce these dangers
	8.E	E	Develop partnerships for a community based vegetation management program including chipping programs
	8.F	N/E	Utilize GIS and the internet as information tools
	8.G	E	Establish a continuing wildland fire technical working group
	8.H	N/E	Protect municipal water recharge zones from wildfires and flooding by stabilizing upper watershed slopes
	8.I	E	Retrofit buildings (public and private) to reduce the risk of wild fire in Lakeview, Pinyon Hills, Kings Canyon, Voltaire Canyon and Timberlake Canyon.

Table 8-3: Mitigation Goals and Potential Actions

Goals	Action	New or Existing Buildings	Description
Goal 9 ***Reduce the possibility of damage and losses due to drought***	9.A	N/E	Watershed stabilization and recharge program to maximize the use of surface sources when available and preserving the groundwater sources for system peaking needs and times of drought.
	9.B	N/E	Encourage public participation in drought strategies through public information programs on water conservation and drought resistant landscaping and through building code ordinances.
Goal 10: ***Reduce the possibility of damage and losses due to landslide***	10.A	N/E	Evaluate natural slopes to determine if there are slope stabilization treatments that would be appropriate to prevent landslides.
	10.B	N/E	Conduct slope stabilization projects to prevent landslides.
Goal 11: ***Reduce the possibility of damage and losses due to hazardous materials***	11.A	N/E	Review building codes and zoning ordinances to reduce public health risks from hazardous materials releases.

Reduce Hazard Effect on N = New Buildings, E = Existing Buildings, N/E = New and Existing Buildings

8.3 NATIONAL FLOOD INSURANCE PROGRAM (NFIP) COMPLIANCE

DMA 2000 Requirements: Mitigation Strategy – National Flood Insurance Program

National Flood Insurance Program (NFIP) Compliance)
Requirement §201.6(c)(3)(ii): [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program (NFIP), and continued compliance with NFIP requirements, as appropriate.
Element
- Does the updated plan document how the planning team reviewed and analyzed this section of the plan and whether this section was revised as part of the update process?
- Does the new or updated plan describe the jurisdiction(s) participation in the NFIP?)
- Does the mitigation strategy identify, analyze and prioritize actions related to continued compliance with the NFIP?

Source: FEMA, March 2008.

Meeting Number Three Agenda

Carson City Hazard Mitigation Plan Update

9:00 to 11:00 am, Wednesday, July 22, 2015
Carson City Fire Department
777 South Stewart Street, Carson City, NV 89701

AGENDA

Meeting Three

• ***Welcome & Introduction***	*Stacey Belt*
• ***Hazard Profile Review***	*Stephanie Hicks*
○ *Earthquake*	*Craig DePolo*
○ *Landslide*	*Craig DePolo*
○ *Seiche*	*Craig DePolo*
○ *Volcanic Activity*	*Craig DePolo*
○ *Hazardous Materials Events*	*Tom Tarulli*
○ *Terrorism (Acts of Violence)*	*Jim Walker*
• ***Review Mitigation measures for Hazards*** *(Refer to Table 8-3: Mitigation Goals and Potential Actions)*	*Stephanie Hicks*
• ***Review of Sections 1 – 5*** *(Latest edits from June 10, 2015 meeting)*	*Tammy Kinsley*
• ***Vulnerability Analysis & GIS Mapping***	*Stephanie Hicks & Eric Schmidt*
• ***Public Outreach and Questionnaire***	*Tammy Kinsley*
• ***What are the next Steps?***	*Stephanie Hicks*
• ***Announcement of Future Meetings:***	*Tammy Kinsley*

Future meetings are scheduled tentatively as follows:

August 26, 2015 – Planning Committee Meeting

October 7, 2015 – Planning Committee Meeting

October 2015 – Public Workshop

Meeting Number Three Sign-in-Sheets

Hazard Mitigation Planning Committee Meeting
July 22, 2015

NAME	AGENCY	PHONE	E-MAIL
Robb Fellows	CCPW	283-7370	RFellows@carson.org
Robert Schneihans	CCFD	283-7209	RSchneihans@carson.org
Karen Johnson	NDEM	687-0373	kijohnson@dps.state.nv.us
Connor Long	NDEM	775-687-0307	clong@dps.state.nv.us
BRIAN CROWE	WNC	445-3327	CROWEB@WNC.EDU
Mark Cyr	The Salvation Army	887 9120	mark.cyr@usw.salvationarmy.org
Ken Sandage	CCSO	cell 720-0726	KSandage@carson.org
Shawn Keating	CC building Div	887-2310	Skeating@carson.org
Angela Barosso	CCHHS	283-7217	abarosso@carson.org
Jim Walker	NDOT	888-7862	jwalker2@dot.state.nv.us
Lee Plemel	CC COM. DEV.	283-7075	LPLEMEL@CARSON.ORG
Dave Ruben	CCFD	283-7153	druben@carson.org
TAMMY KINSLEY	ROANDERSON ENG	215-5013	tkinsley@roanderson.com
Stephanie Hicks	RO Anderson Eng	215-5042	shicks@roanderson.com
Kris Pradere	CCFD	283-7160	KPRADERE@CARSON.ORG
Lisa Christensen	Washoe Tribe	265-8618	
ERIC SCHMIDT	Douglas Co GIS	782-9045	eschmidt@douglasnv.us

Meeting Number Three Handouts

MITIGATION QUESTIONNAIRE

A city partnership has recently been formed to address natural and man-made hazards that may occur in Carson City. A planning committee has been selected to oversee this process. In order to identify and plan for future natural and man-made disasters, we need assistance from the residents of Carson City. This questionnaire is designed to gauge the level of knowledge local citizens have about natural and man-made disaster issues and areas vulnerable to any type of natural and man-made disasters. The information you provide will help coordinate activities to reduce the risk of injury or property damage in the future.

This questionnaire consists of 11 questions and will take approximately 5 minutes to complete.

GENERAL HOUSEHOLD INFORMATION

The following requested demographic information will aid the planning committee in determining the hazard mitigation needs of our community. For example, indicating whether you own a house or are a tenant will help determine the needs for both renters and homeowners. The answers provided in this action will be treated as confidential and will be used solely for the preparation of this plan and will not be provided to any other group or interest.

1. Please indicate your zip code: ____________________
2. Please check all that apply.

Do you own a home in Carson City? ☐ Yes ☐ No

If you do not own a home, do you rent a residence in Carson City? ☐ Yes ☐ No

Do you own a business located in Carson City? ☐ Yes ☐ No

Do you own a business outside of Carson City, but operate your business in the City? ☐ Yes ☐ No

Do you own or operate a vehicle in Carson City? ☐ Yes ☐ No

NATURAL AND MAN-MADE HAZARD INFORMATION

The following requested demographic information will aid the planning committee in determining needs and desires for educating and preparing our community for natural and man-made disasters. The answers provided in this action will be treated as confidential and will be used solely for the preparation of this plan and will not be provided to any other group or interest.

3. In the past 10 years which of the following types of natural and man-made hazard events have you or someone in your household experienced within Carson City, and indicate your level of concern for the hazards impact on Carson City? (Please check all that apply.)

Natural and Man-Made Hazards	Have Experienced Y/N	Low Concern	Moderate Concern	High Concern
Avalanche				
Drought				
Earthquake				
Floods				
Hazardous Materials Events				
Infectious Disease				
Landslide				
Seiche				
Acts of Violence				
Utility Loss				

Page 1

Meeting Number Three Handouts

MITIGATION QUESTIONNAIRE

Volcanic Activity				
Wildland Fire				

4. Prior to receiving this questionnaire, were you aware of your city's Hazard Mitigation Plan (HMP)?
   ☐ Yes ☐ No
5. Prior to receiving this questionnaire, were you aware that the Federal Emergency Management Agency (FEMA) requires your city to update the HMP every five years in order for your city to be eligible for federal pre- and post-disaster hazard mitigation funds? Yes ☐ No ☐

PREPAREDNESS ACTIVITIES IN YOUR HOUSEHOLD

Households can do many things to prepare for a natural and man-made disaster or emergency. What you have on hand or are trained to do when a disaster strikes can make a big difference in your comfort and safety in the hours and days following a natural and man-made disaster or emergency. Basic services, such as electricity, gas, water, and telephones, may be cut off, or you may have to evacuate at a moment's notice. The following questions focus on your household's preparedness for a disaster event.

6. The following questions focus on your household's preparedness for a disaster event.

In your household, have you or someone in your household:	Have Experienced	Plan To Do	Not Done	Unable To Do
Attended meetings or received written information on natural and man-made disasters or emergency preparedness?				
Talked with members of your household about what to do in case of natural and man-made disasters or emergency?				
Developed a "Household/Family Emergency Plan" in order to decide what everyone would do in the event of a disaster?				
Prepared a "Disaster Supply Kit" (stored extra food, water, batteries, or other emergency supplies)?				
In the last year, has anyone in your household been trained in First Aid, Cardio-Pulmonary Resuscitation (CPR) or AED?				

7. What steps, if any, have you or someone in your household taken to prepare for natural and man-made disasters?

☐ Food
☐ Water
☐ Flashlight(s)
☐ Batteries
☐ Battery-Powered Radio
☐ Make a Fire Escape Plan
☐ Fire Extinguisher
☐ Prepared a Disaster Supply Kit
☐ Medical Supplies (First Aid Kit)
☐ Received First Aid/CPR/AED Training
☐ Developed a Reconnection Plan (Where to Go and Who to Call)
☐ Discussed Utility Shutoffs
☐ Smoke Detector on Each Level of the Home
☐ Other (please specify): ____________

8. Have you ever received information about how to make your household and home safer from natural and man-made disasters?
   ☐ Yes ☐ No (IF "NO" Skip to Question 9)

Page 2

Meeting Number Three Handouts

MITIGATION QUESTIONNAIRE

If "YES", how recently?

- ☐ Within the Last 6 Months
- ☐ Between 6 to 12 Months
- ☐ Between 1 to 2 Years
- ☐ Between 2 to 5 Years
- ☐ 5 Years or More

9. From whom did you receive information about how to make your household and home safer from natural and man-made disasters? (Please check all that apply.)

- ☐ News Media
- ☐ University or Research Institution
- ☐ Insurance Agent or Company
- ☐ Utility Company
- ☐ American Red Cross
- ☐ Emergency Manager/Fire Department
- ☐ Health District
- ☐ Other Government Agency
- ☐ Not Sure
- ☐ Other: ______________

10. Who would you most trust to provide you with information about how to make your household and home safer from natural and man-made disasters? (Please check all that apply.)

- ☐ News Media
- ☐ University or Research Institution
- ☐ Insurance Agent or Company
- ☐ Utility Company
- ☐ American Red Cross
- ☐ Emergency Manager/Fire Department
- ☐ Health District
- ☐ Other Government Agency
- ☐ Not Sure
- ☐ Other: ______________

11. What is the most effective way for you to receive information about how to make your household and home safer from natural and man-made disasters? (Please check all that apply.)

Newspapers:
- ☐ Newspaper Stories
- ☐ Newspaper Ads

Television:
- ☐ Television Stories
- ☐ Television Ads

Radio:
- ☐ Radio Stories
- ☐ Radio Ads

Other Methods:
- ☐ Books
- ☐ Postal Mail
- ☐ Email

Other Methods (cont.):
- ☐ Magazines
- ☐ Internet
- ☐ Outdoor Advertisements (Billboards, etc.)
- ☐ Fact Sheet/Brochure
- ☐ School
- ☐ University or Research Institution
- ☐ Fire Department/Rescue
- ☐ Emergency Manager
- ☐ Chamber of Commerce
- ☐ Public Workshops/Meetings
- ☐ Other: ______________

Other Comments:

Please return this questionnaire by mail or drop off to the Carson City Fire Dept.
777 South Stewart St., Carson City, NV 89701 by October 31, 2015. ***Thank you***

Page 3

Meeting Number Four Agenda

Carson City Hazard Mitigation Plan Update

9:00 to 11:00am, Wednesday, August 26, 2015
Carson City Fire Department
777 South Stewart Street, Carson City, NV 89701

AGENDA

Meeting Four

• ***Welcome & Introduction***	*Stacey Belt*
• ***Hazard Profile Review***	*Stephanie Hicks*
○ *Earthquake*	*Craig DePolo*
○ *Landslide*	*Craig DePolo*
○ *Seiche*	*Craig DePolo*
○ *Volcanic Activity*	*Craig DePolo*
• ***Review of Latest edits for Section Five Hazards***	*Tammy Kinsley*
• ***Review of Section 7: Capability Assessment***	
• ***Review of Section 8: Mitigation Strategies***	
• ***Review of Section 9: Plan Maintenance***	*Tammy Kinsley*
• ***Vulnerability Analysis & GIS Mapping***	*Stephanie Hicks & Matthew Richardson*
• ***Public Outreach and Questionnaire***	*Tammy Kinsley*
• ***What are the next Steps?***	*Stephanie Hicks*
• ***Announcement of Future Meetings and Workshop***	*Tammy Kinsley*

Future meetings are scheduled tentatively as follows:

October 7, 2015 – Planning Committee Meeting

October 2015 – Public Workshop

Meeting Number Four Sign-in-Sheets

Carson City Planning Committee
August 26, 2015
Hazard Mitigation Plan Update – Meeting Four

Name	Firm/Agency	Phone Number	Email
Ed James	CWSD	887-7456	edjames@cwsd.org
Robb Fellows	CCPW	283-7370	RFellows@carson.org
Craig dePolo	NBMG	322-7485	eq_dude@sbcglobal.net
Matt Richardson	Douglas Co - GIS		mrichardson@douglasnv.us
Eric Schmidt	Douglas Co GIS	775-782-9894	eschmidt@douglasnv.us
Stacey Belt	CCEM	283-7218	sbelt@carson.org
Mark Cyr	The Salvation Army	721-6900	mark.cyr@usw.salvationarmy.org
Dave Ruben	CCFD	283-7153	druben@carson.org
Jim Freed	CTH	445-8399	james.freed@carsontahoe.org
Phillip Harrison	Taiyo America	775-885-9959 x122	philh@taiyo-america.com
Karen Johnson	NDEM	687-0373	kjohnson@dps.state.nv.us

Carson City Planning Committee
August 26, 2015
Hazard Mitigation Plan Update – Meeting Four

Name	Firm/Agency	Phone Number	Email
Lisa Christensen	Washoe Tribe	775 790 7354	lisa.christensen@washoetribe.us
Jeff Melvin	Carson S.O.	283-7840	jmelvin@carson.org
Shawn Keating	Building Division	887-2310	skeating@carson.org
Jim Walker	NDOT	888-7862	jwalker2@dot.state.nv.us
Tom Tarulli	CCFD	887-2210	ttarulli@carson.org
Chris Smallcomb	NOAA NWS Reno	673-8100 x223	chris.smallcomb@noaa.gov
Kris Pradere	CCFD	887-2210	KPRADERE@CARSON.ORG
Stephanie Hicks	ROAnderson	215-5042	shicks@roanderson.com
TAMMY KINSLEY	ROANDERSON ENG.	215-5013	tkinsley@roanderson.com
Robert Schneihans	CCFD	283-7209	RSchneihans@carson.org

Meeting Number Four Handouts

At meeting four the committee was provided via email and hard copy the consolidated sections one through five, which were complete with edits from the last meeting of July 22, 2015. Sections seven, eight and nine were also provided via email and at the meeting to review per the edits of the last meeting.

Public Workshop

Hazard Mitigation Plan Review
Carson City Emergency Management Open House

October 1st, 2015

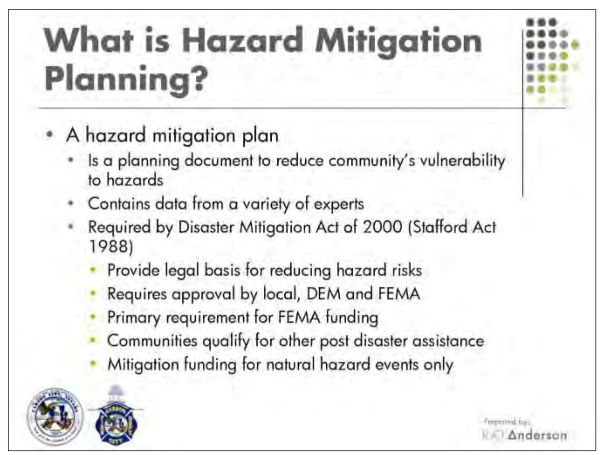
4pm to 7pm Speakers Begin at 5pm

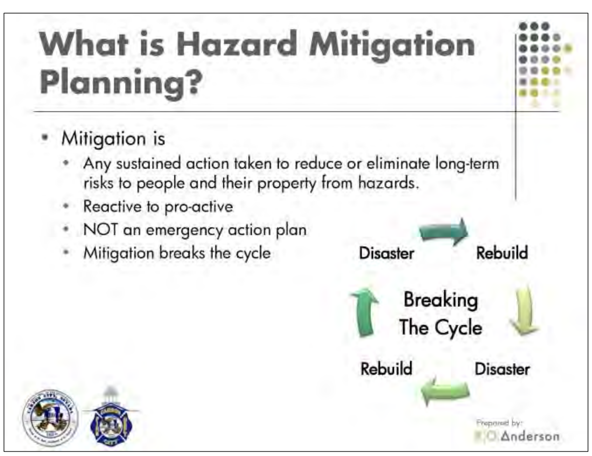
Please join us on the **100th** anniversary of the largest Earthquake ever recorded in Nevada History and hear Craig DePolo tell us about the possible threat facing Carson City. Experts will also talk briefly about floods and fires. Carson City Emergency Management and the Carson City Fire Department are hosting an Open House to review City Hazard Mitigation planning efforts. We're working with local experts and FEMA to update our current plan, but we need your input!

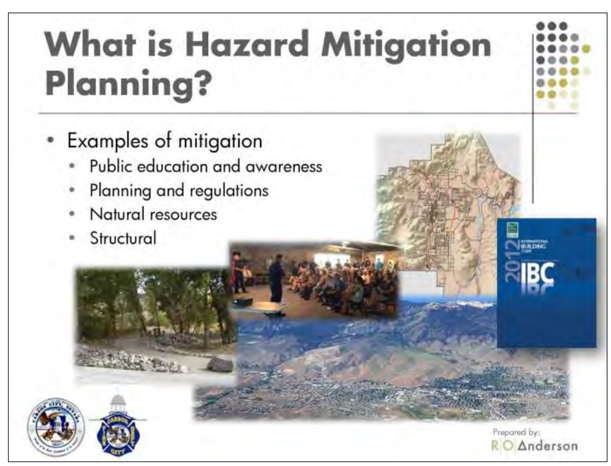
WE WANT YOUR FEEDBACK

Carson City Fire Department
777 S. Stewart St.
Carson City, NV 89701
775-887-2210

Public Workshop Presentation







What is Hazard Mitigation Planning?

- Mitigation is necessary because
  - Disasters cost too much
- In Nevada
  - Over $140 billion dollars in the last 30 years
  - Over $19 billion dollars issued between 2000 and 2010
  - $6 billion dollars for flood damages alone
  - Costs continue to rise
  - State and Federal funding insufficient
  - But every $1 spent in mitigation = $4 saved in future damages


Prepared by: RO Anderson

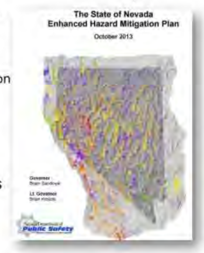
What is Hazard Mitigation Planning?

- Other reasons mitigation is necessary
  - Increase community pride
  - Improve quality of life
  - Prevent damages
  - Saves lives


Prepared by: RO Anderson

What is Hazard Mitigation Planning?

- Who needs a plan?
  - States must have a plan for jurisdictions to qualify for federal funding
  - Standard vs. enhanced plans
    - State of Nevada Enhanced Hazard Mitigation Plan
    - 15% vs. 20% available mitigation funding
  - Covers unincorporated areas within the State
  - Provides hazard information for local plans
  - Update, readopt and reapprove every 5 years


The State of Nevada Enhanced Hazard Mitigation Plan
October 2013

Prepared by: RO Anderson

What is the Planning Process?

Prepared by: RO Anderson

What is the Planning Process?

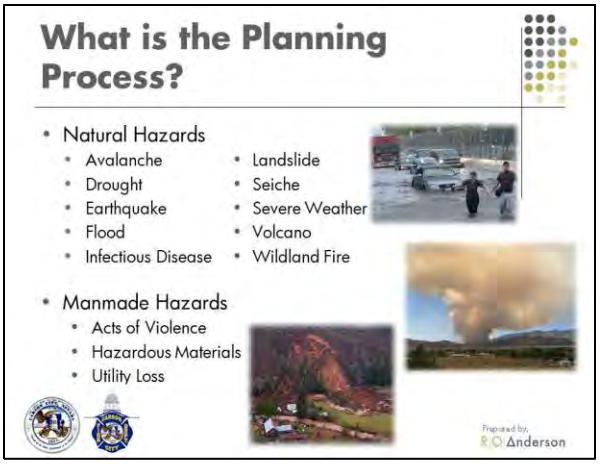
- Partnering agencies
  - Carson City Fire Department
  - Emergency Management
  - Carson City
    - Public Works
    - Planning
    - Health & Human Services
  - Carson Water Subconservancy
  - Carson City Sheriffs
  - NDOT
  - Washoe Tribe of Nevada and California

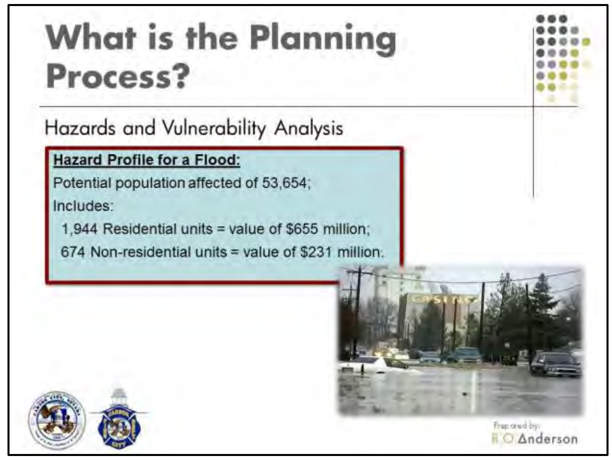
Prepared by: RO Anderson

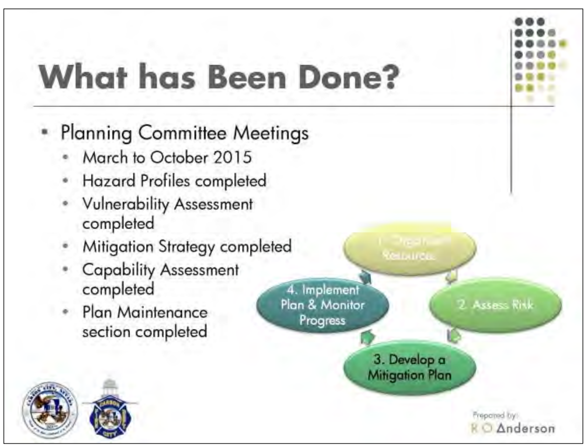
What is the Planning Process?

- Other stakeholders
  - Federal agencies
  - State agencies
  - Private agencies
  - Non-profits
  - Public

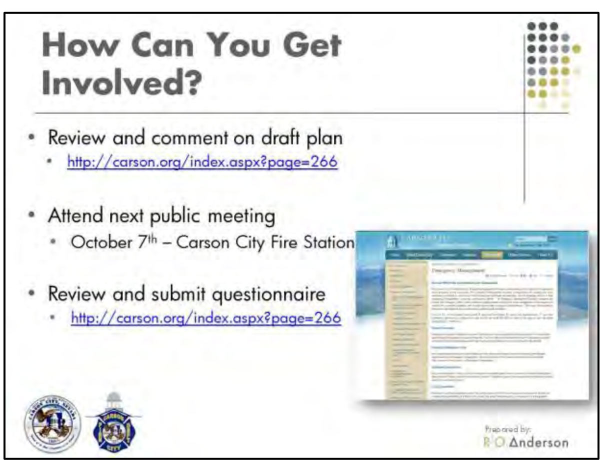
Prepared by: RO Anderson

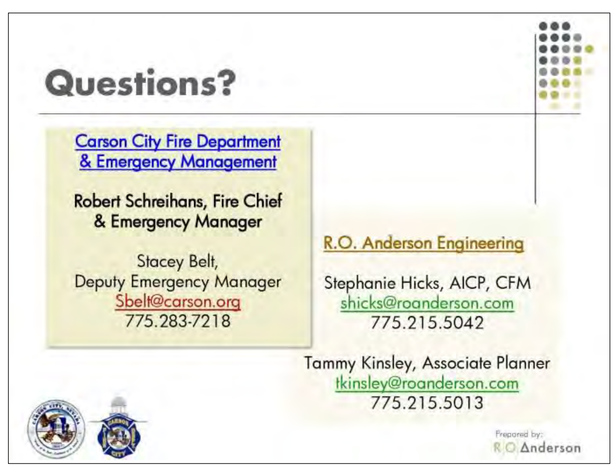

What is the Planning Process?
• Natural Hazards
• Avalanche
• Drought
• Earthquake
• Flood
• Infectious Disease
• Landslide
• Seiche
• Severe Weather
• Volcano
• Wildland Fire
• Manmade Hazards
• Acts of Violence
• Hazardous Materials
• Utility Loss
Prepared by:
R O Anderson


What is the Planning Process?
Hazards and Vulnerability Analysis
Hazard Profile for a Flood:
Potential population affected of 53,654;
Includes:
1,944 Residential units = value of $655 million;
674 Non-residential units = value of $231 million.
Prepared by:
R O Anderson


What has Been Done?
• Planning Committee Meetings
• March to October 2015
• Hazard Profiles completed
• Vulnerability Assessment completed
• Mitigation Strategy completed
• Capability Assessment completed
• Plan Maintenance section completed
2. Assess Risk
3. Develop a Mitigation Plan
4. Implement Plan & Monitor Progress
Prepared by:
R O Anderson


What is Next?
• Finalize Draft Document
• Submit for Approval
DEM Review Final
FEMA Review #1
Local Final Plan Adoption
FEMA Approval
Prepared by:
R O Anderson


How Can You Get Involved?
• Review and comment on draft plan
• http://carson.org/index.aspx?page=266
• Attend next public meeting
• October 7th – Carson City Fire Station
• Review and submit questionnaire
• http://carson.org/index.aspx?page=266
Prepared by:
R O Anderson


Questions?
Carson City Fire Department & Emergency Management
Robert Schreihans, Fire Chief & Emergency Manager
Stacey Belt, Deputy Emergency Manager
Sbelt@carson.org
775.283.7218
R.O. Anderson Engineering
Stephanie Hicks, AICP, CFM
shicks@roanderson.com
775.215.5042
Tammy Kinsley, Associate Planner
tkinsley@roanderson.com
775.215.5013
Prepared by:
R O Anderson

Public Workshop

Sign-in-Sheet

Carson City
Hazard Mitigation Plan Update – Workshop
October 1, 2015

Name	Firm/Agency	Phone Number	Email
Jim Walker	NDOT	888-7862	jwalker2@dot.state.nv.us
Jared Walker	Boy Scouts	720-3453	Jared Riposte @gmail.com
Dave Spencer	CCSO SAR	671-5967	dlspencer2@gmail.com
Stephanie Hicks	ROAnderson	215-5042	shicks@roanderson.com
Tammy J. Kinsley	ROAnderson	215-5013	tkinsley@roanderson.com
Rodd Rummel	CCFD		rrummel@carson.org
Maurice White	Self	297-6484	fishingramp@gmail.com
Lyle Osterloo	self	615-796-9669	lyle.osterloo@inbox.com
BOB HARDESTY	CCSO SAR	775-790-1662	robertdhardesty@yahoo.com
PK ONeill	NV Legislature	775 741-8309	pk.oneill@csn.state.nv.us
Robert Schreihans	CCFD	775 887 2210	rschreihans@carson.org

Carson City
Hazard Mitigation Plan Update – Workshop
October 1, 2015

Name	Firm/Agency	Phone Number	Email
Stacey Bell	CCEM	775 887 2210	sbell@carson.org
Nicki Aaker	CCHHS	775-887-2190	naaker@carson.org
Shawn Keating	Carson City Building	775-887-2310	skeating@carson.org
Todd McMillen		509-868-3170	todd.mac@hotmail.com
Robert Morales	Eagle Valley Children's Home	400 7228	rmorales@evch.net
Courtney Warner	Senior Center	775 883 0703	cwarner@carson.org
Jerry Lockhart	Retired		
F. Forsgren	NDEP	775-841-6513	frank.forsgren@gmail.com
Mark Cyr	The Salvation Army	887 9120	mark.cyr@usw.salvationarmy.org
Leslie Cyr	The Salvation Army	887-9120	leslie.cyr@usw.salvationarmy.org
Dave Ruben	Fire	283-7153	druben@carson.org
JOHN Kinsley		813-7350	JKinsley28@yahoo.

Meeting Number Five Agenda
October 7, 2015

Carson City Hazard Mitigation Plan Update

9:00 to 11:00am, Wednesday, October 7, 2015
Carson City Fire Department
777 South Stewart Street
Carson City, NV 89706

AGENDA
Meeting Five

- ***Welcome & Introduction*** — *Stacey Belt*
- ***Discuss events of October 1st Workshop*** — *Stephanie Hicks and Stacey Belt*
- **STAPLE+ E** — *Tammy Kinsley*
- ***Vulnerability Analysis & GIS Mapping*** — *Eric Schmidt*
- ***Review of Draft Plan*** *(as is complete to date)* — *Stephanie Hicks*
- ***What are the next Steps?*** — *Tammy Kinsley*

- ***Oct 21st final draft to committee for final comments;***
- ***Final comments due to us on Nov 4th;***
- ***Submit Plan to the State (DEM) for review on Nov 18th ;***
- ***Submit Plan back to DEM by Dec 2nd to submit to FEMA.***

Meeting Number Five Sign-in-Sheets

Carson City Planning Committee
October 7, 2015
Hazard Mitigation Plan Update – Meeting Five

Name	Firm/Agency	Phone Number	Email
Matt Richardson	GIS	782-9089	mrichardson@douglasnv.us
Eric Schmidt	Douglas Co GIS	782-9894	eschmidt@douglasnv.us
Stacey Bell	CCEM	283-7218	sbell@carson.org
Nicki Aaker	CCHHS	283-7704	naaker@carson.org
Angela Barosso	CCHHS	283-7217	abarosso@carson.org
Eric Von Schimmelmann	CCIT	283-7007	evonschimmelmann@carson.org
Jim Walker	NDOT	888-7862	jwalker2@dot.state.nv.us
Craig dePolo	NBMG	322-7485	eq-dude@sbcglobal.net
Tim Rowe	CCAA	841-2255	exp-mgr@att.net
Tom Tarulli	CCFD	887-2210	ttarulli@carson.org
Mark Cyr	The Salvation Army	721 6900	mark.cyr@usw.salvationarmy.org

Carson City Planning Committee
October 7, 2015
Hazard Mitigation Plan Update – Meeting Five

Name	Firm/Agency	Phone Number	Email
Lisa Christensen	Washoe Tribe	775-790-7354	lisachristensen@washoetribe.us
Stephanie Hicks	RO Anderson	775-215-5042	shicks@roanderson.com
Tammy Kinsley	RO Anderson	775-215-5013	tkinsley@roanderson.com

Meeting Number Five Handouts

Below is the STAPLE+E evaluation criteria developed by FEMA. Each of the potential actions will be scored by using rankings of 1 for the lowest and 5 for the highest priority, acceptance, feasibility, etc.

Please insert your numeric ranking in the separate STAPLE+E form and calculate the priority totals.

Table 8-3: STAPLE+E Evaluation Criteria for Mitigation Actions

Evaluation Category	Discussion "It is important to consider..."	Considerations
Social	The public Support for the overall mitigation strategy and specific mitigation actions	Community acceptance; adversely affects population
Technical	If the mitigation action is technically feasible and if it is the whole or partial solution	Technical feasibility; Long-term solutions; Secondary impacts
Administrative	If the community has the personnel and administrative capabilities necessary to implement the action or whether outside help will be necessary	Staffing: Funding allocation; Maintenance/operations
Political	What the community and its members feel about issues related to the environment, economic development, safety, and emergency management	Political support; Local champion; Public support
Legal	Whether the community has the legal authority to implement the action, or whether the community must pass new regulations	Local, State, and Federal authority; Potential legal challenge
Economic	If the action can be funded with current or future internal and external sources, if the costs seem reasonable for the size of the project, and if enough information is available to complete a FEMA Benefit Cost Analysis	Benefit/cost of action; Contributes to other economic goals; Outside funding required; FEMA Benefit Cost Analysis
Environmental	The impact on the environment because of public desire for a sustainable and environmentally healthy community	Effect on local flora and fauna; Consistent with community environmental goals; Consistent with local, State and Federal laws

STAPLE + E Evaluation Table

	S		T			A			P			L			E				E					PT
	(Social)		(Technical)			(Administrative)			(Political)			(Legal)			(Economic)				(Environmental)					
Considerations → Mitigation Actions ↓	Community Acceptance	Effect on Segment of Population	Technical Feasibility	Long-term Solution	Secondary Impacts	Staffing	Funding Allocated	Maintenance/ Operations	Political Support	Local Champion	Public Support	State Authority	Existing Local Authority	Potential Legal Challenge	Benefit of Action	Cost of Action	Contributes to Economic Goals	Outside Funding Required	Effect on Land/ Water	Effect on Endangered Species	Effect on HAZMAT/Waste Sites	Consistent with Native Habitat	Consistent with Local / Federal Laws	Priority Total
1.A Update Master Plan to be consistent with the hazard area maps																								
1.B Identify & educate Carson City personnel on high hazard areas																								
1.C Coordinate existing GIS capabilities to identify hazards through the City																								
1.D Develop the data sets that are necessary to test hazard scenarios and mitigation tools, including HAZUS MH																								
1.E Utilize the Internet as a communication tool, as well as an education tool																								
1.F Develop city building codes and ordinances that protect people and structures																								
1.G Continue to update the																								

STAPLE + E Evaluation Table

	S		T			A			P			L			E				E					PT
	(Social)		(Technical)			(Administrative)			(Political)			(Legal)			(Economic)				(Environmental)					
Considerations → Mitigation Actions ↓	Community Acceptance	Effect on Segment of Population	Technical Feasibility	Long-term Solution	Secondary Impacts	Staffing	Funding Allocated	Maintenance/ Operations	Political Support	Local Champion	Public Support	State Authority	Existing Local Authority	Potential Legal Challenge	Benefit of Action	Cost of Action	Contributes to Economic Goals	Outside Funding Required	Effect on Land/ Water	Effect on Endangered Species	Effect on HAZMAT/Waste Sites	Consistent with Native Habitat	Consistent with Local / Federal Laws	Priority Total
Community Wildfire Plan.																								
2.A Develop emergency evacuation programs for neighborhoods in flood prone areas and wildland fire areas																								
2.B Annually review the City's Emergency Operations Plan																								
2.C Conduct a minimum of one disaster exercise each year																								
2.D Establish a budget and identify funding sources for mitigation outreach																								
2.E Work with school districts to develop a public outreach campaign																								
2.F Utilize Business for Innovative Climate Change (BICEP) to increase awareness																								
2.G Prepare, develop, & distribute																								

STAPLE + E Evaluation Table

	S		T			A			P			L			E				E					PT
	(Social)		(Technical)			(Administrative)			(Political)			(Legal)			(Economic)				(Environmental)					
Considerations → Mitigation Actions ↓	Community Acceptance	Effect on Segment of Population	Technical Feasibility	Long-term Solution	Secondary Impacts	Staffing	Funding Allocated	Maintenance/ Operations	Political Support	Local Champion	Public Support	State Authority	Existing Local Authority	Potential Legal Challenge	Benefit of Action	Cost of Action	Contributes to Economic Goals	Outside Funding Required	Effect on Land/ Water	Effect on Endangered Species	Effect on HAZMAT/Waste Sites	Consistent with Native Habitat	Consistent with Local / Federal Laws	Priority Total
appropriate public information about hazard mitigation programs																								
3.A Continue to enforce the International Building Codes																								
3.B Completed the Unreinforced Masonry (URM) building program																								
3.C Identify hazard-prone structures through GIS modeling																								
3.D Acquire and install clean agent systems for the City Hall and Public Safety computer rooms to reduce damage																								
4.A Update Mass Illness Plan and integrate with local Hazard Mitigation Plan																								
4.B Continuation of training and exercise program relative to epidemics																								

STAPLE + E Evaluation Table

	S		T			A			P			L			E				E					PT
	(Social)		(Technical)			(Administrative)			(Political)			(Legal)			(Economic)				(Environmental)					
Considerations → Mitigation Actions ↓	Community Acceptance	Effect on Segment of Population	Technical Feasibility	Long-term Solution	Secondary Impacts	Staffing	Funding Allocated	Maintenance/ Operations	Political Support	Local Champion	Public Support	State Authority	Existing Local Authority	Potential Legal Challenge	Benefit of Action	Cost of Action	Contributes to Economic Goals	Outside Funding Required	Effect on Land/ Water	Effect on Endangered Species	Effect on HAZMAT/Waste Sites	Consistent with Native Habitat	Consistent with Local / Federal Laws	Priority Total
4.C Prepare by acquiring/storing needed medical equipment.																								
4.D Maintain a public program for information and education																								
5.A Identify flood-prone areas using GIS.																								
5.B Continue to update policies that discourage growth in flood-prone areas																								
5.C Review and update flood plans																								
5.D Update and expand Sandbagging Plan																								
5.E Install new flood facilities; upgrade the existing																								
5.Fidentify/implement projects within transferred lands																								
5.G Design and install facilities to capture debris/sediment within Eagle Valley																								
5.H Develop a																								

STAPLE + E Evaluation Table

	S		T			A			P			L			E				E					PT
	(Social)		(Technical)			(Administrative)			(Political)			(Legal)			(Economic)				(Environmental)					
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Flood Management Plan for the New Empire Area																								
5.I Protect and enhance existing municipal water conveyance structures																								
5.J Install a storm water retention facility at Goni Canyon Creek & Channel D																								
5.K Design & install facilities to capture debris/sediment within Eagle Valley																								
5.L Installation of back-up generators for critical infrastructure and facilities																								
5.M Land acquisition of buildings with recurring loss																								
6.A retrofit public buildings to withstand snow loads and sever winds																								
6.B Continue the storm water																								

STAPLE + E Evaluation Table

	S		T			A			P			L			E				E					PT
	(Social)		(Technical)			(Administrative)			(Political)			(Legal)			(Economic)				(Environmental)					
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management plan for snow melt																								
7.A Develop Standards for public buildings to mitigate impacts from terrorist events																								
7.B Develop planning procedures to cover terrorist events and exercises.																								
7.C Retrofit public and high risk buildings																								
8.A Continue to identify areas and update and enforce the most current versions of the Urban-Wildland Interface Code.																								
8.B Update the Carson City Fire Code and model weed abatement and fuel modification ordinances																								
8.C Continue to conduct current fuel management programs																								

STAPLE + E Evaluation Table

	S		T			A			P			L			E				E					PT
	(Social)		(Technical)			(Administrative)			(Political)			(Legal)			(Economic)				(Environmental)					
Considerations ⇨ Mitigation Actions ⇩	Community Acceptance	Effect on Segment of Population	Technical Feasibility	Long-term Solution	Secondary Impacts	Staffing	Funding Allocated	Maintenance/ Operations	Political Support	Local Champion	Public Support	State Authority	Existing Local Authority	Potential Legal Challenge	Benefit of Action	Cost of Action	Contributes to Economic Goals	Outside Funding Required	Effect on Land/ Water	Effect on Endangered Species	Effect on HAZMAT/Waste Sites	Consistent with Native Habitat	Consistent with Local / Federal Laws	Priority Total
8.D Develop a public outreach campaign of the extreme wildland fire dangers																								
8.E Develop partnerships for a community based vegetation management program including chipping programs																								
8.F Utilize GIS and the internet as information tools																								
8.G Establish a continuing wildland fire technical working group																								
8.H Protect municipal water recharge zones from wildfires and flooding																								
8.I Retrofit buildings (public and private) to reduce the risk of wild fire																								
9.A Watershed stabilization and recharge program																								
9.B Encourage public participation																								

STAPLE + E Evaluation Table

	S		T			A			P			L			E				E					PT
	(Social)		(Technical)			(Administrative)			(Political)			(Legal)			(Economic)				(Environmental)					
Considerations ⇨ Mitigation Actions ⇩	Community Acceptance	Effect on Segment of Population	Technical Feasibility	Long-term Solution	Secondary Impacts	Staffing	Funding Allocated	Maintenance/ Operations	Political Support	Local Champion	Public Support	State Authority	Existing Local Authority	Potential Legal Challenge	Benefit of Action	Cost of Action	Contributes to Economic Goals	Outside Funding Required	Effect on Land/ Water	Effect on Endangered Species	Effect on HAZMAT/Waste Sites	Consistent with Native Habitat	Consistent with Local / Federal Laws	Priority Total
in drought strategies through public information programs																								
10. Evaluate natural slopes to determine if would be appropriate to prevent landslides.																								
10.B Conduct slope stabilization projects to prevent landslides																								
11. Review building codes and zoning ordinances to reduce public health risks from hazardous materials releases																								

Appendix F

Plan Maintenance Documents

Sample Press Release for

Annual Maintenance Meeting

Carson City, Nevada is meeting to review and maintain its Hazard Mitigation Plan to assess risks posed by natural and human caused disasters and identify ways to reduce those risks. This plan is required under the Federal Disaster Mitigation Act of 2000 as a prerequisite for receiving certain forms of Federal disaster assistance.
The plan can be found on the City's website at website address.

Public comments and participation are welcomed. For additional information or to request to participate, or to submit comments, please contact Stacey Belt, Carson City Emergency Management, at (775) 283-7209 or email address:

Annual Review Questionnaire

PLAN SECTION	QUESTIONS	YES	NO	COMMENTS
PLANNING PROCESS	Are there internal or external organizations and agencies that have been invaluable to the planning process or to mitigation action?			
	Are there procedures (e.g., meeting announcement, plan updates) that can be done more efficiently?			
	Has the Steering committee undertaken any public outreach activities regarding the HMP or implementation of mitigation actions?			
HAZARD PROFILES	Has a natural and/or human-caused disaster occurred in this reporting period?			
	Are there natural and/or human-caused hazards that have not bee addressed in this HMP and should be?			
	Are additional maps or new hazards studies available? If so, what have they revealed?			
VULNERABILITY ANALYSIS	Do any new critical facilities or infrastructure need to be added to the asset lists?			
	Have there been changes in development patterns that could influence the effects of hazards or create additional risks?			
MITIGATION STRATEGY	Are there different or additional resources (financial, technical, and human) that are now available for mitigation planning?			
	Are the goals still applicable?			
	Should new mitigation actions be added to a community's Mitigation Action Plan?			
	Do existing mitigation actions listed in a community's Mitigation Action Plan need to be reprioritized?			
	Are the mitigation actions listed in a community's Mitigation Action Plan appropriate for available resources?			

Mitigation Action Progress Report

Page 1 of 3

Progress Report Period:______________________________ to __________________________________

(date) (date)

Project Title:____ Project ID#________________________

Responsible Agency:

Address:____

City:____

Contact Person:____

Phone # (s): _________________________________ email address:_________________________________

List Supporting Agencies and Contacts:

____

____

Total Project Cost: ____

Anticipated Cost Overrun/Underrun: ____

Date of Project Approval: ___________________________ Start date of the project: __________________

Anticipated completion date: ____

Description of the Project (include a description of each phase, if applicable, and the time frame for completing each phase): ____

____

____

Milestones	Complete	Projected Date of Completion

Plan Goal(s) Address

Goal: ____

Indicator of Success: ____

Project Status

☐ Project on schedule

☐ Project completed

☐ Project delayed*

*explain ______________________________

☐ Project Cancelled

Project Cost Status

☐ Cost unchanged

☐ Cost overrun*

*explain______________________________

☐ Cost underrun*

*explain______________________________

Summary of progress on project for this report:

A. what was accomplished during this reporting period?

B. What obstacles, problems, or delays did you encounter, if any?

C. How was each problem resolved?

Page 3 of 3

Next Steps: What are the next step(s) to be accomplished over the next reporting period?

Other Comments:

Appendix G

Previous Plan Goals & Actions

ACTION PLAN MATRIX REVIEW

Action No.	Action Item	Discussion - 2011	2012 Update	2013 Update	2014 Update
1.A	Update Master Plan every 10 years. Review/update ordinances every 3 years.	Although there was no one present from the City's planning department, it was mentioned that the Flood Protection Ordinance had just been updated in September.	The City was on schedule regarding this item.	There is no mandatory cycle for updating the City's Master Plan, with the current Plan having been adopted in 2006, and it was not felt a complete update would be completed by 2016 (although it was reviewed each year). Karen Johnson mentioned that when the Master Plan was updated, it should incorporate any new flood maps or new information regarding fault lines that would affect development. It was stated, however, that these issues were addressed in ordinances—with all maps being automatically approved as they came out from FEMA and which did not need to go before the Board for further approval. It was therefore agreed that this action item should be changed to "Annually review the Master Plan and update it relative to hazard mitigation" and "Review/update ordinances as new information becomes available."	Continue to review with the Master Plan update cycle.
1.B	Identify and educate city personnel on high hazards.	Stacey Giomi said that this was being accomplished through the ongoing training of the city's EOC staff.	This training was ongoing for city personnel, and those on this planning team were also being educated by virtue of attending these yearly update meetings.	The Hazard Mitigation Plan was discussed during ongoing EOC staff training so that key city personnel were aware of the Plan. It was also stated that pertinent data could be added to the GIS for internal staff users (a hazard mitigation layer showing high hazards).	Meeting yesterday to update EOC plan, Lots of new personnel.
1.C	Coordinate existing GIS capabilities to identify hazards through the city.	Stacey Giomi said that this had been done when the plan was updated and that there were no additions other than unreinforced masonry buildings, which would be discussed later in the agenda.	This was continuing to be done and has been expanded to more of a regional basis. GIS was now being done for the entire quad-county area (Carson City and Douglas, Lyon, and Storey Counties) and was housed in one location situated in Douglas County.	This has been accomplished although it will continue to be refined with current data and updated information. Also, the City obtained a program called Pictometry, which can be used for hazard mitigation, which is a viewing system that allows access to high resolution oblique photography primarily over populated areas. This aerial photography allows users to see the outside of buildings and to take very accurate measurements of those buildings and surrounding property. GIS layers can then be integrated into this program. Currently, Carson City, Douglas County, and Storey County have this program, while Lyon County will be getting it soon, and they were currently discussing	Check with Eric. Will GIS map locations of URM? Field survey to ground truth, take address and put into GIS. Pictometry is complete.

1

Action No.	Action Item	Discussion - 2011	2012 Update	2013 Update	2014 Update
				expanding the geo-fence around all four counties so that each jurisdiction will have the ability to view the entire quad-county area.	
1.D	Develop the data sets that are necessary to test hazard scenarios and mitigation tools, including HAZUS MH.	Stacey Giomi said that this was an ongoing process and hasn't been done since developing the last plan matrix. Karen Johnson mentioned that UNR was doing this for earthquake and may be taking it on for flood, so this may be something the city would not need to do itself but rather UNR would do it for them.	The Nevada Bureau of Mines and Geology has obtained data (and continues to seek new data) for its MyPlan Risk Assessment web application, which planners in emergency situations can use. This is live data that currently contains information relative to fire, flood, and earthquakes. And also included in this application is a listing of potential unreinforced masonry buildings.	Nothing new to report for the past year.	Craig will run suite of HAZUS runs for earthquake. Eric will use FEAM Mapping.
1.E	Utilize the internet as a communication tool as well as an educational tool. *(Item 8.F will be combined with this item in the future.)*	Stacey Giomi said that this was ongoing and that the HMP itself was posted on the internet.	The City's Hazard Mitigation Plan was posted on the internet, and the City was continually exploring increased use of social media. Some departments, such as the Health Department, were using the internet quite extensively, and the City has both a Facebook page and a Twitter account.	See Item 1.C related to Pictometry (which is a component of an internet-based educational tool).	Pictometry not available to public. - GIS public viewer may have some of these layers. - Any website has flood data. - Mobile app for public to send in info to City. Carson City app – way to send out info to public.
1.F	Develop city building codes and ordinances that protect people and structures from drought, earthquake, flood, landslide, severe weather, and wildfire.	Stacey Giomi said that this was ongoing, and the City was typically on a three-year cycle, with the next code adoption cycle being in 2012 for the model codes. The 2012 model codes are out now, and the city will start working on adopting those codes shortly after the first of the year—including building/fire/residential codes.	The City began work on the adoption of the 2012 series of model codes—fire, building, and residential—last year, and their goal is to have them adopted and in place by September 2013.	Effective September 1, 2013, the City adopted the 2012 series of International Codes—building, fire, residential, property maintenance, and wildland urban interface—and also adopted were the uniform plumbing code and the international and uniform mechanical codes.	Yes, 2012 adopted. No new adoption until 2018. (every six year)
2.A	Develop emergency evacuation programs for neighborhoods in flood-prone and wildland areas.	Stacey Giomi said that they have specific plans in place regarding the City's retention dams for those people downstream from them and have emergency communications systems in place to notify those people in the event of a dam failure. In terms of wildland fires, they have identified their wildland urban interface area and have developed a map for emergency evacuation of those neighborhoods. So this action has been accomplished.	The City has developed pre-designated warning locations for those living downstream of water retention dams and for those living within identified wildland urban interface (WUI) zones which they can access quickly through the use of their emergency notification software. The maps are pre-identified and pre-assigned. Also, letters were sent out last year to all those residents who lived downstream of levees and dams informing them of that potential hazard.	This item has been accomplished as programs have been developed for the City's wildland urban interface areas and dam inundation zones.	Map is on website currently. Plan on continuing updates as they occur
2.B	Annually review the City's EOP and update and integrate with local Hazard Mitigation Plan.	Stacey Giomi said that this has not been done since the adoption of the HMP, but it is planned to be accomplished in the current fiscal year.	The update of the City's EOP was started last year and should be finished by the end of this year.	Nothing was done on this item in 2013.	Met March 16 and plan is in draft form. Anticipated complete on June 30th 2015. Scheduling workshops now.
2.C	Conduct minimum of one disaster exercise a year.	Stacey Giomi said that more than one exercise has been conducted in the past year and that they have an exercise plan	Following is a list of exercises conducted in 2012:	The following exercises/workshops were conducted in 2013:	**Stacey will provide list electronically. Any other offices to provide information to Stacey.**

2

Action No.	Action Item	Discussion - 2011	2012 Update	2013 Update	2014 Update
		that will be incorporated.	1) On April 13-14, a full-scale exercise was held with Carson City Health & Human Services (CCH&HS) and NV State Division of Health, targeting the following capabilities: Planning, Mass Care, Emergency Operations Coordination, Onsite Incident Management, Healthcare System Preparedness, and Volunteer Management. 2) In May, a full-scale exercise was held with the Carson City Fire Department (CCFD) and the Community Emergency Response Team, targeting the following capabilities: Communications, Emergency Public Information & Warning, and Onsite Incident Management. 3) On June 20, a full-scale exercise was held with the CCFD, Carson City Public Works (CCPW), and Carson City Sheriff's Office (CCSO) Dispatch, along with the fire agencies of East Fork, Central Lyon County, and Tahoe Douglas, targeting the following capabilities: Communications, Emergency Public Information & Warning, Onsite Incident Management, and WMD/HazMat Response & Decontamination. 4) On October 6, a full-scale exercise was held with CCH&HS, Carson City Emergency Management Division, CCPW, CCSO, Carson City School District, NV Public Health Foundation Northern Nevada Immunization Coalition, and Western Nevada Medical Reserve Corps, targeting the following capabilities: Community Preparedness, Emergency Operations Coordination, Emergency Public Information & Warning, Information Sharing, Medical Countermeasure Dispensing, and Volunteer Management. 5) On November 14, a tabletop exercise was held at Carson City Hall targeting the following capabilities: Emergency Public Safety & Security Response and Communications. 6) On December 17, Carson Tahoe Hospital conducted a mass casualty/sheltering exercise, which scenario involved a small plane crash into Sierra Surgery, causing an evacuation of that building into the main hospital. 7) Two exercises were conducted by the Sheriff's Office last year—one tabletop exercise with	1) In March, a WMD/HazMat Response and Decontamination workshop was held with Carson Tahoe Hospital, Carson City Fire Department, and Carson City Emergency Management. 2) On April 17, training was conducted by the Carson City Sheriff's Office for law enforcement, emergency managers, hospital personnel, mental health and public health professionals, fire/EMS personnel, etc., in regard to Operating a Family Assistance Center and Call Center during a Mass Fatality Incident. 3) On June 22, a Mobile Medical Facility Deployment Drill was conducted with Carson City Fire, Public Works, Health & Human Services, and Emergency Management, along with the Carson City CERT and MRC. 4) On October 5, a full-scale POD (Point of Dispensing) exercise was held with the City of Carson City—Health & Human Services, Emergency Management, Public Works, Sheriff's Office—along with the Carson City School District, Nevada Public Health Foundation, Northern Nevada Immunization Coalition, and the Western Nevada Medical Reserve Corps. 5) On October 30, a full-scale CTH Bomb exercise was sponsored by the Carson Tahoe Healthcare System, which included participants from Carson City Emergency Management, Fire/EMS, and Health & Human Services, along with Carson Tahoe Long Term Acute Care Hospital, Minden Emergent Urgent Care, Nevada State Division of Public and Behavioral Health, and Sierra Surgery Center. 6) On November 6, a Lake Tahoe Environmental Response Tabletop Exercise was sponsored by the Regional Response Team 9, the US EPA, the US Coast Guard, the USDA Forest Service, the Nevada Department of Public Safety, the California Governor's Office of Emergency Services, the Nevada Department of Environmental Protection, Carson City, Douglas County, and El Dorado County (CA).	

3

Action No.	Action Item	Discussion - 2011	2012 Update	2013 Update	2014 Update
			the Fire Department and one active shooter exercise involving the Capitol Complex.	7) On November 12, an ARkStorm workshop was held at the Nevada Division of Emergency Management which presented a scientific overview of regional impacts and operational continuity strategies.	
2.D	Establish a budget and identify funding sources for mitigation outreach.	Stacey Giomi said that not much has been done in this area.	There was still no budget to address this item.	There was still no budget to accomplish this item—but it was mentioned that it could be put into the application for the plan update.	Per Stacey, Yes, we will be doing community outreach in a number of ways. - Health Dept. will be working on a mitigation plan for infectious disease and will include outreach. (Do to Eboli outbreak) Funding from CDC.
2.E	Work with school districts to develop a public outreach campaign that teaches children how to avoid danger and behave during an emergency.	Kevin Curnes said that the Fire Department's fire prevention inspectors have been actively involved in developing new evacuation plans for the schools and in the Young Defender Program. Stacey mentioned that the Fire Department has presented awareness to school-aged children while they were in the schools; however, they have not yet provided disaster preparedness or fire disaster training.	The school district conducts monthly drills at each of its sites—including fire, earthquake, and lockdown scenarios—which are required by law. The Fire Department and the Sheriff's Office also reach out to children at public events held at least twice a year which provide them with hazard information.	The school district continued to conduct its required monthly drills at all of its sites, and the college continued to conduct lockdown drills. The Sheriff's Office and the Fire Department also reached out at public events during the year.	Same a 2013; Great Shake Out; Nevada Flood Awareness Week; Active Shooter Training in schools. WNC will do a tabletop exercise in each class. School Dist. continued.............
2.F	Utilize Business for Innovative Climate Change (BICEP) to increase awareness and knowledge of hazard mitigation and encourage businesses to develop/ implement hazard mitigation actions.	Karen Johnson said that this was to educate the local businesses on the hazards in the area, such as earthquake, and make them aware of what those hazards could do to their business models. Stacey said that nothing yet has been done on this, but they could plan to hold an educational class through the Chamber of Commerce on disaster preparedness or something similar.	A presentation was made in May 2012 to the Chamber of Commerce regarding general business continuity planning as it related to earthquake damage. In addition, letters were being sent out each year to everyone in the city whose property could be affected by flooding. Outreach in this area was somewhat limited, however, due to budget restraints.	A Wildfire Awareness Week was held in May which reached out to businesses, and flood information was distributed to the citizens (which is done on an annual basis). Next year a Flood Awareness Week will be held in November.	Wildfire Awareness Week- May. Will also hold a Flood Awareness Week.
2.G	Prepare, develop, and distribute appropriate public information about hazard mitigation programs and projects at Carson City-sponsored events and on the Carson City's/Fire Department's website.	Stacey Giomi said that this was being done on a fairly routine basis. A disaster preparedness program was scheduled for October 8 at a faith-based facility—and it was being done for the Boy Scouts as well. Robb Fellows stated that they had sent out a letter at the end of August/beginning of September to everyone who was in or next to a special flood hazard area with information about what to do in case of flooding and where to obtain additional information.	This was continuing to be done—and letters were sent out to all property owners who lived in a special flood hazard area informing them of that hazard.	This continued to be done. (See 2.F)	Continues to be done
3.A	Continue to enforce the International Building Code (IBC) provisions pertaining to grading and construction relative to seismic hazards. Update Carson City codes to	Stacey Giomi said that this was being done.	This was continuing to be done.	This continued to be done.	Continue to enforce. Codes updated.

4

Action No.	Action Item	Discussion - 2011	2012 Update	2013 Update	2014 Update
	IBC 2012 when it is released.				
3.B	Implement an Unreinforced Masonry (URM) building program that determines the structural safety of critical infrastructure, and retrofit buildings, if necessary.	Stacey Giomi said that this was not something they've done yet, and although it had a low priority, he felt they should at least map and identify the URM buildings and then identify how they could reinforce the public buildings. Karen Johnson mentioned that UNR has a list of these buildings from the Carson City Assessor's Office and has already begun mapping them. Stacey then said that the city should wait until UNR does its assessment, and Karen mentioned that the maps, when finished, would be posted on a UNR-hosted website, which then could be pulled up by the city's GIS people and reviewed by the city team.	Data has now been provided on potential unreinforced masonry buildings, but they have not yet reviewed or verified that data—but plan on doing so prior to the Plan's next update. They started working with the U.S. Department of Homeland Security's assigned critical infrastructure protection representative in Nevada last year to evaluate City-owned critical infrastructure. Also last year a group of DHS evaluators came out and did a critical infrastructure assessment on key state facilities in Carson City. So this item was getting done not just specifically to unreinforced masonry—but generally as it pertained to hazards those buildings could encounter from exposure to such things as fire, flood, terrorist attack, etc.	The City had the gross data in 2013 but no funding to actually ground-proof it (proofing information from the Assessor about whether or not a building was unreinforced masonry). Money will be requested in the next grant application to hire someone to accomplish this task. As Clark County is developing a pilot program (with FEMA funds) to buy testing equipment, etc., in order to ground-proof their buildings (using a university intern), it was suggested that once this program was developed, Carson City would be able to take advantage of it and develop its own program. Although the program itself might not be fully developed for another year, the form that will be used as part of the inspection checklist for ground-proofing should be finished earlier.	Completed and performed surveys. FEMA's Seismic Risk Assessment program implementation over the next 5-years
3.C	Identify hazard-prone structures through GIS modeling.	See above.	This item has been accomplished through the City's mapping programs as well as the MyPlan program—as these programs contained overlays of the facilities that were in areas prone to various hazards.	No additional work was done in 2013.	Craig to provide new fault map.
3.D	Acquire and install a foam fire suppression system for the City Hall and Public Safety computer rooms to reduce damage to computer equipment.	Stacey Giomi stated that this has not yet been done, but was a low priority.	This was an item needing to be accomplished—but which has not yet been done.	As no budget, nothing was done on this item.	No action due to lack of funding.
4.A	Update Mass Illness Plan and integrate with local Hazard Mitigation Plan.	Dustin Boothe stated that the Mass Illness Plan was updated either every year or every other year and that it had been updated earlier this year.	A part of this Plan was updated in 2011 but no update was done in 2012.	This plan was updated in 2013 and was included as an annex to the Public Health Emergency Operations Plan.	Continually Reviewed annually
4.C	Prepare by acquiring/storing needed medical equipment.	Stacey Giomi stated that he believed this has been done by both the hospital and Carson City Health & Human Services.	This was continuing to be done.	This has been accomplished.	Ongoing updating of equipment and supplies
5.A	Identify flood-prone areas with GIS. Update storm water system plans. Develop project proposals to improve storm water facilities.	Robb Fellows said that this project was ongoing and that they added to their storm drain plan every year, and were always either maintaining or improving the system. They were currently working on a project on a west side meadow (Kings Canyon area) by the Quill Water Treatment Plant, which was meant to control flood water.	This item was being accomplished routinely, and Public Works developed a multi-hazard map in 2012.	This item continued to be accomplished and was ongoing. The basin on the south end of town by the freeway interchange—primarily for Voltaire Canyon—has been completed, with a future project being to connect the canyon to that basin. (A Mitigation Progress Report will be submitted on this project.)	Ongoing, System improvements being done w/ freeway and City projects as well. All this info is being added to database and GIS.

Action No.	Action Item	Discussion - 2011	2012 Update	2013 Update	2014 Update
5.B	Adopt or update policies that discourage growth in flood-prone areas.	Robb Fellows stated that these policies were in place and were part of the Flood Protection Ordinance and other Master Plan documents. This Flood Protection Ordinance had just been updated earlier this month.	This item has been accomplished and was an ongoing process.	This item will be removed as it is already in the ordinance.	Remove already in Ordinance.
5.C	Review and update flood plans for coordination with adjacent counties, cities, and special districts supporting a regional approach to flood.	Robb Fellows stated that they were part of the Regional Flood Plan with five counties and were working towards the goals of that plan. They provide an annual report to the Board talking about what they accomplished in the previous year. Ed James mentioned that they were working on a five-year plan with FEMA at the present time. The counties involved are Alpine, Douglas, Carson City, and Lyon, with something slightly different being done with Churchill. Ed said that they were working on a Master Plan and developing a charter in order to deal with flooding on a regional basis rather than by individual counties. Stacey Giomi mentioned that the Public Works Director was working on a regional mutual aid plan for public works, which he believed would be the first of its kind in the state of Nevada. This will be a county-to-county mutual aid plan for public works resources (which will include Lyon, Douglas, Storey, and Carson). The language was modeled after fire mutual aid plans, where you get 24 hours of free assistance from a neighboring county and can use it for either a disaster or an everyday occurrence.	Carson Water Subconservancy District completed a risk MAP Charter for the Carson River Watershed. This was accepted by the Carson City Board of Supervisors in January 2012. The document is a collaborative effort between local, state, and federal agencies to identify, assess, communicate, and plan for flood risk within the Carson River Watershed through several counties and two states. The National Weather Service, in consultation with flood managers and emergency managers in Douglas County and Carson City, modified the flood state along the East Fork of the Carson River. This was due to the lack of available gauges along the river and an effort to improve public warnings and provide enough time for residents to be alerted to potential flooding.	The Board adopted the update to the Regional Floodplain Mitigation Plan in the fall. The risk map and model for flooding along the Carson River has been sent to FEMA, and the mapping will come out in about a year. Also, once this is approved, they have received funds from FEMA to look at updating the regional floodplain mapping and model when development occurs in the floodplain.	Ongoing with Regional Plan and Risk Map Project. Meetings continue to update specific parts.
5.D	Update and expand Sandbagging Plan.	Stacey Giomi said that this was an annual process, and the city updated this plan every year prior to the winter season.	This was an ongoing process and continued to be done.	The Sandbagging Plan was updated, with a couple more areas being added.	Added Voltaire Canyon and Saliman. Ongoing updates to Sandbagging Plan.
5.E	Install new flood facilities and update storm drain system.	See 5.A.	A storm drainage project along Garnet Way to South Sutro Terrace was accomplished. This project improved the ability for storm water to flow past residences without causing backups which could lead to localized flooding. The retention pond on Bonanza Drive was cleared of debris and accumulated sagebrush and vegetation. This project was accomplished to ensure the adequate storage ability of the retention pond. This is a flood control pond that protects homes downstream from this drainage.	No new work was done—but there was a rate increase in the storm water utility to do capital improvements to the system.	May be duplicative. Might want to trim some of these flood section ones down. Need to identify Specific locations, i.e. streets, areas to be accomplished within the next five years.; Can be broad, but do need specifics. Regional Flood Plan.

Action No.	Action Item	Discussion - 2011	2012 Update	2013 Update	2014 Update
5.F	Upon completion of land transfers associated with the Lands Bill which includes land trading with Carson City, BLM, US Forestry, and Washoe Tribe: identify/implement projects within transferred lands and other areas within Carson City that need slope stabilization for flood and landslide.	Stacy Giomi said that the land transfer has not completely occurred yet but was expected to be completed within the next four to six months. It went before the Board a couple of meetings ago, and they have 180 days from that date to complete the transfer.	The land transfers have not yet been completed—the U.S. Forest Service exchanges were accomplished last year but the Bureau of Land Management exchanges were not. However, it was expected that some would be done this year, with others to follow in subsequent years.	U.S. Forest lands were acquired but no work was done in regard to their stabilization—and the Bureau of Land Management lands have yet to be acquired.	No updates from 2013, still true.
5.G	Design and install facilities to capture debris/sediment within Eagle Valley.	Robb Fellows said that this was an ongoing project and that they had recently acquired an easement from BLM for a sedimentation basin on the corner of South Edmonds and Valley View. Stacey Giomi mentioned that there were several sediment debris water retention basins within the city and that a significant amount of work had been done in conjunction with the freeway construction.	The National Weather Service, in consultation with flood managers and emergency managers in Douglas County and Carson City, modified the flood state along the East Fork of the Carson River. This was due to the lack of available gauges along the river and an effort to improve public warnings and provide enough time for residents to be alerted to potential flooding. The City has done maintenance work regarding this project and has enlarged basins to better capture the debris and sediment, and improvements were made to Ash Canyon Road.	A prescribed burn in a flood control waterway was done—Linear Ditch off Saliman Road—to improve flows. Once the BLM property is acquired, a project will include the Goni watershed.	(BLM Properties) Three basins planned in Goni Watershed but those lands have not come to Carson City yet.
5.H	Develop a Flood Management Plan for the New Empire Area and install a new flood control facility for the area.	Robb Fellows stated that the New Empire Area was identified as a special needs area, with maintenance work being done and details being worked out to make the system more efficient during the upcoming winter cycle. There is no specific plan for this area, but it is part of the Capital Improvement Plan.	Nothing has yet been done in this area because there has been no funding—but this project will remain on the radar until funding does become available.	Nothing was done in this area the past year.	Nothing done, But Still Needed. (Put long list in the appendix)
5.I	Protect and enhance existing municipal water conveyance structures, storage, and treatment facilities.	Stacey Giomi stated that this was ongoing and that a water tank had recently been replaced on Koontz Lane. Robb Fellows stated that the existing facility had been in poor shape and wasn't up to the structural properties it needed to be, so a new tank was installed.	The north-south component of the large transmission water line was completed last year, which tied Carson City's water system into water rights the City owned in Douglas County as well as tying the Carson City and Douglas County water systems together. Although there is now water in this pipe, they are currently working on the booster stations to pump that water into Carson City. The east-west component of this line is still to be completed.	Another large portion of the Carson-Douglas intertie was completed—from the prison farm to Saliman and Robinson—and the booster stations have been built so water was now flowing between Douglas County and Carson. The next portion to be completed will be to Roop Street/Mills Park, and there will be another intertie going behind Costco and Walmart.	Mills Park under construction; Costco/Walmart complete. Next phase goes to Washington and Phillips.
5.J	Install a storm water retention facility at Goni Canyon and storm drain system at Goni Creek.	Robb Fellows said that this was an ongoing project and that although they submitted a mitigation project request through FEMA and it had been considered, it was not approved. They do plan, however, to continue to pursue grant funds for this project.	This project is still being planned but there is currently no funding for it.	Nothing done as no funding was available.	Maybe combine with 5G.

Action No.	Action Item	Discussion - 2011	2012 Update	2013 Update	2014 Update
~~5.K~~	~~Design and install facilities to capture debris sediment within Eagle Valley.~~	As this was a repetition of 5.G, this item should be eliminated.			
5.L	Land acquisition of buildings with recurring loss or of land which could be used as catch basins for flood control projects.	Robb Fellows said that there were three properties in the city considered to be repetitive loss properties—one by the river and two on the west side—and they were always looking for ways to mitigate those properties, either through purchase or some type of protection. Stacey Giomi then requested Robb to e-mail him the parcel numbers of those properties so they could be identified in the Plan.	Although one of the goals of the City is to have no repetitive loss properties, there is no funding currently available to accomplish this.	Nothing done as no funding was available. There are currently three repetitive loss properties in the city, with one possibly resulting in an acquisition.	Nothing done yet, but may have a willing seller.
6.A	In areas at risk to severe weather, retrofit public buildings to withstand snow loads and severe winds to prevent roof collapse/damage.	Stacey Giomi said that there was no plan in place to identify these buildings as they were only identified during a real event. However, as there were local building codes which addressed these issues specifically, this project was being addressed to the extent possible.	This project has essentially been accomplished.	Accomplished.	Ongoing reviewing infrastructure.
6.B	Develop Storm Water Management Plan for snow melt and integrate with local Hazard Mitigation Plan.	Stacey Giomi said that along with updating the Sandbagging Plan, the City annually updates its Snow Plowing/Snow Removal Plan. Robb Fellows said that they also have a map where they keep track of troubled areas.	This project continues and is ongoing.	This project continues and is ongoing.	Ongoing. Looked at several sites for snow storage.
7.A	Develop building codes for public buildings to mitigate impacts from terrorist events.	Stacey Giomi said this was a low priority item, and he believed the development of the current existing codes (International Building Code, International Fire Code, and International Residential Code) adequately addressed these issues.	It was felt that existing codes were adequate in regard to this matter. Also, there was continuing evaluation by the Homeland Security Critical Infrastructure individual, with several buildings in Carson City having been evaluated last year—including the state buildings of the Governor's Mansion, Capitol Building, Supreme Court, Legislature, Mail Room, Printing Office, and Information Technology, and the city buildings of City Hall, Court Complex, Public Works, and Wastewater. Buildings slated to be evaluated next year are Dispatch and Sheriff's Office. This evaluation gives them a software tool specific to each building which evaluates what they have in place and allows them to add security measures into the software program to determine how those measures would change their security rating and how they would compare to like facilities throughout the country.	Accomplished.	**Remove.** NDOT also looked at their building. PA System and ability to lock down and strobe lights on outside of buildings. WNC – Fire Dept. and Sheriff helping identify issues for active shooter. **MOVE THESE TO 7B**

Action No.	Action Item	Discussion - 2011	2012 Update	2013 Update	2014 Update
7.B	Develop a planning document to cover terrorist events and exercises.	Stacey Giomi said that the Sheriff's Office and the Fire Department developed Incident Action Plans for each public event held in the city. These plans address intelligence received by the Sheriff's Office through the Fusion Centers within the state that might indicate the potential for harm coming to a member of the public or a member of the emergency response community. So, while they had no single planning document, plans were being done for each event which addressed this topic.	See above as information for 7.A also covers this item. Also, procedures are in place by the Sheriff's Office for active shooters, bomb threats, hostage situations, and terrorist attacks—with two exercises being held last year (see #7 in 2.C Exercise section). The Fire Department also prepares and maintains preplans of key hazard facilities—which contain key access points, water and utility shutoffs, etc., which would be key for the Fire Department to control any kind of a disaster (and which will be shared with the Sheriff's Office). The School District has a Crisis Response Plan which includes a site plan with all their shutoffs, etc., and that the Fire Department and the Sheriff's Office have access to that plan.	The Sheriff's Office became more active in participating in the school district's drills.	Ongoing, continues to be done. Incorporate 7.A. - NDOT has updated policies on active shooter.
7.C	Retrofit public buildings to increase safety and reduce the impact of terrorist events.	Stacey Giomi said that this was a low priority but was ongoing. They primarily address this issue by hardening facilities by installing a restricted entry (locks, proximity cards, etc.), and although they have a citywide plan to do this for every building, it's a matter of finding funding which they presently don't have.	This project is continuing to be done as facilities are hardened. The card key system was installed at the Corporate Yards last year and will be installed at the Fire Department in 2013.	The Schools developed a single point of entry for their buildings, using bond money. Dispatch, the Sheriff's Office, the Public Safety Complex, the Quill Treatment Plant, and the fire stations were all evaluated by the Department of Homeland Security.	Still looking for funding. Have requested evaluations of Health Dept. Building for active shooter. - Last school building will complete signal pt of entry. - All fire station buildings now have card access.
8.A	Identify areas and update and enforce Urban Wildland Interface Code (UWIC)	Stacey Giomi stated that we were doing this and have also done a couple of mitigation projects in the wildland urban interface. He said that a mitigation action progress report will be completed on the work done in this area. (Stacey then asked Robb Fellows to prepare a mitigation action progress report for each project he has been involved in.)	This project is ongoing and continues to be done.	The International Code Council WUI 2012 code was adopted, and the WUI boundaries were updated.	Ongoing, code on 6 year adoption. Southern Boundaries changed due to freeway. - Enforcement is done every year.
8.B	Update the CC Fire Code and model weed abatement and fuel modification ordinances.	Stacey Giomi said that they have not yet done this, but it will be done in conjunction with the code adoption cycle in 2012.	This update was begun in 2012 and will be completed in 2013.	This was completed.	**Remove** until next Six year Update. Ongoing code updated every six years.
8.C	Continue conducting Fuel Management Programs.	Stacey Giomi said that they were doing this and that it was an ongoing process. A mitigation action progress report will be done for the fuel work that has been done.	Several wildland fuel reduction projects were completed during this period. The following projects in the wildland urban interface on the west side of Carson City were to create community defensible space in a 100-200 foot wide protection area by reducing fuel loading and wildfire intensity and to modify vegetation structure and composition to reduce fire behavior by utilizing the following three	Fuel reduction projects conducted in 2013 were as follows: 1) Hand Thinning Fuel Break Construction/Maintenance—third phase of fuel break construction—Eagle Creek, Kingsview, C-Hill—was completed in September. 2) Mowing Fuels Treatment—third phase of fuel break construction and	Ongoing - Seasonal F/F work from June to September on Fuel program: Clearing brush and weeds on all City (and in special occasions) private lands.

Action No.	Action Item	Discussion - 2011	2012 Update	2013 Update	2014 Update
			methods to remove fuels: 1) Hand Thinning Fuel Break Construction/Maintenance—by utilizing hand crews, a total of 16.36 acres was treated in the areas of Eagle Creek/Lakeview, Kingsview, and Long Ranch Open Space. 2) Mowing Fuels Treatment—by utilizing mechanical mowing equipment, a total of 27 acres was treated in the areas of Eagle Creek, Lakeview, Upper & Lower Combs Canyon, Timberline Road, West Winnie Lane, Adams Property, and Kings Canyon (including the Quill Plant). 3) Mastication Fuels Treatment—by utilizing mechanical mastication equipment, a total of 12 acres was treated in the areas of the Adams Property, Timberline & Combs Canyon, Voltaire Canyon, and Long Ranch Open Space. The following project located in the wildland urban interface on the south and east sides of Carson City was to reduce fuel loading in Carson City rights-of-way and modify vegetation structure and composition to reduce fire behavior and fire intensity: 1) Carson City Right of Way Fuels Mastication Treatment—by utilizing mechanical mastication equipment, a total of 17,000 linear feet of rights-of-way and 3 acres of fuel mosaic in the Pinion Hills 60' wide right-of-way was treated.	maintenance completed in August. 3) Mastication Fuels Treatment—fuel break construction—Riverview Park, Imus Park, C-Hill—completed in June. For the above three projects, the CCFD wildland fuels management officer completed treatment prescriptions specific to the projects. Vegetation structure and composition were modified to reduce fire behavior by removing 50 to 80% of the hazard fuel in project boundary. 4) WUI Fine Fuels Reduction with Sheep—due to drought conditions, just one band of 750 sheep + lambs were scheduled for the project, who primarily grazed cheatgrass and other grasses with a minor consumption of shrubs. They grazed across 2,000 acres and reduced approximately 71 tons of biomass. (Mitigation Action Reports are on file for the above projects.)	
8.D	Develop a public outreach campaign of the extreme wildland fire dangers and steps that can be taken to reduce these dangers.	Stacey Giomi stated that at the end of 2010 and into the spring of 2011, they conducted a parcel-by-parcel review of every home in the wildland urban interface and developed a database of those homes. They were then following up with those property owners to ensure code compliance, education, and mitigation.	A public education and outreach campaign focused on wildland fires was conducted in May 2012. Wildfire Awareness Week was kicked off with a public display of firefighting equipment and wildland fuel reduction demonstrations. This event was accompanied by a community evacuation exercise for the Kings Canyon area. A 200-acre wildland fire on December 30, 2011, allowed for the opportunity to discuss the potential for "off-season" wildland fires, especially as they might occur during times of drought. This fire allowed the Fire Department to discuss wildland fire safety.	Had a very active educational campaign for the WUI. Held a Wildfire Awareness Week, and Chief Giomi did a couple of television interviews with local outlets.	Ongoing, annual wildfire awareness. Event due in April 2015. _ Talk to HOA's year round

Action No.	Action Item	Discussion - 2011	2012 Update	2013 Update	2014 Update
8.E	Develop partnerships for a community-based vegetation management program including chipping programs.	Stacey Giomi said they have partnerships with their Fire Safe Council chapters and that the chapters identify projects within each of their chapter areas. And although the Fire Department helps with those programs, the chapters are relied upon to identify which programs they want, which has included chipping, creating fuel breaks, etc.	A fuel trailer/dumpster program is in place for those living in the wildland urban interface (WUI). Last year, 340 tons of hazardous fuel were removed from the community and recycled. Citizens living in the WUI can request that a trailer or dumpster be delivered to their homes, and after putting their hazardous wildland fuel into them, the trailer or dumpster will be picked up by the City and taken to the landfill where the fuel will go through a chipping process.	The fuel trailer/dumpster program was still in place for those living in the WUI, and last year, 339 tons of hazardous fuel were removed from the community and taken to the landfill for recycling.	Residential Chipping program Ongoing. Tonnage. Purchasing and received new dumpster May 2015. Purchased new Trailer in 2015. Annual Tonnage for 2014 286.88 tons.
8.F	Utilize GIS and the internet as information tools.	Stacey Giomi said that this was being done.	This was being done on an ongoing basis. *It was decided that GIS should be added to Item 1.E. thus eliminating this item number.*	Same as 1.E.	Completed work with GIS to Put Arcviewer on bldg. dept. website to show WUI boundaries.
8.G	Establish a continuing wildland fire technical working group.	Stacey Giomi said that they have the Fire Safe Council chapters, and the Fire Prevention Bureau holds quarterly meetings of those teams.	Although the Fire Safe Council chapters disbanded in 2012 from the state level, the Fire Department maintains cooperative meetings on a quarterly basis with that group and continues to work with those people in the WUI.	Although the Fire Safe Council disbanded in 2012, the Fire Department continued to work with these groups in 2013.	The Network was established; similar to Fire Safe Council (disbanded) but not grants. It is through UNR extension office process.
8.H	Protect municipal water recharge zones from wildfires and flooding by stabilizing upper watershed slopes.	Robb Fellows stated that a lot of this will be contingent upon the Lands Bill being passed.	This was continuing to be done, and Public Works also works with Open Space for possible grants.	This continues to be done.	Continues - Ongoing
8.I	Retrofit buildings (public and private) to reduce the risk of wildfire in Lakeview, Pinion Hills, Kings Canyon, Voltaire Canyon, and Timberlake Canyon.	Stacey Giomi said that although the priority for this project was high, the cost to retrofit some of these buildings was also high—so no action has been taken on this item. In the assessment of these parcels, they have identified whether building retrofits needed to occur, and if so, they have recommended these retrofits to the property owners who could do them as they had the funds. It was mentioned that Robb Fellows had applied for a grant for this project, but it was not picked up by FEMA. Karen Johnson mentioned that one reason this grant was not approved was that FEMA required a consent letter from every homeowner to be provided with the application and that they did not have one from everyone. It was mentioned that this could be a public relations problem—as those people who signed the letters would then be expecting the work to be done, not realizing that the funding might not be received.	Although this was a funding issue, the City does conduct an evaluation on an annual basis of all built structures in the WUI and provides that information to the property owners from an educational perspective. By doing this, property owners who were in the process of remodeling would receive information on how they could specifically make those remodels fit their buildings. The Fire Department also reviews those building permits to ensure the property owners' remodeling plans would be approved.	Evaluations continued to be done.	Evaluations continue - ongoing. - Fire Dept. Gives Suggestions to retrofit - Additions to homes must meet bldg. code for wildfire but do not have to retrofit entire house. - Not in next 5 years.

Action No.	Action Item	Discussion - 2011	2012 Update	2013 Update	2014 Update
9.A	Watershed stabilization and recharge program to maximize the use of surface sources when available and preserving the groundwater sources for system peaking needs and times of drought.	Robb Fellows said that this was also part of the Lands Bill. However, they currently use Vee Cee Canyon for a major part of the recharge program and that they were also conducting a project in the Kings Canyon/Ash Canyon area, part of which was to infiltrate water into the ground.	The Nevada Division of Environmental Protection completed a Carson River Mercury Superfund Site Long-Term Sampling and Response Plan. This is an example of a planning effort aimed at maintaining safe water quality in the Carson River region. Also, see Item 5.I as it speaks to stabilizing the watershed due to drought.	This is ongoing, but no new projects were done in 2013. The State will be including a drought risk assessment for the 2016 update of its Hazard Mitigation Plan, and would include any particular areas the City would like studied.	This needs to be combined with others (Saying the same thing) Still a need. See Robb Fellows. 3/17/15
9.B	Encourage public participation in drought strategies through public information programs on water conservation and drought-resistant landscaping and through building code ordinances.	Stacey Giomi said that this was being done through mailings (twice during the summer) to all water users within the city's utility system, talking about water conservation, such as when you could and could not water.	The mailings referenced at the 2011 meeting continued to be done in 2012.	The mailings continued to be done—and there was an ordinance in place in regard to scheduled watering.	Pamphlets and outreach program info to schools. Educational component continues, still distribute to schools. 3/17/15
10.A	Evaluate natural slopes to determine if there are slope stabilization treatments that would be appropriate to prevent landslides.	Stacey Giomi stated that this has been done to the extent of the lands they have, but has not been done to the land they have yet to acquire.	The sheep grazing practice on slopes within Carson City has reduced fuels, thereby producing less severe fires.	Nothing new on this item other than what had been done previously.	All on West side, Nothing New. Forest Service land has transferred to Carson City near C hill area. 3/17/15
10.B	Conduct slope stabilization projects to prevent landslides.	The areas involved for these projects would mainly be around C-Hill, but no projects have yet to be identified.	No specific stabilization has been done (but see above comment).	Nothing new has been done on this item.	Nothing new. 3/17/15
11.A	Review zoning ordinances to reduce public health risks from hazardous materials releases.	Stacey Giomi said that has been done and was in the master plan, thereby becoming part of that update.	This has been done, with zoning being part of the master plan.	Accomplished.	**REMOVE** 3/17/15
	Avalanche next five years.				Provide Avalanche area map. Provide information to public education Put information on Carson City website Avalanche Warning System currently provided by the Sierra Avalanche Center. Provide Road signage at specific areas.
	Utility Loss				Develop Long term Emergency Energy Plan for extended outages.

Revised: 06/10/2015

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Appendix H
Earthquake Hazards and Seismic Risk Mitigation in Carson City

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Earthquake Hazards and Seismic Risk Mitigation in Carson City

Craig M. dePolo

Nevada Bureau of Mines and Geology

University of Nevada, Reno

November, 2015

Executive Summary

Carson City has the highest earthquake hazard in Nevada. Several historical earthquakes have shaken the county, including one of the most damaging earthquakes in Nevada, the 1887 Carson City earthquake. Background earthquakes, magnitude 3 and smaller, are frequent in Carson City. Areas of persistent background seismicity include the northern part of Carson City, south of Prison Hill, and the northern Pine Nut Mountains. Several young earthquake faults exist in and surrounding Carson City. The larger faults bound the mountains, and smaller faults cross through the mountains and/or basins. There is evidence in the geologic record of paleoearthquakes with magnitudes in the upper 6 to 7 range, some of which were only 200 years apart. It is clear earthquakes are a major landscape-forming process in the Carson City area and earthquakes have occurred in the recent geologic past and historically. Maximum magnitude earthquake estimates of M6.5 to M7.2 were made for the major faults in the area. Some of these estimates were used as scenario earthquakes to understand the potential consequences of local earthquakes on Carson City.

Probability calculations indicate it is likely (78-79%) Carson City will experience Modified Mercalli Intensity (MMI) VI shaking levels within a 50-year time period. Over a 50-year time period, chances of damaging ground motion associated with MMI VII and triggering an emergency response are 55-57%, of MMI VIII and launching a community recovery effort 19-25%, and of MMI IX widespread damage 6-10%. Carson City also faces potential surface rupture, earthquake-induced liquefaction hazard, earthquake-induced landslide and rock fall hazard, and potential lake tsunami and seiche hazard in Lake Tahoe.

Twelve earthquake scenarios were modeled using HAZUS-MH to illustrate the potential impacts of these earthquakes. These are generalized estimates and should be considered to be ± a factor of 10 of what could happen. Costs and impacts of these events to Carson City range from $4 million for a magnitude 5 at the State Capitol to $690 million. These costs roughly double when the impact on the entire state is considered. Damage levels in Carson City become substantial with earthquakes of magnitude 6.5 and greater, with 48 people requiring hospitalization, 181 other injuries, and 12 fatalities. Other seismic vulnerabilities in the county include over 100 unreinforced brick buildings.

One of the largest challenges to Carson City is preparing its citizenry for the earthquake hazard. In 2015, fewer than 7% of its population participated in the Great Nevada ShakeOut, 69% fewer than in 2013. This indicates that the citizenry is not embracing the real threat from earthquakes they face and may not be adequately prepared. Substantially increasing participation in earthquake preparedness should be a major goal of the leadership in Carson City. Other goals include reducing the earthquake risk of seismically vulnerable buildings and securing the contents and nonstructural components in buildings and homes.

Table of Contents

Historical Earthquakes

An earthquake is a sudden motion on a fault that creates shaking and trembling of the Earth. The effects of an earthquake can be felt far beyond the site of its occurrence. Earthquakes usually occur without warning and, after just a few seconds, large events can cause massive damage and extensive injuries and casualties. The most common effect of earthquakes is ground motion, or the vibration or shaking of the ground during an earthquake. Other effects include offset of the ground and liquefying soils.

Earthquakes that have Strongly Shaken Carson City

Carson City has been strongly shaken by many earthquakes in the last 150 years (Table 1; Fig. 1). One of these events, the 1887 earthquake, caused considerable damage to the city and surrounding communities. This section briefly reviews these historical events. They are unequivocal evidence of the earthquake hazard in Carson City. Most people subscribe to the logic that “if it has happened before, it can happen again” and thus, historical earthquakes can be a powerful motivation to people that the earthquake threat is real. The earthquake effects have been gleaned from newspapers and other accounts. This information is limited in scope and depth, however, principally because the effects and damage from earthquakes tend to be underreported. Newspapers only report damage in the first few days, when most of it is still not widely known. Additionally, earthquake damage is commonly considered to be private information and is not volunteered. Scientists and engineers didn’t begin detailed documentation of earthquakes until the mid-1900s.

The size of an earthquake can be expressed in two ways, earthquake magnitude (M) and Modified Mercalli Intensity (MMI). Earthquake magnitudes are correlated to the energy release of an earthquake and are determined by seismologists from seismic waves. Earthquake magnitudes can also be correlated with fault rupture length and maximum surface displacement, and are the basis for earthquake scenario models. The Modified Mercalli Intensity scale is based on the effects of an earthquake and considers human experience, shaking effects, and inflicted damage (Appendix). The MMI scale is reported in Roman Numerals to help distinguish the two scales.

Table 1. Historical Earthquakes That Have Produced Strong Shaking in Carson City

Date	Magnitude	Nearest Community	Effects	MMI CC*
1857, Sept. 3	6.3	Incline Village(?)	unknown	?
1860, March 15	6.5	Reno(?)	content damage	VI
1869, May 30	6.0	Virginia City	two eqs?, panic	VI
1869, Dec. 27	6.4, 6.2	Virginia City	content dam, wall cracks	VI+
1887, June 3	6.5	Carson City	build. damage, liquef.	VII-VIII
1896, Jan. 27	5+?	Carson City	cracked walls, fallen plast.	VI+
1897, May 15	5+?	Virginia City?	fallen plaster	VI+
1932, Dec. 20	7.1	Gabbs	surface rupt., chim. dam.	VI
1933, June 25	6.0	Wabuska	build. and chim. damage	VI+
1954, July 6	6.2	Fallon	build. and plaster damage	VI
1954, Dec. 16	7.1, 6.9	Fallon	build. and plaster damage	VII

* Modified Mercalli Intensity in Carson City

Table 1 indicates that 13 to 14 earthquakes have caused Modified Mercalli Intensity VI or greater intensity shaking in Carson City over the last 158 years. This is an average of once every 12 years. The 1887 earthquake caused severe damage (MMI VII-VIII) to Carson City during this 158-year time period. The locations of the largest events are shown in Figure 1, as are the seismic belts of Nevada. Carson City is in the Walker Lane seismic belt.

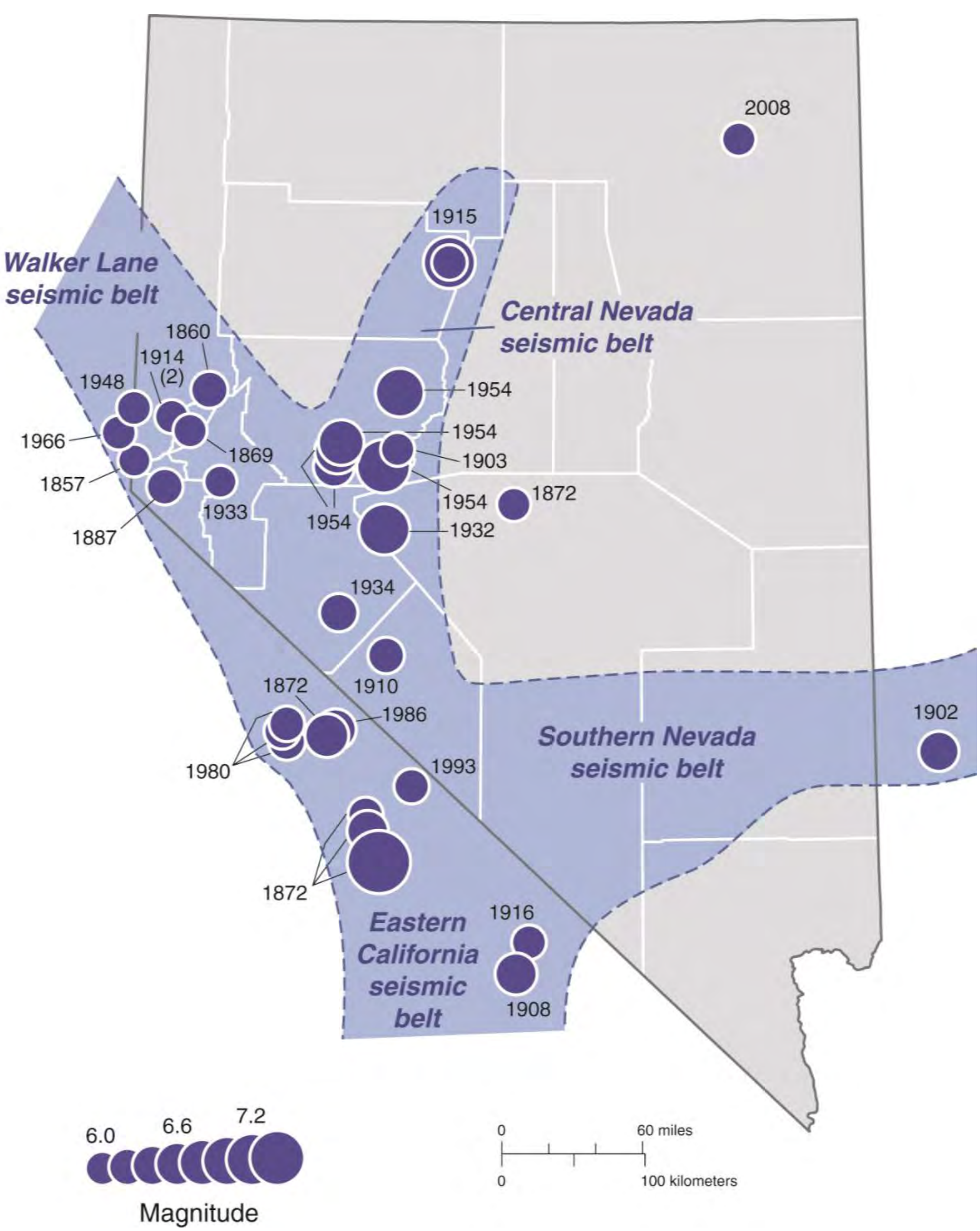

Figure 1. Major earthquakes and seismic belts in Nevada. The epicenters of the major earthquakes that caused strong ground motion in Carson City are shown on this map. Carson City is within the Walker Lane seismic belt.

1860, March 15 Virginia Range Earthquake

The earliest earthquakes with reported effects in Carson City were part of a series of six to seven events with magnitude 6 or greater that occurred between 1855 and 1869. The largest of these was on March 15, 1860, but details for most of these earthquakes, including 1860, are scant and largely incomplete. The 1860 earthquake may have originated in the Virginia Range northeast of Reno. The event occurred at about 10:45 (PST) on a Thursday morning and had a magnitude of about 6.5. The effects in Carson City are summarized in the March 16, 1860 Sacramento Union and in dePolo and others (2003):

> In Carson City, the earthquake was so severe that a general rush was made for the street from nearly every house in town, goods were shaken from the shelves of stores, and a general panic prevailed for a few minutes.

This description is consistent with Modified Mercalli Intensity VI in Carson City.

1868. May 29 Steamboat Springs Earthquakes

During 1868 and 1869 as many as four M6 events may have originated in the Steamboat Springs region. The first one, or possibly two events, occurred on Friday night, May 29, 1868 (PST), when it is reported that two similar-sized earthquakes occurred 10 minutes apart (dePolo and others, 2003). The magnitude of at least one of these events was M6. In Carson City, many people rushed into the streets, doors, windows, and lamps oscillated and vibrated, but no significant damage was reported (dePolo and others, 2003). These effects are consistent with a Modified Mercalli Intensity of VI.

1869, December 26 & 27 Steamboat Springs Earthquakes

Two earthquakes of magnitude 6.4 and 6.2, respectively, occurred on the evening of Sunday, December 26, 1869, again likely in the Steamboat Springs area. The first occurred at 6:00 pm (PST) and was reported to have lasted from 6 to 20 seconds. The second event occurred between 2 and 3:20 am (PST) on Monday December 27th, 8 to 9 hours after the first. In Carson City, the shocks were very severe and it was implied that “brittle ware” (dishes and cups) was broken (Territorial Enterprise, 1/5/1870). People went out into the streets and some were seasick (dePolo and others, 2003). Brick walls were damaged to some extent and there was slight damage to other types of buildings (dePolo and others, 2003). These reports are consistent with Modified Mercalli Intensity VI+. These earthquakes also illustrate the potential to have multiple major, potentially damaging earthquakes in a short period of time.

1887, June 3 Carson City Earthquake

The June 3, 1887 Carson City earthquake (magnitude 6.5) was one of the most violent earthquakes in western Nevada’s history. The event occurred at 2:40 a.m. (PST) in the morning. Buildings were severely damaged in Carson City and Genoa, some so severely that they likely had to be partially torn down and rebuilt. In Carson City, the earthquake was preceded by a heavy rumbling sound, was strong enough to throw some people to the ground, and threw many people out of bed (dePolo and others, 2003). Shaking lasted between 3 and 30 seconds (dePolo and others, 2003). It caused general hysteria in Carson City, Genoa, and Virginia City, where people ran out of buildings wearing only their sleeping garments (The Nevada Tribune, 6/3/1887). In Carson City, “within five minutes after the shock the streets were filled with people – some badly frightened, some considerably amused, and all chattering volubly over the occurrence, with each man relating his own personal experience” (Morning Appeal, 6/3/1887). A Modifired Mercalli Intensity map for the 1887 earthquake is shown in Figure 2. Many aftershocks undoubtedly occurred, but only a few were noted. The largest aftershock occurred on June 23rd at 3 a.m. and was described as a lively, [Carson] valley-wide shake (Genoa Weekly Courier 6/24/1887). Possible aftershocks continued to shake Carson City throughout 1888 and again in the summer of 1889 (dePolo and others. 2003).

Several newspaper accounts describe the damage in Carson City from the main shock. All stone and brick buildings had damage from the earthquake; the Capitol walls were cracked, and two to three other buildings were badly wrenched (Virginia Evening Chronicle, 6/3/1887). The Rosser Building, located opposite of the mint, sustained severe damage (dePolo and others, 2003). This building was described as violently cracked, especially the east-west walls. It was stated that, "had another shock occurred the rear part would have been laid level to the ground" (The Nevada Tribune, 6/3/1887). "The east-west walls exhibit signs of a very severe shaking, leaving crevices between the north and south walls of two inches in width" (Carson Daily Index, 6/4/1887). "The wall dividing Muller Schmitt & Co.'s store from Burlington's was cracked in many places and the chimneys of the Ormsby House are in badly shaken up condition (The Nevada Tribune, 6/4/1887). "The building occupied by Mr. Schnieder, the baker, and Walter Chedic, grocer, and owned by Geo. W. Kitzmeyer, has a crack in the walls that one can run his hand through" (The Nevada Tribune, 6/4/1887). "The Rinckel building, opposite the Post Office, is badly damaged, nearly all the plaster in the second story rooms being shaken down, while the rear wall has separated at least an inch from the main building" (The Nevada Tribune, 6/4/1887). The Virginia Evening Chronicle noted that, "Shultz's stone market was most seriously damaged of all". "In the Capitol Building considerable plaster was shaken down in the Governor's and other offices, and a slight crack is noticeable in the west wall" (the Nevada Tribune, 6/4/1887). Dozens of buildings in Carson City were cracked or damaged by the 1887 earthquake, making this one of the most damaging earthquakes in Nevada's history.

There was considerable content and nonstructural damage in Carson City from the 1887 earthquake. It is noted in the Carson Daily Index (6/4/1887) that, "A considerable amount of crockery was thrown from the shelves in E.B. Rail's, M.A. Downey's and Thaxter and Company's grocery store; a case of goods was smashed in Fisher & Decker's saloon, and a similar casualty occurred in Thaxter's drug store … and a thousand other little smash-ups happened in various stores." "Very few houses in Carson [City] escaped without some evidence of the quake, either in the form of broken plastering, furniture, glassware, etc" (Carson Daily Index, 6/4/1887). The Morning Appeal (6/3/1887) stated that, "every store in the city lost from $20 to $30 on broken crockery and glass ware". In addition to a major amount of content damage, windows were also broken, such as at the railroad offices (Carson Daily Index 6/4/1887).

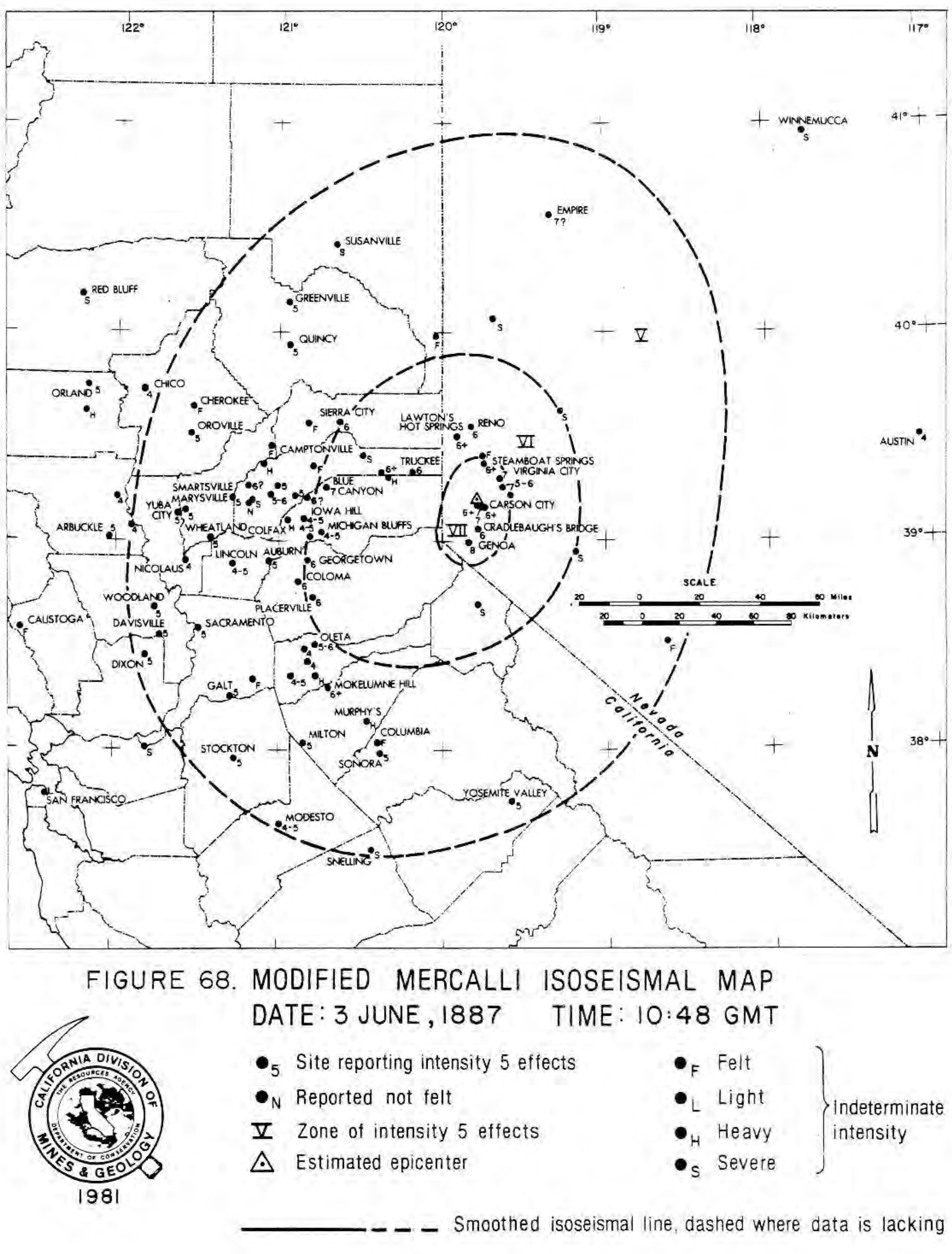

Figure 2. Modified Mercalli Intensity map for the 1887 Carson City earthquake showing the reported effects in Nevada and California. The map made by Toppozada and others (1981).

Liquefaction occurs when seismic waves pass through saturated granular soil, distorting its granular structure and causing some of the granules to collapse into the empty spaces between grains. This increases the pore-water pressure and when this pressure is sufficient, soil can behave like a fluid for a brief period and flow. Liquefaction was reported in Carson and Eagle Valleys. “Parties who were out to Cradlebaugh’s Bridge report a general demoralization of the earth thereabouts, there being several fissures from one to three inches wide out of which water and dirt were thrown into the air for some time. It is also reported that the toll house has been moved about two inches from its original foundation” (The Nevada Tribune 6/4/1887); this was likely caused liquefaction-induced lateral spreading of the ground. At the Boyd Ranch near Genoa, “In the corral, walking across either way, the ground seems as though all was hollow underneath, and by driving a pole down two or three feet, water flows immediately to the surface, and wherever a fissure is seen, black sand several inches deep has been thrown up” … (Nevada Tribune 6/6/1887). The well at the Boyd Ranch had dried up and filled with sand (Carson Daily Index 6/4/1887). These reports indicate that substantial liquefaction occurred in Carson Valley from this event. Liquefaction also likely occurred in Eagle Valley although it is less documented. It is commented that a “large fissure was opened in the ground on the road to the State Prison” (Carson Daily Index 6/4/1887), which may have been caused by liquefaction. Other phenomena that may have been liquefaction occurred along the Carson River.

Earthquake-induced rock falls were noted in mountainous terrain. Along Geiger Grade, “It [the earthquake] loosened several boulders on the hill above the [Philadelphia] brewery and sent them crashing into the ravine below” (Virginia Evening Chronicle 6/3/1887).

One fire related to the 1887 earthquake was reported. This was at the Martin’s hotel in Mound House, east of Carson City (Carson Daily Index 6/5/1887; Reno Evening Gazette 6/6/1887). The fire began at about a half past nine when the flames of a stove fire escaped through a separation in the stove pipe that was thought to have been caused by the earthquake and set fire to the woodwork behind (Carson Daily Index 6/5/1887). The loss was estimated to be $1,500; $500 of this was insured (Carson Daily Index 6/5/1887).

The 1887 earthquake was felt throughout western Nevada and eastern California. Shaking was noted in Winnemucca and Austin in Nevada (Virginia Evening Chronicle 6/7/1887; Reese River Reveille 6/4/1887) and as far west as San Francisco (Foothill Weekly Times 6/10/1887, Grass Valley, CA). In Genoa, nearly all chimneys were damaged and there was some significant building damage (dePolo, 2012). In Glenbrook, chimneys were broken off at the roof level, plaster was cracked, and lamps and dishes were broken (dePolo, 2012). In Virginia City, walls were cracked, and plaster and contents were damaged in Virginia City and Dayton (Virginia Evening Chronicle 6/3/1887 and 6/4/1887).

The Modified Mercalli Intensity from the 1887 earthquake in Carson City was VII to VIII. The strong shaking had a short duration. If the shaking had been a little longer, walls that were left standing unsupported would likely have collapsed.

1896, January 27 Carson City Earthquake

A short earthquake sequence occurred near Carson City from January 25 to January 27, 1896, just eight and a half years after the 1887 earthquake. The largest event in the sequence occurred about 1 o'clock in the afternoon on the 27th. In Carson City this earthquake created a large crack in the side of the government building, shook some plaster down from the ceiling of the county building, cracked the ceiling of the Post Office, and broke a pane of glass in a door at the newspaper office (Holden, 1898; Doten, 1975; Territorial Enterprise 2/29/1896). Professor C.W. Friend reported in Holden (1898) that, "all the shocks, including those of the 25th, were vertical and produced a very strange feeling." This may indicate that the earthquakes had normal dip-slip motion. The main shock of the 1896 earthquakes produced Modified Mercalli Intensity VI+ levels of damage in Carson City.

1897, May 15 Southern Virginia Range Earthquake

At least seven small earthquakes shook Carson City and Virginia City between May 14 and May 21, 1897. The most severe of these earthquakes occurred at 11:02 a.m. PST on May 15th. This event was strong enough to bring down “several square yards of plaster” in Carson City (The Morning Appeal 5/16/1897) and brought down plaster and a piece of a brick wall in Virginia City (Daily Territorial Enterprise 5/16/1897; Doten, 1975). The main shock of this sequence caused Modified Mercalli Intensity VI to VI+ levels of shaking in Carson City.

1932 Cedar Mountain Earthquake

In the 1930s several earthquakes shook western Nevada, beginning with the 1932 magnitude 7.1 Cedar Mountain earthquake. Six months later, the 1933 magnitude 6 Wabuska earthquake occurred. Both of these events were strongly felt in Carson City. The December 20, 1932 Cedar Mountain earthquake initiated just north of Gabbs, Nevada and ruptured 46 miles (75 km) to the south, into Monte Cristo Valley (Gianella and Callaghan, 1934; Bell and others, 1999). The earthquake occurred at 10:10 p.m. PST and was felt from Los Angeles to Salt Lake City and throughout Nevada (Fig. 3). This earthquake was located in a remote part of Nevada, but nevertheless caused severe effects on local towns. Some miner’s cabins near the earthquake collapsed (Gianella and Callaghan, 1934) and there was damage in the town of Luning, where china was thrown across rooms and chimneys and walls collapsed (MMI IX; U.S. Coast and Geodetic Survey, 1968). There were some injuries in Mina; a man suffered a skull fracture when he fell from operating a small mining train (Nevada State Journal 12/26/1932) and two children were injured when an adobe house collapsed (Reno Evening Gazette 12/21/1932). Chimneys fell as far away as Fallon and Reese River Valley (Reno Evening Gazette 12/21/1932 and 12/22/1932).

Near Gabbs, Nevada, the earthquake produced scattered ground offsets over about 46 miles (75 km), with the most pronounced and continuous surface rupture near the southern end, where as much as 6.6 feet (2 m) of right-lateral offset occurred.

The 1932 earthquake caused some damage in Carson City. People ran out into the streets and overwhelmed the local telephone switchboards, which lit up with calls (Carson City Daily Appeal 12/21/1932). “Several large cracks appeared in the walls of the Federal building” and books and other small items were knocked on the floor (Carson City Daily Appeal 12/21/1932). In Carson City, shaking was consistent with Modified Mercalli Intensity VI.

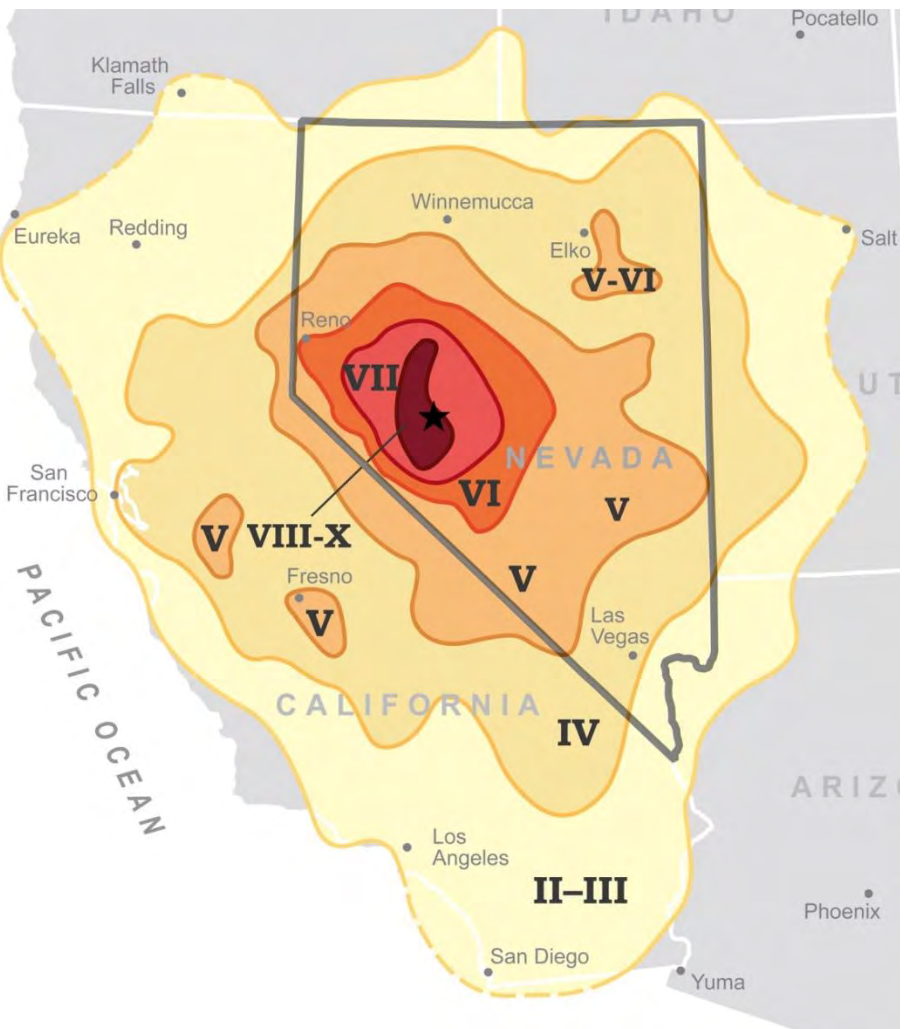

Figure 3. Modified Mercalli Intensity Map of the magnitude 7.1 1932 Cedar Mountain Earthquake, modified from Stover and Coffman (1993). For descriptions of Intensity levels please see Appendix.

As an interesting side note, earthquake lights in the direction of the earthquake area were reported by residents in Carson Valley (Gardnerville Record-Courier, 2/1/1933). Prospectors closer to the earthquake reported lightning near the peak on Pilot Mountain (Reno Evening Gazette, 2/2/1933), indicating an electrostatic discharge may have occurred in the earthquake area and been the source of lights observed in Carson Valley.

1933, June 25 Wabuska Earthquake

The 1933 Wabuska earthquake occurred on June 25, at 12:45 p.m. PST on a Sunday afternoon. It was a magnitude 6 event that strongly shook western Nevada and caused damage over 37 miles (60 km) from the epicenter. The earthquake caused some severe damage in Yerington and Wabuska and liquefaction in Mason Valley. In Yerington, the rear wall of the three-story brick Courthouse was cracked and separated from the building by 2 inches (5 cm), plaster was cracked throughout the building, and the window in the county clerk's office was broken (The Mason Valley News 6/30/1933; Reno Gazette Journal 6/27/1933). The Mason Valley News reports that "at the Parker ranch cracks running from an inch to three inches traversed the property. For some time water shot from the openings and floated the land for a distance of 200 feet [this is the dimension of the area that moved]." This is evidence of liquefaction occurring during this event.

In Carson Valley people scrambled from stores and homes (Gardnerville Record-Courier 6/30/1933) "The duration of the quake was not as long as the one in December [1932 Cedar Mountain earthquake] but was more violent while it lasted" (Gardnerville Record-Courier 6/30/1933). In Carson City, damage was limited to some plaster falling the state capitol and Federal Buildings and merchandise being thrown from shelves (Carson City Daily Appeal 6/26/1933). Two old chimneys fell in Carson City (Neumann, 1935); these may have been weakened by the 1932 earthquake. The Modified Mercalli Intensity from the 1933 earthquake in Carson City was VI to VII, identified as VI+ here.

1954, July 6 Rainbow Mountain Earthquake

The July 6, 1954 Rainbow Mountain earthquake was the first of five major earthquakes that occurred in the Fallon region over a six-month time period. The mainshock had a magnitude of 6.2 and was followed by a magnitude 6.1 aftershock about 11 hours later. Both earthquakes had surface ruptures associated with them (Tocher, 1956; Caskey and others, 2004). The earthquakes were dominantly right-lateral strike-slip movement, although surface ruptures were most notably made up of small scarps with vertical offset. This pair of earthquakes reminds us of the challenging environment emergency responders in the earthquake environment face. An earthquake nearly as strong as the original quake, or stronger for that matter, can occur during a rescue operation or the like, when people are in vulnerable positions.

In Carson City, the Rainbow Mountain earthquake was "felt by all and frightened all in the community" (Murphy and Cloud, 1956). Damage was slight, consisting of minor plaster falling (e.g., capitol building) and cracking of walls (Murphy and Cloud, 1956). The damage was consistent with Modified Mercalli Intensity VI.

1954, December 16 Fairview Peak-Dixie Valley Earthquakes

On December 16, 1954, a truly remarkable set of earthquakes occurred in Nevada. The magnitude 7.1 Fairview Peak earthquake struck west of Fallon in the early morning hours, 3:07 a.m. This was followed just four minutes and 20 seconds later by a second magnitude 6.9 earthquake that was a triggered earthquake on a separate fault, not just an aftershock from the first event. The pair of earthquakes formed surface ruptures that were in an area 62 miles long (100 km) and 9 miles wide (14 km). The quakes shook the entire state (Fig. 4). These events are a dramatic reminder of the earthquake threat Nevada faces.

In Carson City, ornamentation fell in the Assembly Chamber of the State Capitol and there were many cracks in other buildings (Murphy and Cloud, 1956). It was "felt by all and frightened all" in the community, chimneys were cracked and damaged was considerable to brick (Murphy and Cloud, 1956). Intensity in Carson City was MMI VII.

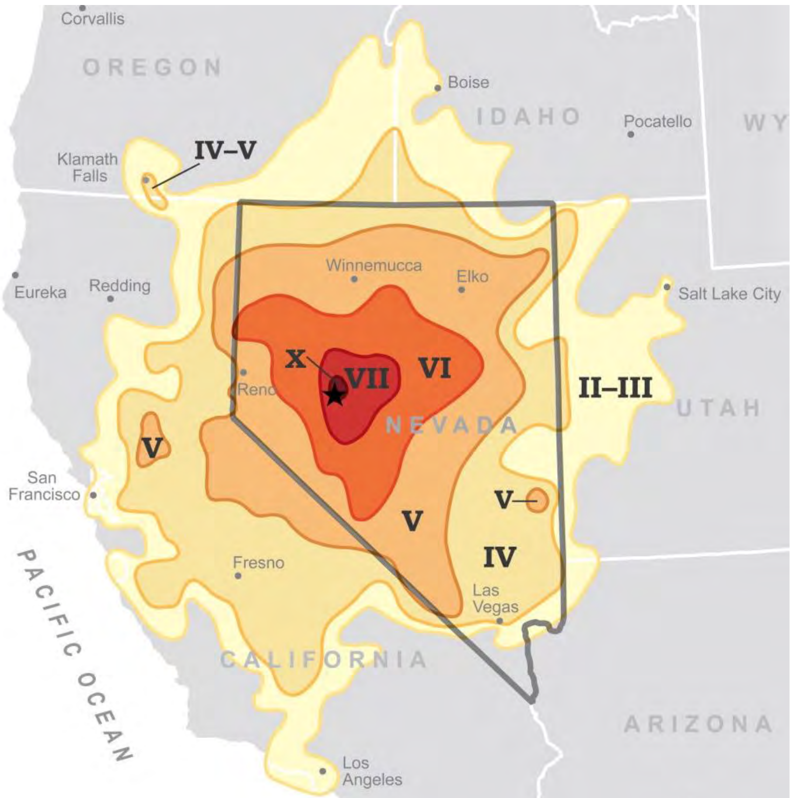

Figure 4. Modified Mercalli Intensity map for the 1954 Fairview Peak-Dixie Valley earthquakes. Modified from Stover and Coffman (1993).

Seismicity in the Carson City Region

There is a persistently high rate of background seismicity in the Carson City region. In the county, high rates of background seismicity (earthquakes of magnitude ≤3) occur in the northern and southern parts of the urban corridor and in the Pine Nut Mountains (Fig. 5). Lower rates of background activity have been recorded throughout the county. This high rate of earthquake activity is an indication of the high-level of earthquake threat that exists in Carson City.

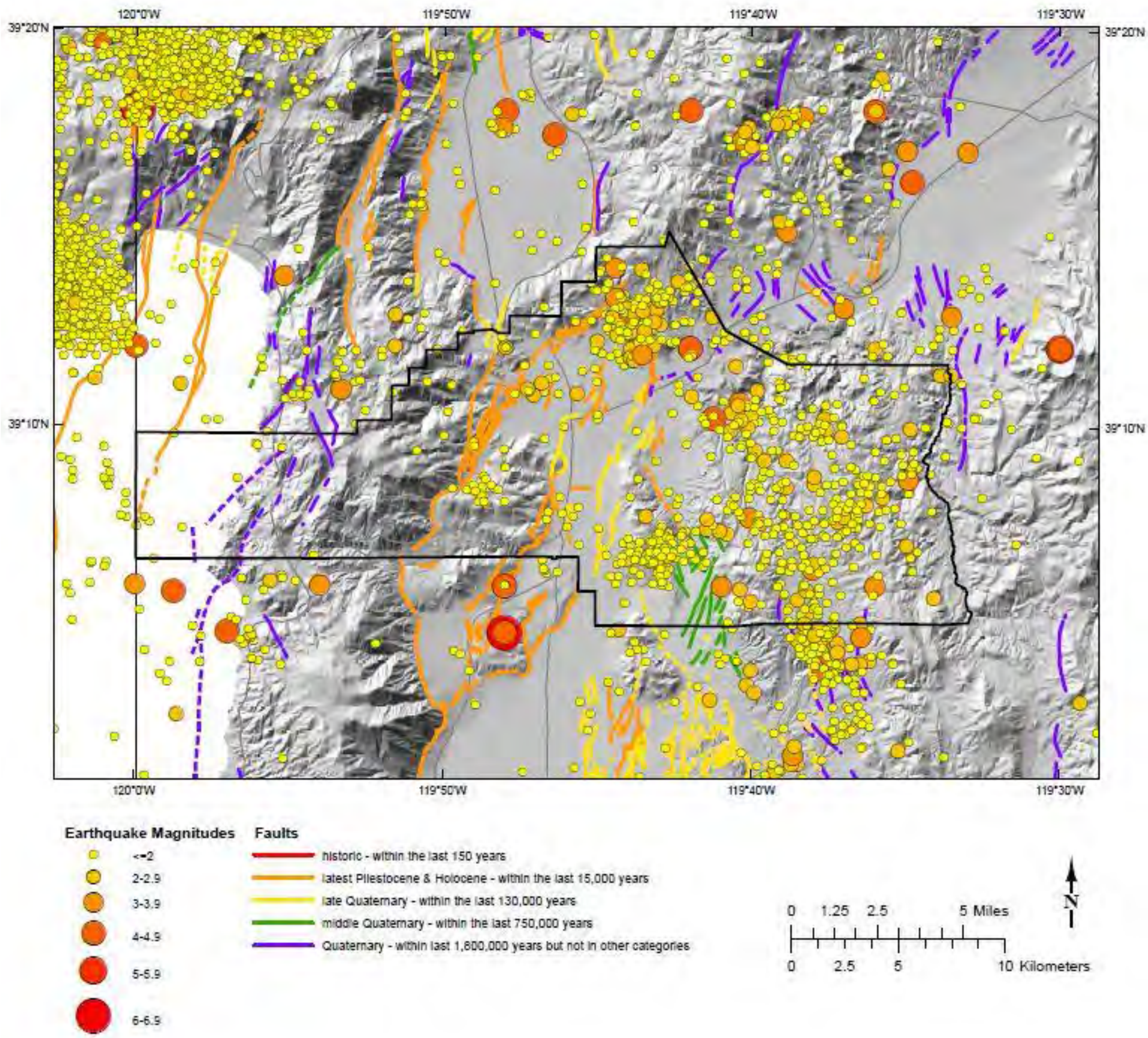

Figure 5. Earthquakes and Quaternary faults in the Carson City region.

Earthquake Faults and Potential Earthquake Magnitudes

Late Quaternary Faults in the Carson City Region

Late Quaternary faults are the sources of most earthquakes in Nevada (earthquakes can also be associated with volcanic and geothermal activity). Identifying and studying local late Quaternary faults leads to a better understanding of the earthquake and surface rupture threats faced by a community and can be used to develop useful earthquake planning scenarios.

Carson City lies in a highly active tectonic setting, near the boundary of extension associated with the Basin and Range Province and the relatively rigid Sierra Nevada Province. Some of the most active normal dip-slip faults in the provinces exist in this region. It is also in the Walker Lane belt, where one fifth of the plate motion between the Pacific Plate and the North American Plate occurs, manifested partly through strike-slip faults and strike-slip earthquakes. Thus, Carson City is being extended and wrenched, and this deformation largely occurs in the upper crust through earthquake activity. Carson City has one of the highest earthquake hazards in Nevada and the Basin and Range Province.

Quaternary faults in the Carson City region are shown in Figure 6. The largest late Quaternary faults in Carson City are shown in Figure 7 and are listed in Table 2. The faults in Table 2 are divided into normal dip-slip faults that have primarily vertical motion accommodated on moderately dipping fault planes and strike-slip faults that have primarily lateral motion, usually accommodated on steeply dipping or vertical fault planes. The focus on these faults is to identify their locations and parameters such as fault length and single-event displacement, which are used to determine the largest potential magnitude earthquakes that can occur along them. We think in terms of maximum earthquakes because these are the most demanding to prepare for; if a small earthquake occurs along a fault, the effects would be mitigated through the preparation of the larger event. These magnitude estimates have an uncertainty of about 0.3 units, so an earthquake a little larger than the estimates is possible, but these values are deemed reasonable without considering unusual circumstances.

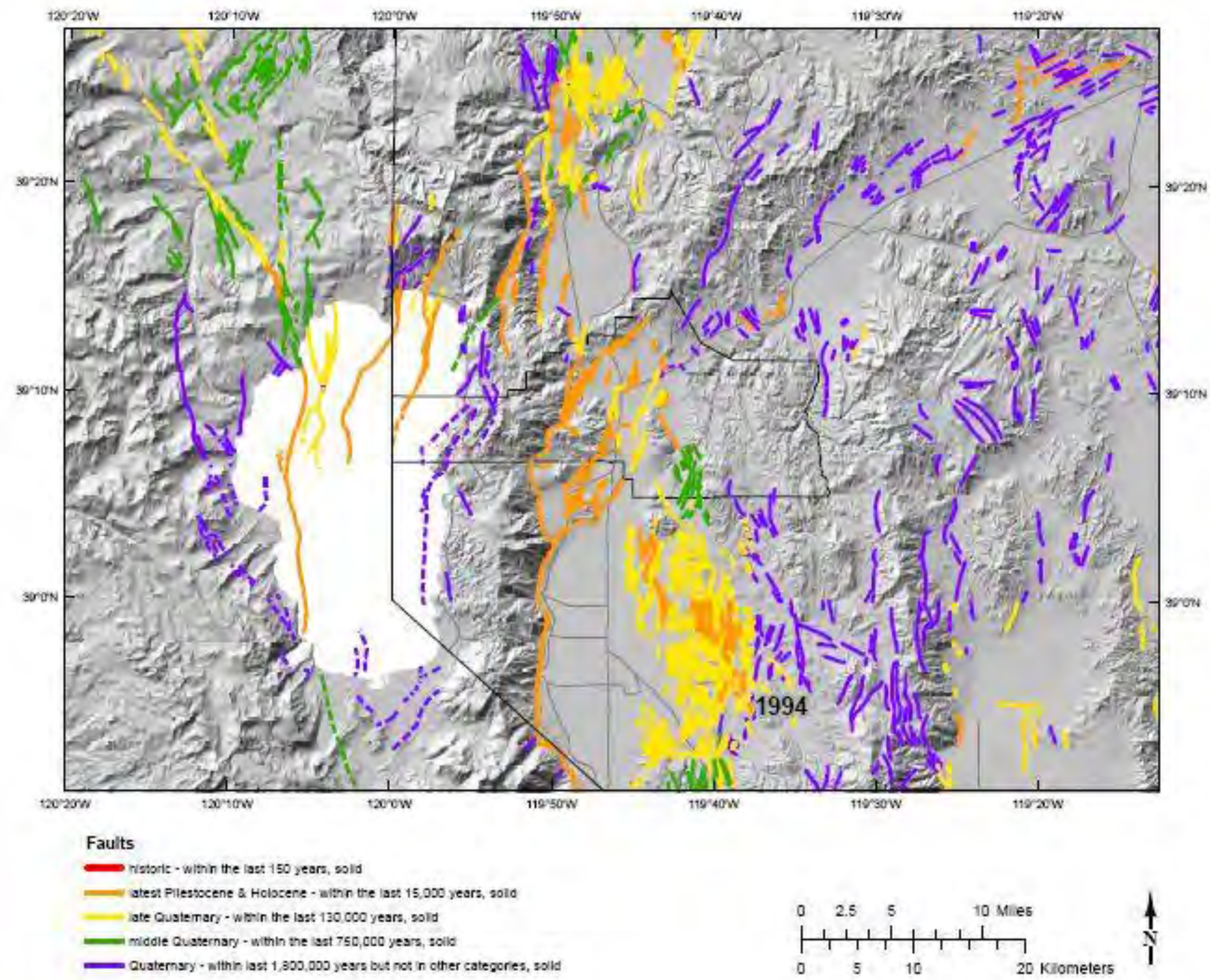

Figure 6. Quaternary faults in the Carson City region taken from dePolo (2008).

There are two scales of normal faults in the Carson City region, large, east-side-down range-bounding faults and smaller faults within the ranges or valleys. The large normal faults are northerly striking and the relative down-dropping of their eastern sides (hanging walls) create Eagle, Carson, and Tahoe Valleys. These faults appear to have large earthquakes that offset the ground vertically by 3 to 16 feet (1 to 5 m). Offsets of this size correlate with earthquakes of magnitude 6.7 to 7.2. Smaller normal faults are located within Eagle Valley, the Carson Range, and the Pine Nut Mountains. Some of these smaller faults, such as the Carson City fault, intersect large range-bounding faults and can fail with earthquakes along the larger faults as well as fail independently with earthquakes of magnitude 6.5 to 7. All of these fault sources are capable of producing damaging earthquakes. Most faults within the Pine Nut Mountains are not well studied and recent activity on these faults has not been documented. These faults do have expression in the landscape, however, and some are likely earthquake sources.

Faults extend a significant distance below the surface and normal faults have moderate dips as is shown in the cross section in Figure 8. Earthquakes commonly nucleate near the lower part of the seismogenic zone, so the epicenters above this point are commonly miles away from the mapped surface trace.

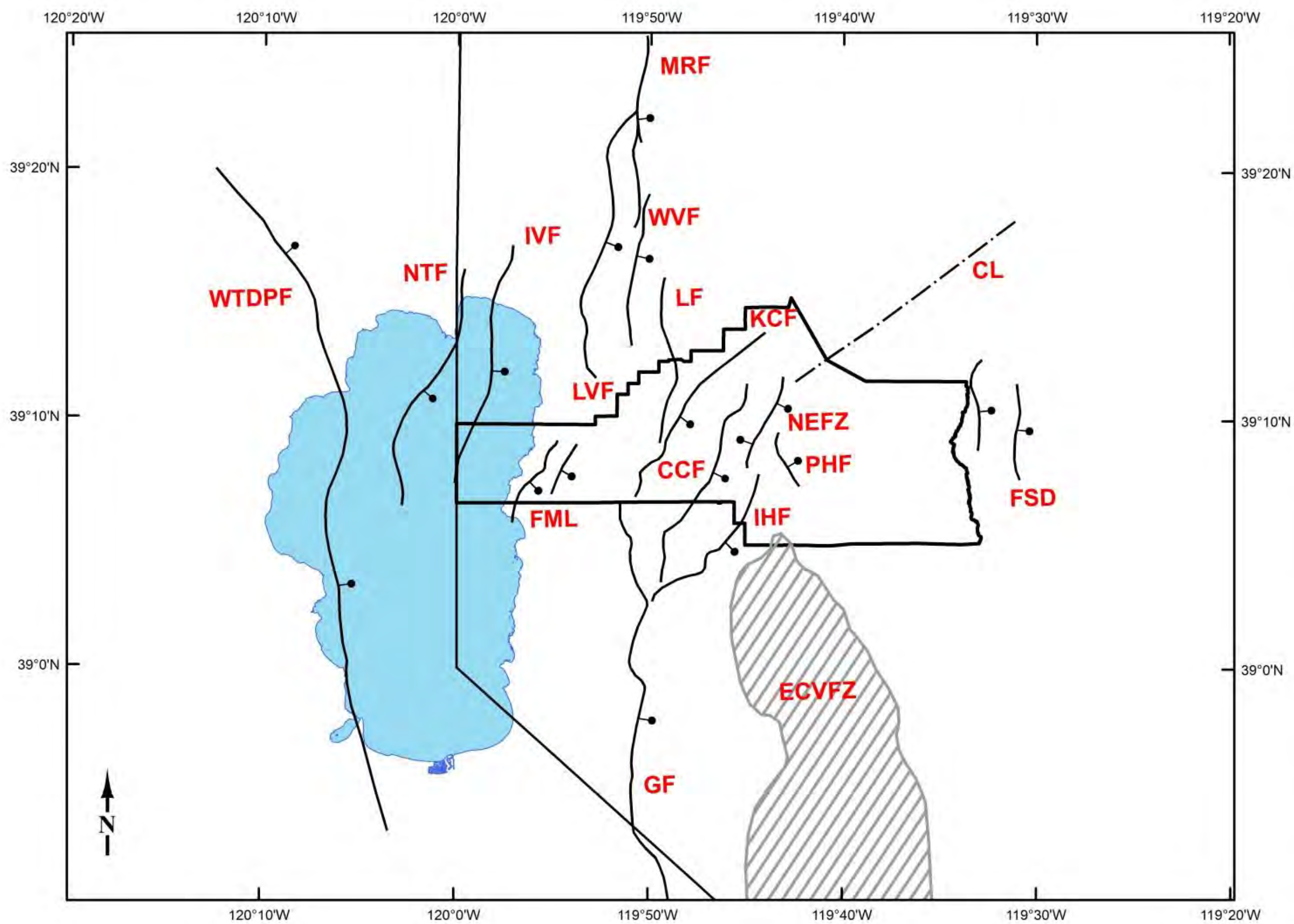

Figure 7. Schematic map of major late Quaternary faults in the Carson City region. CCF – Carson City fault, CL – Carson lineament, ECVFZ – Eastern Carson Valley fault zone (many faults in hachured area), FML – faults near Marlette Lake, FSD – faults southwest of Dayton, GF – Genoa fault, IVF – Incline Village fault, IHF – Indian Hill fault, KCF – Kings Canyon fault zone, LF – Lakeview fault, LVF – Little Valley fault, MRF – Mt. Rose fault zone, NEFZ – New Empire fault zone, NTF – North Tahoe fault, PHF – Prison Hill fault, WTDPF – West Tahoe – Dollar Point fault, WVF – Washoe Valley fault.

Table 2. Major Late Quaternary Faults in Carson City

Normal Dip-Slip Faults	Activity
Kings Canyon fault zone (KCF)	late Holocene
Carson City fault (CCF)	late Holocene
Indian Hill fault (IHF)	late Holocene
Lakeview fault (LF)	<15 ka
Prison Hill fault (PHF)	Holocene
Incline Village fault (IVF)	late Holocene
Pine Nut Range faults (?)	unknown
Genoa fault (GF)	late Holocene
Washoe Valley fault zone (WVF)	late Holocene
West Tahoe-Dollar Point fault (WTDPF)	late Holocene

Possible Strike-Slip Faults	Activity
Carson lineament (CL - left lateral?)	late Quaternary(?)
Eastern Carson Valley fault zone (ECVFZ, right-lateral oblique)	late Holocene
Northeast-striking faults near Marlette Lake (FML, left-lateral oblq?)	unknown
Faults in Pine Nut Mountains (?)	unknown

There are some local strike-slip faults in the Carson City region although the surface expression of these is less distinct than the normal faults. There are many smaller strike-slip background earthquakes. South of Carson Valley, near Double Spring Flat, a strike-slip earthquake of magnitude 5.8 occurred in 1994. Three possible strike-slip faults in the county are the Carson lineament, the Eastern Carson Valley fault zone, and short, northeast-striking faults in the Marlette Lake area. It is also possible that there are some unrecognized strike-slip faults in the Pine Nut Mountains.

In order to develop an understanding of the basin development and fault hazard in Carson City, a basin depth and late Quaternary fault map was produced (Fig. 9). The basin depths are from work done by Abbott and Louie (2000). They report the Eagle Valley basin with a maximum depth of 1,640 feet (500 m) deep. Based on proximity, the main basin and its two deepest portions appear to be formed by movement along the Carson City fault (Fig. 9). The New Empire fault zone is along the southeastern portion of the basin, and is likely at least partly related to, or accommodating the development of, the southeast side of the basin (Fig. 9). There is a much smaller basin against the Kings Canyon fault zone with a modeled maximum depth of 656 ft (200 m; Abbott and Louie, 2000), and can be related to movement along that fault zone. Thus, the development of the Eagle Valley basin can largely be attributed to movement along contemporary faults. One possible exception is the northeasterly elongation of the main basin. This area extends past the New Empire fault zone and is parallel and coincident with the trend of the Carson lineament. It is possible that there is a relationship between this northern portion of the basin and the Carson lineament. If so, this may be a possible earthquake hazard.

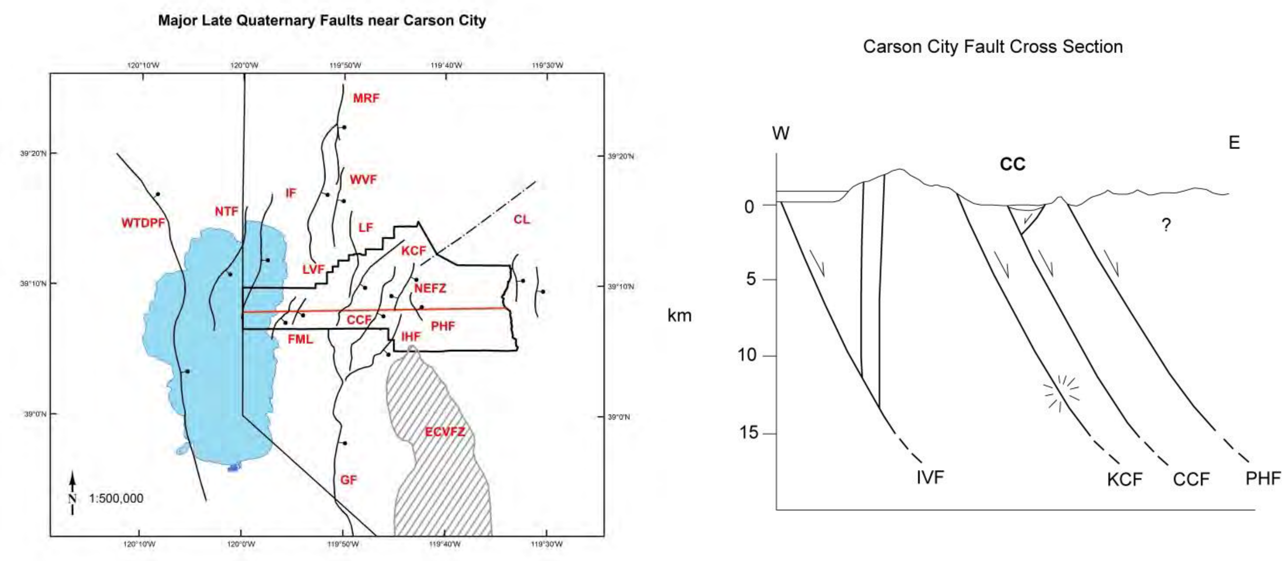

Figure 8. Major faults in the Carson City region with a red line for the cross section (left) and a cross section through the Earth (right) showing the downward projection of those faults (10 km is roughly 6 miles and 15 km is roughly 9 miles). IVF – Incline Village fault, KCF – Kings Canyon fault zone, CCF – Carson City fault, PHF – Prison Hill fault, CC – Carson City. Arrows show the motion of the faults, the asterisks is a common nucleation depth for major earthquakes along faults, and the question mark is where unknown faults might be. An earthquake on the Kings Canyon fault zone might have an epicenter on the east side of Carson City because the fault projects down and east.

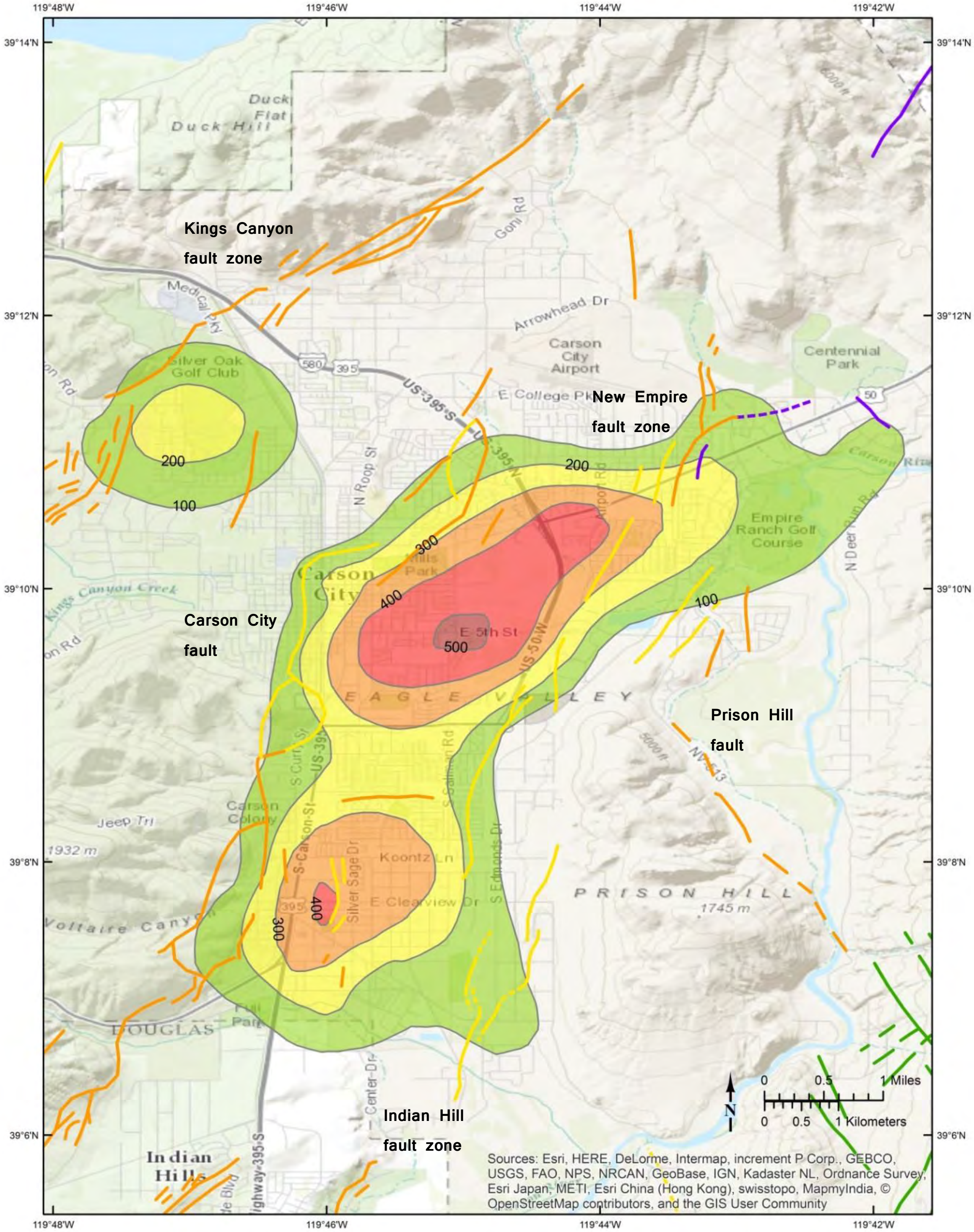

Figure 9. Quaternary faults and basin fill depths in Carson City. Basin depths from Abbott and Louie (2000), are principally based on gravity measurements and are contoured in meters. The deepest part of the basin is 1640 feet (500 m) deep. Orange faults have moved within the last 15,000 years, yellow faults have moved within the last 130,000 years, green faults have moved within the last 750,000 years and blue faults have moved within the last 2,600,000 years.

There are several major faults that surround Carson City and earthquakes along these faults can cause damage in the county. The major faults that immediately surround the county are listed in Table 3, but they are not discussed further or modeled in this report. They can be viewed on geologic maps, such as Stewart (1999).

Table 3. Major Late Quaternary Faults near Carson City

Normal Dip-Slip Faults

Little Valley fault
North Tahoe fault
Faults south-southwest of Dayton

Kings Canyon Fault Zone (KCF)

The Kings Canyon fault zone is located at the base and in the lower slopes of the Carson Range and the southwestern part of the Virginia Range. It is made up of a zone of two to six parallel fault traces over most of its length. The Kings Canyon fault zone extends from near Highway 50 to the vicinity of McClellan Peak for a distance of 10 to 11 miles (16 to 18 km). The fault is an eastward-dipping normal dip-slip fault with a possible left-lateral component that likely underlies all of Carson City. A major earthquake on the Kings Canyon fault zone would undoubtedly cause major damage to Carson City. The Capitol suite of scenario earthquakes and the Kings Canyon fault zone scenario represent earthquakes that could occur on this fault.

The southern end of the Kings Canyon fault zone appears to intersect an east-west tear fault near Highway 50, which intersects the Genoa fault to the west. This is a “conservative” discontinuity in the Carson Range fault system, meaning that earthquakes can cross it without a large change in volume. This can facilitate an earthquake on the Genoa fault crossing or triggering an earthquake on the Kings Canyon fault zone, or visa versa. The northeastern end of the Kings Canyon fault zone dies out as it approaches the volcanic centers near McClellan Peak (Trexler and Bell, 1979; Bell and Trexler, 1979). Recent activity along the fault zone is indicated by young fault scarps and grabens and uplifted late Quaternary alluvial fan deposits near Vicee Canyon. The zone has also formed several well-developed fault facets on the eastern front of the Carson Range.

The Kings Canyon fault zone was trenched between Ash and Vicee Canyons along the youngest appearing fault trace, which was also the one that was closest to urban development (dePolo, 2014). Three trenches and a soil pit were dug for this investigation. Trench 3 yielded the best paleoseismic information, with a series of stacked colluvial deposits, each thought to be related to an earthquake event. The results of this study were somewhat surprising. The preferred interpretation of the information collected is that four paleoearthquakes with vertical offsets of 6.4 feet (~2 m) each occurred between ~4000 and ~1420 years ago (dePolo, 2014). At Trench 3, a total vertical offset of 27 ±1.6 feet (8.4 ±0.5 m) was created by these late Holocene events. Accelerator radiocarbon and optically stimulated luminescence dates indicate that the offset alluvial fan surface was much younger than previously thought (~5 ky versus ~15 ky). Thus, a relatively high slip rate for the Basin and Range Province was calculated for this late Holocene cluster of events. OxCal modeling of the dates and event horizons yielded the following ages and uncertainties for the four-event model (ybp – years before present):

Paleoearthquake 1: 1420 ± 70 cal ybp
Paleoearthquake 2: 1630 ± 110 cal ybp
Paleoearthquake 3: 1820 ± 140 cal ybp
Paleoearthquake 4: 3960 ± 820 cal ybp

The best age for the alluvium just below the fan surface at Trench 3 was luminescence sample KC3-L2 (4420 - 5260 ybp) and taken with the vertical offset of the fan surface was 8.4 ±0.5 m, yields a vertical fault slip rate of 1.5 to 2.0 m/ky, but this includes two open intervals at either end. Considering the four-event model, three closed intervals can be used to calculate fault slip rate. Considering uncertainties involved, the vertical slip rate of the earthquake cluster Paleoearthquake 1 –

Paleoearthquake 3 ranges from 1.7 to 3.9 m/ky (fault slip rates are always reported in metric units.

Existing evidence indicates that the Kings Canyon fault zone did not fail during the most-recent event along the Genoa fault to the south, but there are candidate events along the zone with ages that are permissive to be correlative to the prior event along the Genoa fault.

Ignoring uncertainties, the time interval between these recent events along the Kings Canyon fault zone was ~200 years to ~2400 years, and it has been 1420 years (at least 1350 years considering uncertainty) since the last event. The potential maximum earthquake magnitude estimate for this fault zone, M6.9, is weighed heavily on using the surface displacement per event.

Carson City Fault (CCF)

The Carson City fault is a normal down-to-the-east fault that is within the hanging wall of the Genoa and the Kings Canyon faults (Fig. 7). The Carson City fault splays northeast off a salient in the Genoa fault, crosses through the middle of Indian Hill, and continues north into Carson City. Movement along the Carson City fault formed the main part of the basin in Eagle Valley (Fig. 9).

The fault poses a near-field shaking hazard and surface rupture hazard to Carson City. Nevada's State Capitol and Legislative Buildings are within a quarter mile (0.4 km) of the surface trace of Carson City fault, which beneath them. The fault goes through Carson City, which is built on its footwall and hanging wall. In Carson City, houses and other buildings are built near and on the fault, and development is approaching the southern part of the fault.

The Carson City fault is 10 to 11 miles (16 to 18 km) long, depending on whether it ends at the Indian Hill fault or continues all the way to intersect with the Genoa fault. The northernmost part of the fault is mapped as ending just south of the Carson City Airport (Bell and Trexler, 1979).

Geomorphic features along the Carson City fault are well-developed and distinct, evidence of a fairly active, late Quaternary fault. Fault scarps from the last event that can be seen within Indian Hill and the southern part of the central portion of the fault. These scarps are easily visible as shadows in the mid-afternoon lighting. Pease (1979b) commented that three bevels can be seen in fault scarps within Indian Hill, indicating a late Pleistocene and two Holocene events. Within Carson City, there is a prominent scarp just west of Bonanza Street. This northerly trending fault scarp is as high as 43 feet (13 m) and offsets early Quaternary deposits (Kirkham, 1976; Trexler, 1977). The fault along Bonanza Street is a groundwater barrier. Trees along the fault grow larger than surrounding trees. The northernmost fault expression in town is a scarp with a maximum height of 16 feet (5 m) in late Quaternary alluvium (Kirkham, 1976; Trexler, 1977). The central part of the fault bounds a short range front (C Hill) and has well-developed fault facets (360 feet (110 m) high), oversteepened range bases, side-hill scarps and benches, and compound scarps. A low tectonic trim line, or small bench created by increased activity along the fault, is present just south of C Hill. There are two hot springs proximal to the Carson City fault. The Carson City Hot Springs lie about 0.4 miles (0.7 km) north-northwest of the north end of the Carson City fault and Hobo Hot Springs is near the intersection with the Genoa fault.

There have been two major paleoseismic studies along the Carson City fault, Pease (1979b) and Ramelli and others (1999). Pease did scarp morphology studies along the southern part of the fault and a trench study to confirm the most recent age of faulting (Pease, 1979a). Ramelli and others (1999) trenched a young scarp along the Carson City fault and developed timing constraints on the last two paleoearthquakes.

Pease (1979b) examined fault scarps along the Carson City fault in the Indian Hill area and noted the faults offset Holocene alluvium and that the fault scarps have three bevels indicating three late Pleistocene or Holocene events. Total offset of these three events is estimated to be 10.8 to 27.9 feet (3.3 to 8.5 m) based on surface offsets (Pease, 1979a). Pease (1979b) found that soils in deposits offset by these events are poorly developed Entisols (~4000 years old) and infers that the three most recent events along the southern Carson City fault are younger than 4,000 years.

Pease (1979 - unpublished, presented in Bell and others, 1984) had a trench excavated across a 3.3-foot-high (1-m-high) scarp in Holocene alluvium to verify the most recent activity of the Carson City fault. The displacement along the fault plane on Pease's (1979 unpublished) trench log was 5.9 ±1.6 feet (1.8 ±0.5 m) for a single event.

Ramelli and others (1999) trenched a small scarp on the south side of a prominent hill, just southwest of Carson City, called C Hill. Ramelli and others (1999) identified evidence for three paleoearthquakes in the C Hill trench, and were able to constrain the age of the two most recent events. The main fault zone and several extension fissures offset all but the youngest alluvial deposits, and extend to near the ground surface (Ramelli and others, 1999). Ramelli and others (1999) collected a piece of charcoal near the bottom of a fissure formed during the most recent event which yielded a radiocarbon date of 390 ±40 ^{14}C ybp. This date closely approximates the age of the most recent event along the Carson City fault, assuming the charcoal was on the surface when the event occurred and fell into the fissure (Ramell and others, 1999). The next oldest event offset alluvium vertically by 3.9 ± 1 feet (1.2 ±0.3 m; Ramelli and others, 1999). This event offset alluvium that has a radiocarbon date of 2,590 ±130 ^{14}C ybp, and thus, the second oldest earthquake was younger than this date.

There is only a single-earthquake interval rate and a reconnaissance rate available for the Carson City fault. A single interseismic interval between Paleoearthquake 2 and Paleoearthquake1 (youngest) is available for the Carson City fault. Using the range in calendar-corrected constraining dates, the range of years for this interseismic interval is 1,840 to 2,640 years. DePolo (1998) estimated a long-term reconnaissance fault slip rate of 0.2 m/ky for the Carson City fault based on maximum basal fault facet height and an empirical relationship.

The timing of the most recent events along the Carson City fault and the Genoa fault is similar and both faults may have ruptured together during these events.

Indian Hill Fault (IHF)

The Indian Hill fault is a normal dip-slip fault zone with displacement down-to-the-southeast (Fig. 7). The fault has been mapped at a scale of 1:24,000 by Pease (1979b), Bell and Trexler (1979), and Garside and Rigby (1998). The overall trend of the fault zone is N40ºE, but locally, fault strikes vary from EW to NS. Because of its northeast orientation, it is possible there is a left-lateral strike-slip component. The Indian Hill fault is relatively simple and continuous, consisting of a single fault, except in the central part of the zone where a major fault trace distributes into multiple traces in Indian Hill.

The Indian Hill fault splays off of a salient along the Genoa fault, bounds southern Indian Hill, and partly extends into these hills. The fault continues east and after crossing Clear Creek, where fault expression has been eroded away or buried by young alluvium, forms a couple back-facing, down-to-the-east fault scarps in the western flank of Prison Hill. The fault zone effectively separates Carson Valley from Jacks Valley, Indian Hills, and Eagle Valley to the north. The Indian Hill fault is 7.7 miles (12.5 km) long from its intersection with the Genoa fault to the end of its mapped trace at the base of Prison Hill. A maximum length of 8.7 miles (14 km) includes possible fault extensions into Prison Hill or along the western flank of the hill.

There has been limited fault exploration of the Indian Hill fault zone. Trexler and Bell (1979) and Pease (1979a) dug two trenches across the central part of the fault zone and Pease (1979a) logged these (Trexler and Bell, 1979; Trenches 5 and 6) and additionally logged a utility trench across the fault (Pease, 1979a; Trench 1). Trench 5 was dug across a 3.3-foot-high (1-m-high) fault scarp and exposed the main fault down-dropping a middle to late Pleistocene surface that is buried by two Holocene packages of alluvium and has a large fissure developed at the fault from the most recent event. The middle to late Pleistocene age for the surface is based on a ~12-inch-thick (~30-cm-thick), well-developed, prismatically structured, reddish-colored argillic horizon, that is generally correlated with local soils that 10s of thousands to 130,000 years old (Trexler and Bell, 1979; Bell and Pease, 1980).

Trexler and Bell (1979) indicate that both of the recent events occurred within the last 3,000 years. This time constraint is based on an Entisol, or incipient soil (A-C soil profile), formed on the upper Holocene alluvium. No soil is mapped as formed in the alluvial package below this, indicating the two events probably occurred relatively close in time. Vertical offsets during the two most recent events are about 3.3 ft (1 m) each as measured from the trench log. Pease (1979a), Trexler and Bell (1979), and Bell and Pease (1980) all interpret a hiatus on this fault in late Pleistocene to allow the soil (B horizon) to form across the fault. The most recent event along the Indian Hill fault may have been part of the most recent event on the Genoa fault.

New Empire Fault Zone (NEFZ)

In New Empire and eastern parts of Carson City (Fig. 7), there are several late Quaternary faults that make up a complicated fault pattern that is not easily characterized (Fig. 10; dePolo 1996). These faults have been divided into two fault zones by dePolo (1996), the New Empire fault zone on the west and the Prison Hill fault on the east. The New Empire fault zone is a group of eroded fault scarps and lineaments that trend north-northeast from Prison Hill through New Empire, and northward towards the Virginia Range. Along strike, faults within the zone have different characteristics, possibly indicating a segmented nature to this zone. The New Empire fault zone bounds the eastern part of sedimentary basin under Eagle Valley and appears to have created that side of the basin (Fig. 9). The zone is made up of normal dip-slip faults (it is unknown if there is any strike-slip component). Most of the faults have northeasterly or northerly strikes, and individual faults have down-to-the-west or down-to-the-east downthrown sides. The most recent fault activity in the New Empire fault zone was indicated by Bell and Trexler (1979) to be from Holocene (11,500 years) to as much as 100,000 years old.

The New Empire fault zone is about 3 mi (5 km) long where it crosses the northern part of Eagle Valley. If the zone includes the southern extension along the northwestern part of Prison Hill, the length increases to 5 mi (8 km). DePolo (1996) measured a vertical separation of 28 ft (8.5 m) of an alluvial surface estimated to be between 180,000 and 220,000 years old (estimated maximum age of 500,000 years) along this fault zone. Using these values, vertical fault slip rate of 0.05 m/ky (range 0.02 to 0.06 m/ky) was estimated.

Lakeview Fault (LF)

The Lakeview fault is a normal dip-slip fault, which has down-to-the-east displacement (Fig. 7). The surface trace of the Lakeview fault lies above the Kings Canyon fault zone, in the lower slope of the Carson Range. The two faults overlap for 3.7 miles (6 km). The northern half of the Lakeview fault (north of Vicee Canyon) is at the base of the range and the fault is the main range front fault in that area. A compound fault scarp in Washoe Valley with a similar strike, but across a small step and gap in surface expression, may be a northern extension of this fault. The Lakeview fault is 7.1 mi (11.5 km) long including the fault scarp in Washoe fault, and could be as long as 9.9 mi (16 km) considering possible fault extensions in Washoe Valley. Similar to the Kings Canyon fault zone, the Lakeview fault underlies much of Carson City.

The Lakeview fault is a relatively unstudied fault. There is a young, single-event side-hill bench in the range front just north of Lakeview, which is visible with shadowing in the mid-afternoon sun. This section of the Lakeview fault and fault scarp in Washoe Valley are considered to have Holocene activity (Trexler and Bell, 1979).

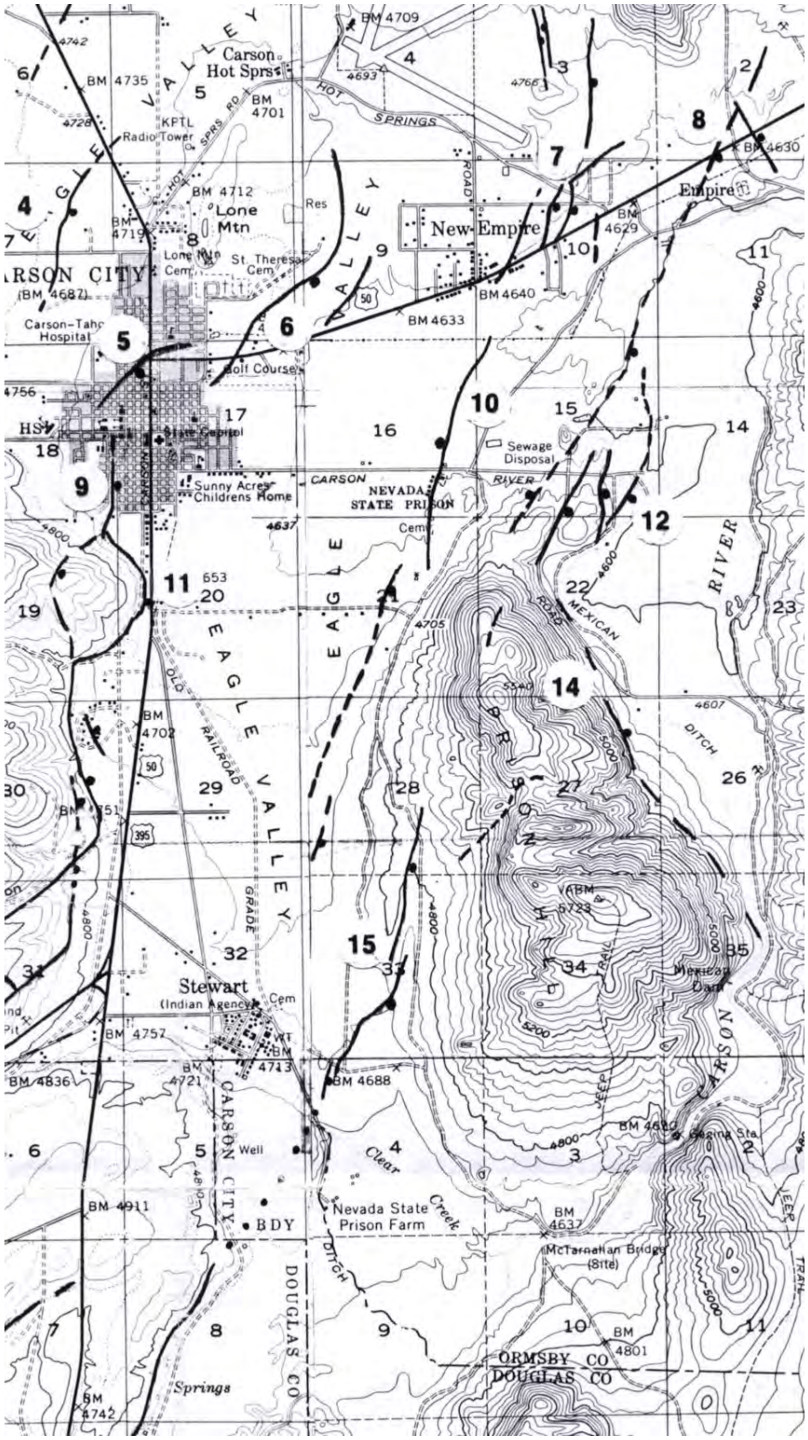

Figure 10. Section of fault map from dePolo (1996). The New Empire fault zone includes faults at Locations 7 and 10. The Indian Hill fault ends near Location 15, and continues to the southwest. The Prison Hill fault is at Locations 12, 14, and possibly 8. Faults are black lines, dashed where inferred and dotted where concealed.

Prison Hill Fault (PHF)

The Prison Hill fault (Fig. 7) bounds the eastern side of Prison Hill and the eastern side of a low uplifted area that extends north of Prison Hill (this low uplifted area is bounded on the western side by the New Empire fault zone). The Prison Hill fault is a normal dip-slip fault with down-to-the-east displacement. It is a singular fault trace along the base of Prison Hill. At least three fault traces make up the central section of the fault. Evidence for addition parallel fault traces may have been eroded by flooding from the Carson River.

The main trace of the Prison Hill fault can be followed for 3.1 mi (5 km). A maximum length of 5.6 mi (9 km) considers an additional northernmost trace and fault extensions across the river to the south.

In the central part of the Prison Hill fault, a consultant's trench exposed a vertical separation of 8.2 ft (2.5 m) of an argillic horizon, thought to be of Sangamonian age (74,000 to 130,000 years before present; dePolo, 1996). The trench was across a splay off the main fault, and thus a minimum fault slip rate of 0.04 m/ky (0.02 to 0.05 m/ky) was estimated by dePolo (1996). An oversteepened portion of the compound fault scarp appeared to be a single-event offset of about 1.9 ft (60 cm). Only the central portion of the Prison Hill fault was mapped by Bell and Trexler (1979), who indicated the age of youngest fault displacement was mid to late Pleistocene (35,000 to 100,000 years before present). Trench exposures and a scarp along Prison Hill indicate the youngest activity was likely Holocene.

Incline Village fault (IVF)

The Incline Village fault (Fig. 7) is a normal, down-to-the-east, dip-slip fault, which extends from the Carson Range, southward through Incline Village and under Lake Tahoe. Movement along the fault formed fault scarps on land as much as 15.5 ft (4.75 m) high and on the floor of Lake Tahoe (Seitz and others, 2006). The well-mapped fault trace is 8.4 mi (13.5 km) long, with a maximum length of 12.7 mi (20.5 km) including an extension to the south along sub-lacustrine landform and along glacially eroded ridge to the north (Seitz and others, 2006; Hines and others, 2014). The fault has been trenched onshore (Seitz and others, 2005) and imaged offshore (Seitz and others, 2006). Seitz and others (2005) estimate an average vertical slip of 12.1 ft (3.7 m) per event for two events exposed in the trench, and a fault slip rate of 0.11 m/ky. Three events were identified in the trench. The most recent event was about 500 years ago, the previous event was about 32,000 years ago, and the third event back was between 36,700 and 62,000 years ago (Seitz and others, 2005). Seitz (2012) noted a substantial overlap of the Incline Village fault and the North Tahoe fault, and a small step between these and the West Tahoe - Dollar Point fault. It is possible that the Incline Village fault can fail as part of a much larger, cascading earthquake, not unlike the Genoa and Carson City faults being thought to have failed together about 300 years ago (Ramelli and others, 1999; Ramelli and Bell, 2014).

Northeast-Striking Faults near Marlette Lake (FML)

The faults near Marlette Lake (Fig. 7) have not been investigated. There are general landforms along them that could have been formed by late Quaternary activity. Two, northeast-striking faults have been singled out as possible earthquake sources. There is ~4.3 mi (~7 km) of fault-related geomorphology. A maximum length of 7.4 mi (12 km) extends the faults to Marlette Lake and south a short distance into Lake Tahoe.

Pine Nut Range faults

Not many Quaternary faults are mapped in the northern Pine Nut Range (Fig. 6). There are lineaments and possible fault-controlled slopes along some faults that may indicate recent fault activity. A maximum background earthquake scenario (M6.5) is considered for this area to understand the potential impact of any late Quaternary faults which might exist.

Genoa fault (GF)

The Genoa fault is the largest and most spectacular late Quaternary fault in Carson Valley. It is part of the Carson Range fault system, which bounds the eastern side of the Carson Range and underlies adjacent valleys to the east, including Carson Valley. The Genoa fault is an east-side-down normal dip-slip fault (Fig. 7). Fault scarps, fault facets, and other geomorphic expressions indicate earthquake rupture lengths extended 16 to 47 mi (25 to 75 km) and coseismic ground offsets were as much as 18 ft (5.5 m; Ramelli and others, 1999a). Fault studies indicate the most recent large event occurred 300 to 400 years ago and the prior event was about 1,800 years ago (Ramelli and others, 1999a; Ramelli and Bell, 2014). The size of the ground offsets and the probable length of paleoearthquakes indicate a moment magnitude 7.2 for these events. Such an earthquake would cause severe damage to Carson City and general damage to the entire Reno-Carson City urban corridor. Figure 2, the Modified Mercalli Intensity of the 1932 Cedar Mountain earthquake, gives an idea of the area an earthquake of this magnitude could affect. Surface rupture from the Genoa fault could occur in Jacks Valley, Indian Hills, and along the Carson City, Kings Canyon, and Indian Hills fault zones.

The Genoa fault appears to have had two recent events that were clustered in time. The short-term fault slip rate appears to be about 2-3 m/ky, whereas the longer term slip rate may be closer to 0.3 to 0.8 m/ky (Ramelli and others, 1999a). If the large earthquake displacemements along the Genoa fault are considered with the longer term slip rates, large events are separated by several thousand to over 10,000 years. It is not clear whether the recent activity of the Genoa fault will continue at a higher rate or at a longer-term rate. It is fortunate that a large earthquake recently occurred along the fault, presumably providing some time before the next event.

Eastern Carson Valley fault zone (ECVFZ)

The Eastern Carson Valley fault zone is 11 to 16 mi (18 to 26 km) long and over ~6 mi (~10 km) wide. It is unusual because it is made up of many fault traces spread out over an area, rather than being a narrower zone of faults (Fig. 7). There are literally hundreds of individual fault traces in this belt (dePolo and others, 2000). The fault zone is in the eastern half of Carson Valley and movement along these faults has created the foothill topography of the Pine Nut Mountains.

Earthquakes appear to occur along the Eastern Carson Valley fault zone in variable and complicated ways. It is likely there are at least two modes of earthquake faulting. These are normal dip-slip movement, possibly involving several parallel faults, and north-northwest right-lateral strike-slip movement involving multiple surface faults failing together in left stepping breaks. The normal dip-slip mode is the predominant structural makeup of the fault zone, with subparallel normal dip-slip faults. The strike-slip rupture mode is indicated by the most recent event, which occurred about 520 to 920 years ago (dePolo and Sawyer, 2005). This event created small fault scarps that were partially arranged in a left-stepping en-echelon pattern. This pattern is consistent with right-lateral faulting along northwest oriented blind fault, or a series of triggered earthquakes along the northerly striking planes, which may release of some right-lateral stresses.

Earthquake magnitude estimates for the Eastern Carson Valley fault zone were based on overall length and do not consider the possibility of significant parallel fault trace ruptures potentially increasing the fault length. The length-based magnitude estimate is 6.7. A minimum displacement of >4.6 ft (>1.4 m) was found in one trench along the Eastern Carson Valley fault zone by dePolo and Sawyer (2005). This correlates to an earthquake of magnitude of ≥6.8 and this value was adopted as the estimated potential magnitude. Additional paleoseismic studies are needed to understand the rupture modes of earthquakes and how often earthquakes occur along the Eastern Carson Valley fault zone.

Carson Lineament (CL)

The Carson lineament is a northeast-trending topographic lineament, which is over 30 miles (48 km) long and is difficult to characterize as a seismic hazard. The lineament appears to influence the major faults in Carson City; the northern end of the Kings Canyon fault zone and the Carson City fault both change strike crossing the lineament and become more northeasterly striking, paralleling the Carson lineament (Fig.7). The orientation of the northern part of the main basin in Eagle Valley is parallel to the lineament (Fig. 9). The Carson lineament appears to be influencing contemporary tectonics. The lineament lacks a through-going late Quaternary fault that one might identify and characterize as a potential earthquake source. There are some small Quaternary faults along the lineament, which can be characterized (c.f., Stewart, 1999) and a background earthquake threat can be considered for the lineament, but whether there is any greater hazard is not known. Within Carson City, the Carson lineament's greatest effect may be influencing the location and orientation of late Quaternary faults, and basin structure.

West Tahoe - Dollar Point fault (WTDPF)

The West Tahoe-Dollar Point fault is located on the western side of the Lake Tahoe basin (Fig. 7). The northerly striking surface and subaqueous fault trace is in California, but the fault dips to the east and is a major seismic hazard for the Tahoe basin and Carson City. The West Tahoe-Dollar Point fault is the largest fault in the Tahoe basin and is range-bounding along much of its length. The fault is 31 to 38 mi (50 to 60 km) long and has a maximum single event offset of ~12 ft (~3.7 m; Brothers and others, 2009). These parameters indicate the West Tahoe-Dollar Point fault is a substantial earthquake source. The preferred age of the most recent event is 4,100 to 4,500 years ago (Brothers and others, 2009). This fault could be the source of a tsunami in Lake Tahoe, through faulting of the lake floor, and/or from triggered collapse and sliding of subaqueous sedimentary banks around the lake, and/or from large landslides entering the lake. Brothers and others (2009) determined a Holocene fault slip rate for the West Tahoe-Dollar Point fault of 0.4 to 0.8 m/ky based on offset Tioga-aged glacial deposits.

Most estimates of earthquake magnitude potential along the West Tahoe-Dollar Point fault are magnitude 7.1, which is adopted as the maximum magnitude. A large earthquake along the West Tahoe-Dollar Point fault would be expected to create severe shaking in the communities surrounding Lake Tahoe, including Carson City. Lake tsunami and seiche could also occur along the shores of Lake Tahoe from an earthquake along this fault.

Background Earthquakes

Although the larger faults in the county have been mapped, many other potential earthquake faults have not been individually recognized because they are inconspicuous, buried by sediments, or are structurally blind (a blind fault doesn't come to the surface). A background earthquake potential is used to account for earthquakes along these other, unrecognized faults. A background earthquake is an event that can occur anywhere, whether there is an indication of a fault at the surface or not. In 2008, the damaging, magnitude 6 Wells earthquake occurred about 5.4 mi (9 km) north of the town of Wells (Smith and others, 2011), didn't rupture the surface and was considered a background event (Ramelli and dePolo, 2011). An event similar to Wells can occur anywhere in the county.

A magnitude 6.5 earthquake is considered the general threshold of surface-rupture faulting (dePolo, 1994) and is used for the maximum background earthquake hazard. It is acknowledged, however, that higher background earthquake levels, as high as magnitude 7, can occur if multiple faults fail in sequence during an earthquake, as appears to have happened in the 1932 Cedar Mountain earthquake (Bell and others, 1999).

Maximum Magnitude Analysis of Faults

A wide range of earthquake sizes can occur along a fault, from very small earthquakes to an earthquake that extends the maximum dimension of the fault zone. The largest event that will likely occur along a fault is termed the *maximum earthquake*. Most of the earthquake-planning scenarios produced in this report are based on the maximum earthquakes. Logically, if you can handle the largest event, you can handle any smaller event as well ("plan for the worst and hope for the best"). Table 4 lists several parameters for the major faults in Carson City, including those used in the magnitude analysis, including the maximum and minimum surface lengths and single-event displacements

Two fault parameters and two studies were used to estimate maximum earthquake magnitudes. Maximum magnitudes were scaled based on fault length and maximum fault displacement. The relationships used between moment magnitude and these fault parameters were developed by Wells and Coppersmith (1984) and Wesnousky (2008) and are shown in Table 5. Wells and Coppersmith (1984) is the standard reference (e.g., National Seismic Hazard Map) and Wesnousky (2008) is a more contemporary study. These relationships are based on measured rupture lengths and surface displacements from historical earthquakes with known magnitudes. The "all fault types" relationship was used from each study because the statistics are more robust and there are multiple fault types in Carson City; in other words, a distinction is not made between normal dip-slip or strike-slip earthquakes in the magnitude estimation. The results using the two studies were within 0.2 magnitude unit of each other (Table 6).

Maximum Earthquake Magnitudes for Faults in Carson City

The lengths of the Major late Quaternary faults range from 3.1 miles (5 km) to ~47 miles (75 km), with many between 6 miles and 12 miles (10 and 20 km). Single-event displacements have been from 2 to 18 feet (0.6 to 5.5 m). These parameters correlate with magnitudes ranging from M5.9 to M7.2. The range in estimated magnitude values for an individual fault is 0.6 units or less (Table 6). These magnitude values were then considered for determining the scenario earthquake magnitudes so that scenarios will be as realist as possible. In general, there was more weight assigned to the single-event displacement values when determining the scenario event magnitudes. This was because they could be more precisely and confidently determined. It is commonly hard to predict exactly where an earthquake rupture will end and whether other faults could be triggered for additional slip. Whereas, single-event displacements are measured from trench exposures of offsets or scarp measurements and the offset datum can commonly be identified. The maximum earthquakes from the local and nearby faults illustrate the earthquake potential of Carson City and some are adopted as scenario earthquakes, presented in a later section.

Table 4 Faults in Carson City - Lengths, Offsets, and Age of the Most Recent Event

Fault	Lmin[1]	Lmax[1]	Dmax[2]	MRE[3]	Reference
Kings Canyon fz.	16	18	2.1	1420	dePolo, 2014
Carson City f.	16	18	1.5	300-400	dePolo, 2008
Indian Hill f.	12.5	14	1	300-400?	Pease, 1979
New Empire fz.	5	8	-	<15 ka	dePolo, 1996
Lakeview f.	11.5	16	-	<15 ka	Trexler & Bell, 1979
Prison Hill f.	5	9	0.6	<15 ka	dePolo, 1996
Incline Village f.	13.5	20.5	2.75	500	Seitz +, 2005
Marlette Lake fs.	7	12	-	?	Stewart, 1999
Washoe Valley- Mount Rose f.	25	36	2-2.5	<690-910	Ramelli +, 1999
Genoa f.	25	75	5.5	300-400	Ramelli and Bell, 2014
E. Carson V. fz.	18	26	>1.4	~520-920	dePolo and Sawyer, 2005

1 - length of the fault zone in km, expressed in minimum and maximum values to encompass uncertainty.

2 - maximum displacement during a single earthquake.

3 - years before present; these ages are greatly simplified and are uncertain. Commonly ranges of potential ages are given or the ages act as one-sided constraints. Nevertheless a simplification is done to give the general public an approximate age of the last event.

Table 5 Earthquake Magnitude Scaling Relationships Used for Estimating Maximum Earthquake Magnitudes

Wells and Coppersmith (1994) - All Fault Types

Length (L, km):	Mw = 5.08 + 1.16 log (L)
Maximum Displacement (MD, m):	Mw = 6.69 + 0.74 log (MD)

Wesnousky (2008) - All Fault Types

Length (L, km):	Mw = 5.30 + 1.02 log (L)

Table 6 Faults in Carson City - Maximum Magnitude Estimates

Fault	Lmin-wc	Lmin-wy	Lmax-wc	Lmax-wy	Dmax-wc
Kings Canyon f.	6.5	6.5	6.5	6.6	6.9
Carson City f.	6.5	6.5	6.5	6.6	6.8
Indian Hill f.	(6.4)	(6.4)	(6.4)	6.5	6.7
New Empire f.	(5.9)	(6.0)	(6.1)	(6.2)	-
Lakeview f.	(6.1)	(6.3)	6.5	6.5	-
Prison Hill f.	(5.9)	(6.0)	(6.2)	(6.3)	6.5
Incline Village f.	(6.4)	6.5	6.6	6.6	7.0
Marlette Lake fs.	(6.1)	(6.2)	(6.3)	(6.4)	-
Genoa f.	6.7	6.7	7.3	7.2	7.2
Washoe Valley-Mount Rose f.	6.7	6.7	6.9	6.9	6.9-7.0
E. Carson V. fz.	6.5	6.6	6.7	6.7	>6.8
W. Tahoe-Dollar Point f.	7.1	7.0	7.1	7.1	7.1

L = fault length; D = surface displacement; wc = Wells and Coppersmith (1994); wy = Wesnousky (2008).

Location, Extent, Probability, and Hazards of Future Earthquakes

Damaging earthquakes can occur anywhere in Carson City and it is likely that a strong earthquake will strike the county in the next 50 years. Quaternary faults are mapped throughout Carson City and surrounding it (Figs. 6 and 7). The seismicity map (Fig. 5) shows that earthquakes can occur between the faults as well. The county is small enough that a strong earthquake in any location within it will affect the entire county in potentially damaging ways.

Probability of an Earthquake Occurring

Two probability estimates are presented, a probability of the occurrence of an earthquake with a certain magnitude threshold and the probability of the occurrence of damaging levels of ground motion. The probabilities are based on are the input data for the National Seismic Hazard Maps: http://earthquake.usgs.gov/hazards/.

The earthquake probability estimations for several communities are given in Table 7 and are illustrated for the county and state in Figures 11, 12, and 13. These were generated using the website https://geohazards.usgs.gov/eqprob/2009/index.php. The probabilities were estimated for earthquakes of magnitude ≥5.5, ≥6, ≥6.5, and ≥7 occurring within 50 years and 31 mi (50 km) of communities in different parts of the county (Table 7). The specific locations include the State Capitol, Lakeview, East New Empire, Stewart, and Lake Tahoe. Table 7 indicates the chance of having a M≥5.5 earthquake, which can be potentially damaging if nearby, is 79-82% within a 50 year time period. Considering magnitude M≥6, a 59-63% chance of occurrence is estimated in the next 50 years within 31 miles. This is a similar sized earthquake as occurred in Wells, Nevada in 2008 and is the size of earthquake the probability maps shown in Figures 11 and 12. The probability of a M≥6.5 earthquake occurring in 50 years and within 31 miles is 43-47% and the probability for a M≥7 earthquake is 15-16%. A magnitude M≥7 event would likely have damaging effects throughout the county and is shown in Figure 13. The probabilities of having an earthquake in the Carson City region are significant and are some of the highest probabilities in the state.

Table 7. Probabilities of Potentially Damaging Earthquakes in Carson City within 50 years and 31 miles (50 km)

Community	M≥5.5	M≥6	M≥6.5	M≥7
State Capitol	82%	63%	46%	16%
Lakeview	82%	63%	46%	16%
East New Empire	82%	63%	47%	16%
Stewart	81%	61%	46%	16%
Lake Tahoe	79%	59%	43%	15%

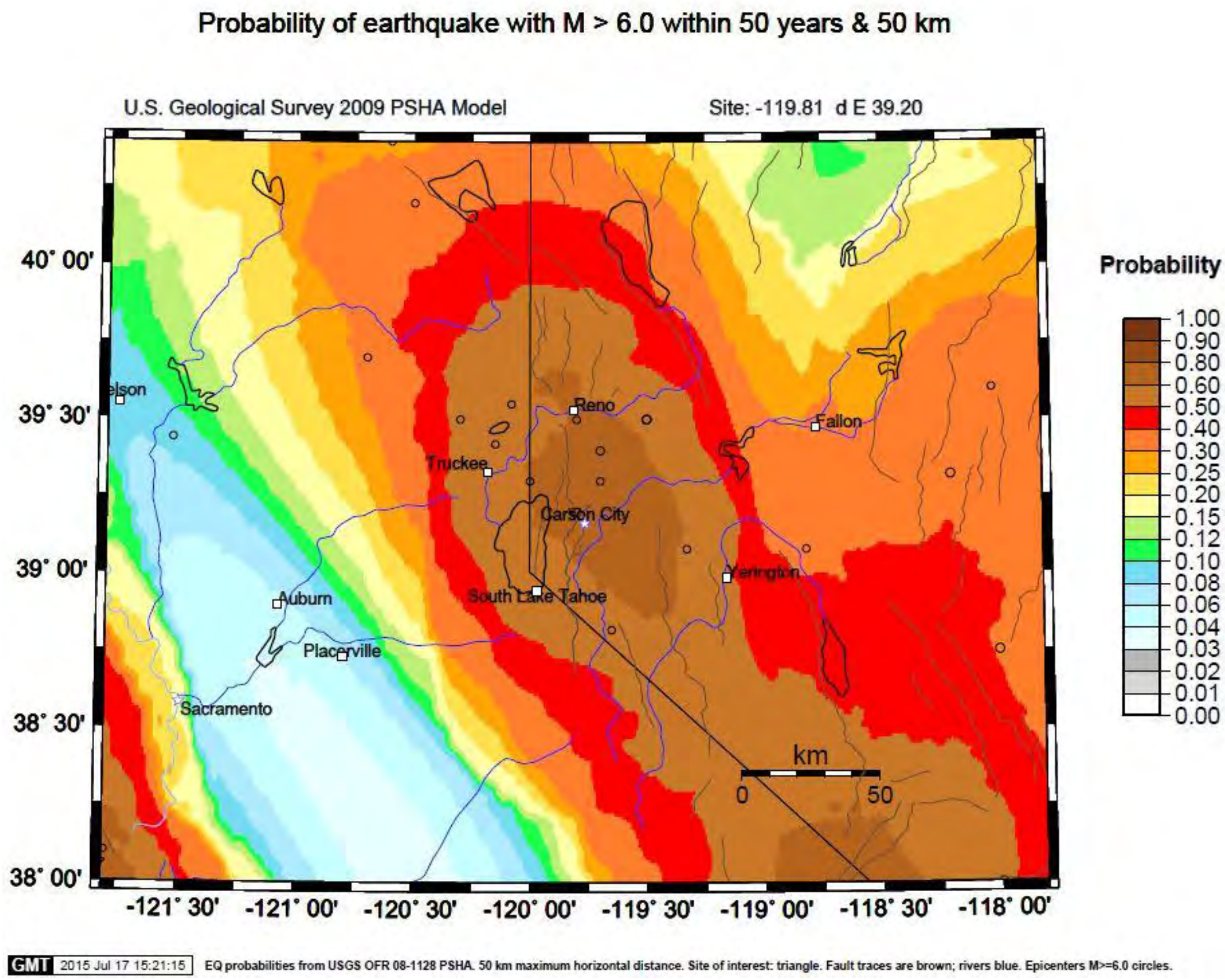

Figure 11. A probability map of the chances of having a magnitude 6 or larger earthquake within 50 years and 31 miles (50 km) in the Carson City region. The probabilities can be multiplied by 100 to get percentages. Map created using the USGS website https://geohazards.usgs.gov/eqprob/2009/index.php .

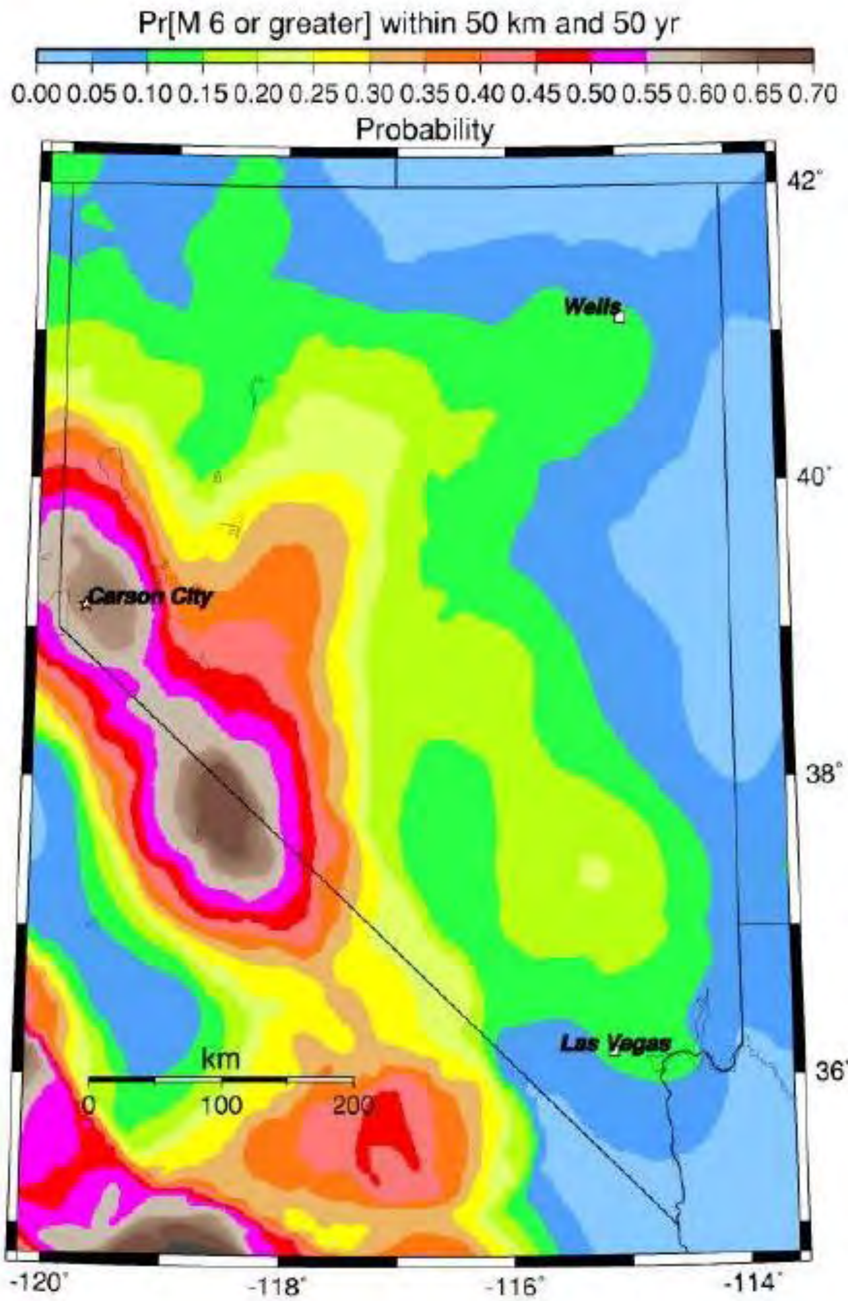

Figure 12. A probability map of the chances of having a magnitude 6 or larger earthquake within 50 years and 31 miles (50 km) for Nevada (figure courtesy of Stephen Harmsen, U.S. Geological Survey).

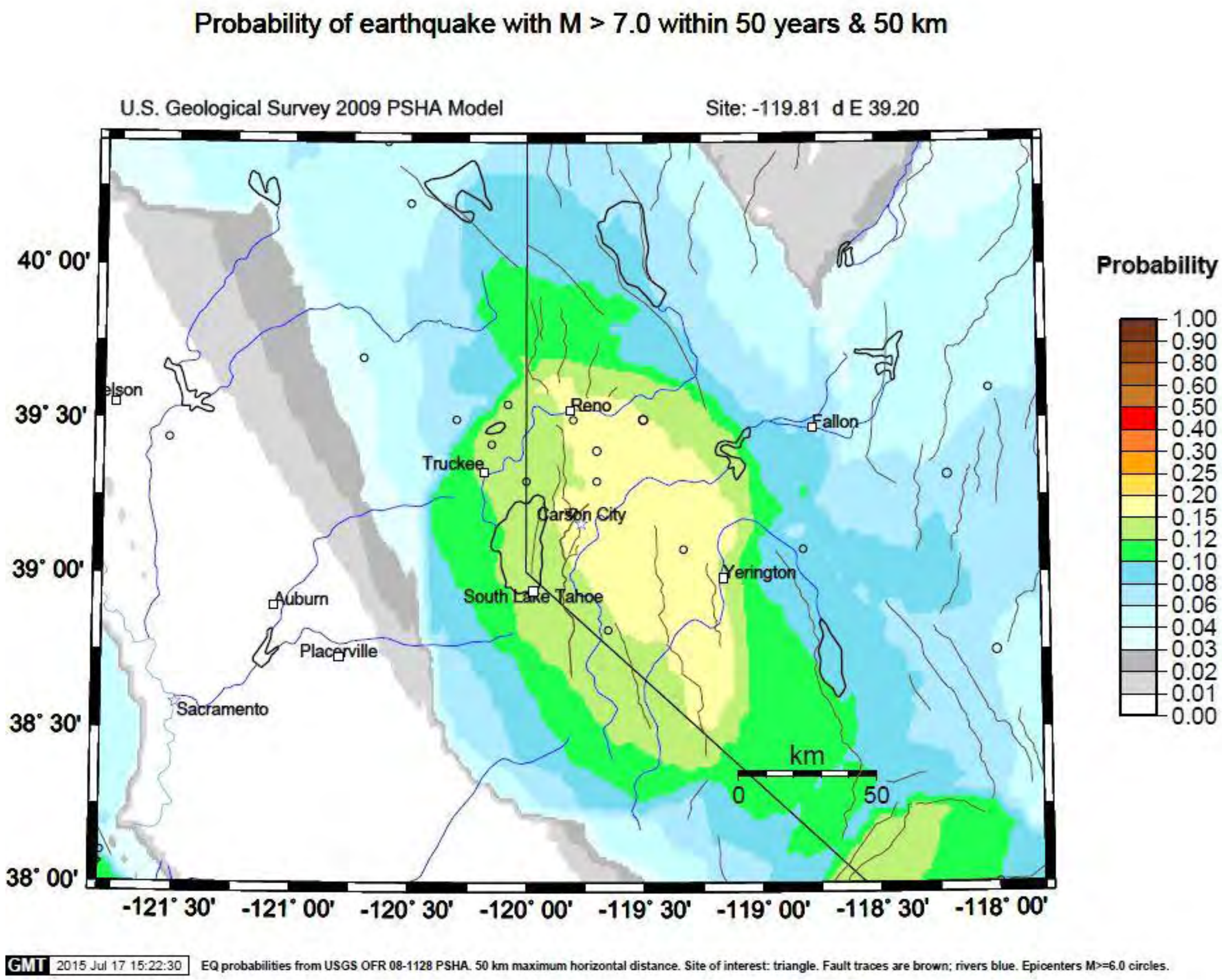

Figure 13. A probability map of the chances of having a magnitude 7 or larger earthquake within 50 years and 31 miles (50 km). The probabilities can be multiplied by 100 to get percentages. Map created using the USGS website https://geohazards.usgs.gov/eqprob/2009/index.php .

Probability of Modified Mercalli Intensity Occurring

A second estimate of the probability of earthquake occurrence in Carson City considers the chances of damaging ground motion occurring. This approach inherently considers how close an earthquake is to Carson City, so there is a clearer sense of damage potential. The basis for this estimate is a figure made by Dr. John Anderson of the Nevada Seismological Laboratory (fig. 14) using input from the National Seismic Hazard Map. Figure 14 shows the annual exceedance rate (which can be used to calculate a probability of occurrence) versus different strengths of ground motion, expressed as peak ground acceleration. The ground motion hazard curves for different parts of the county are shown in Figure 14. Also shown are the ranges of ground motion that correlate with Modified Mercalli Intensities (horizontal bars labeled with Roman Numerals); these intensity values are based on accelerations given in Bolt (1999). The black horizontal line across the entire graph is the annual exceedance rate that is used in the International Building Code. The graph indicates that there is substantial seismic hazard considered in the building code for Carson City (this is where the curves intersect the horizontal building code line). Building code ground motion input values are in the range of ground motions associated with Modified Mercalli Intensity IX.

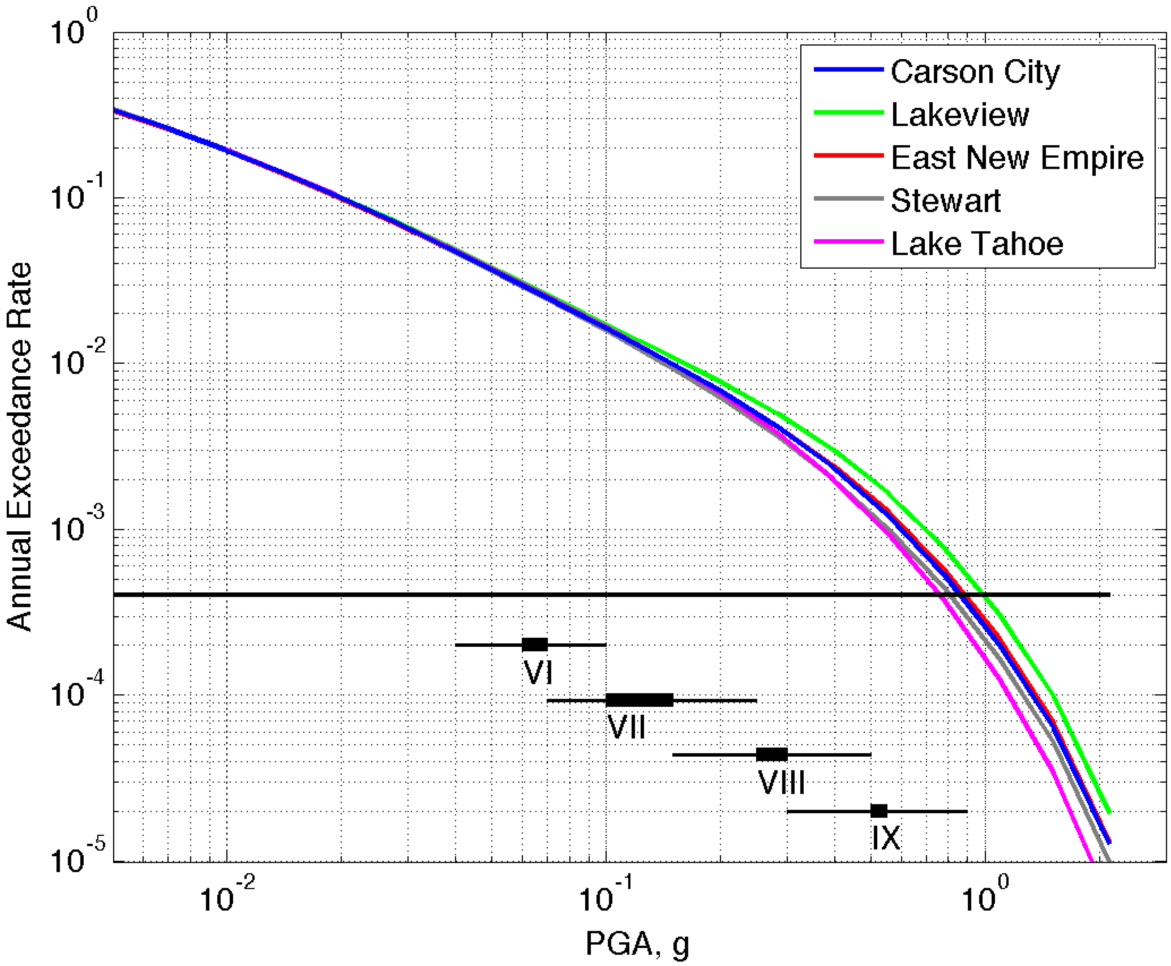

Figure 14. U.S. Geological Survey earthquake hazard curves for five parts of Carson City. Also shown are ranges of ground motion that are associated with different, indicated Modified Mercalli Intensities; these values are from Bolt (1999). The figure was courtesy of Dr. John A. Anderson, Nevada Seismological Laboratory.

Using Figure 14, an estimate of the probability of the levels of ground motion corresponding to different Modified Mercalli Intensities can be made for Carson City (Table 8). The core parts of the intensities (thicker parts of the line) were used for the probability estimates. Maximum and minimum annual exceedance rates were estimated where these ground motions intersected the hazard curves. These were used as occurrence rate estimates in a Poisson probability calculation for a 50-year time period. The probabilities are narrow ranges, which give a false sense of precision. They should be considered generalized estimates. Fortunately, the probability of an intensity level occurring can be reduced through the mitigation of seismic risks. For example, modern built-to-code construction in Carson City should survive an earthquake well.

Table 8. Poisson Probabilities of Modified Mercalli Intensity Ground Motions Occurring in Carson City Based on U.S. Geological Survey Hazard Curves

Earthquake Intensity*	**50-Year Probability**
VI	**78-79%**
VII	**55-57%**
VIII	**19-25%**
IX	**6-10%**

* Intensity VI - cracks in walls and people to be frightened; Intensity VII levels - chimneys to topple and an emergency response; Intensity VIII levels - weak buildings to partially collapse and a recovery effort to be mounted; Intensity IX levels - damage to some modern buildings.

The probabilities presented in Table 9 indicate that it is likely (78-79%) Carson City will experience Modified Mercalli Intensity VI shaking levels within a 50-year time period. The chances of damaging ground motion associated with Intensity VII and an emergency response associated with an earthquake are 55-57% in a 50-year time period. Stronger ground motion associated with Intensities VIII and IX have a 19-25% and 6-10% chance of occurring in 50 years, respectively. Communities that experience these levels of ground motion and damage (if it occurs) commonly have to mount community recovery efforts that can last over a year.

Earthquake Strong Ground Motion Hazard

Shaking of the ground is the most damaging and widespread effect from earthquakes. Estimating the potential ground motion at a site considers several factors including the magnitude of an earthquake, how far away it is, whether a site is on rock or soft sediments, and the size and shape of an underlying sedimentary basin if there is one. Many of these considerations and earthquake and fault data sets are used in making the U.S. Geological Survey's National Seismic Hazard Map (http://earthquake.usgs.gov/hazards/products/), which specifies these ground motion results, principally for use as ground motion estimates in the International Building Code.

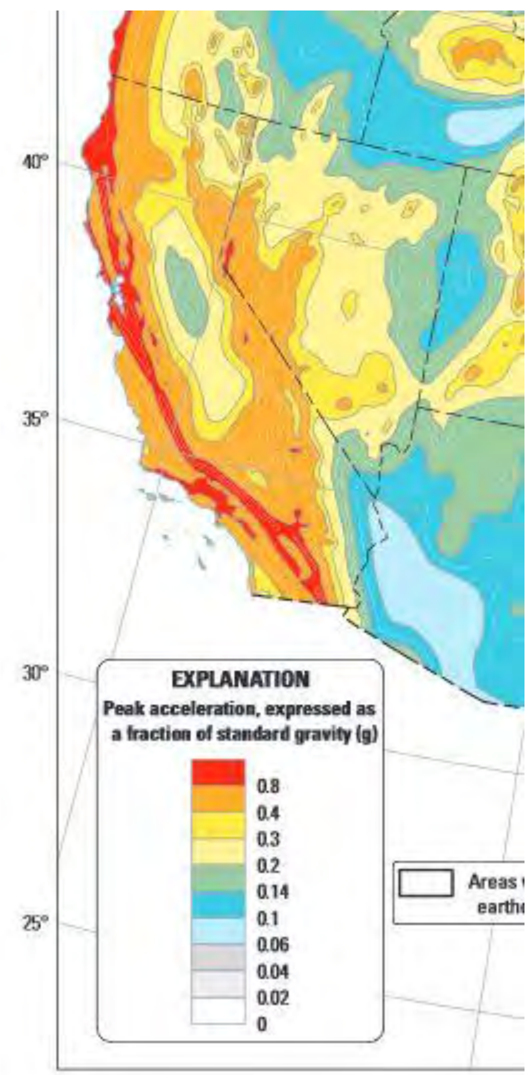

Figure 15. Portion of the 2014 National Seismic Hazard Map that covers Nevada. The map is of Peak Ground Acceleration, with an exceedance rate of 2% in 50 Years. Carson City is in the highest hazard level shown on the map (>0.8 g)

The 2014 estimate of ground motion for Carson City is the highest in Nevada and on the map, which includes California (Fig. 15). Design ground motions for the 5% chance of exceedance in 50 years are 0.4 to 0.8 g peak ground accelerations for the western and easternmost parts of the county and ≥0.8 g in Carson City. Ground motion values tend to mean more to engineers that design buildings to withstand them than the general public.

Earthquake Surface Rupture Hazard

When earthquakes reach magnitude 6.5 ±0.3, the rupture tends to offset the ground surface (c.f., dePolo, 1994). These offsets are known as earthquake surface rupture or ground rupture. In Carson City, evidence for surface rupture hazard includes paleo-earthquake ground ruptures and offset landforms that were created by repeated offset along a fault.

The potential for ground surface rupture is along and immediately adjacent to the mapped traces of late Quaternary faults (faults that have moved in the last 130,000 years). Faults within this timeframe have had major earthquakes in the Basin and Range Province (dePolo and Slemmons, 1998). For example, the 1887 magnitude 7.4 Sonoran, Mexico earthquake, the largest historical normal dip-slip earthquake in the province, ruptured a fault that hadn’t moved in 100,000 years (Bull and Pearthree, 1988).

There are many late Quaternary fault traces in the county and many fault traces of unknown age. Some faults are relatively simple ruptures, such as sections of the Carson City fault, and others are broad and include many fault traces, such as the Eastern Carson Valley fault zone. Surface rupture hazard partly depends on the complexity fault traces, so faults like the multi-trace Eastern Carson Valley fault zone pose a wide-spread surface rupture hazard.

The most straightforward way to mitigate for surface rupture hazard is to avoid construction across late Quaternary faults. In denser housing developments, areas along faults can be used for natural green belts, parks, and golf courses. Backyards can be placed along faults to help protect streets and utility lines. Some structures, such as pipelines, cannot avoid crossing active faults in some areas. Fortunately, pipelines can be engineered and constructed to limit damage from ground offset. For example, a pipeline covered with loose sand on the down-thrown side can pull out of the ground without being broken when vertical offset occurs. The key is to know where the faults are located and how much offset can occur to plan wisely for surface rupture hazard and encourage the appropriated mitigation design of facilities that must cross faults.

Guidelines on the best exploratory and mitigation approaches for potentially hazardous faults would be useful for Carson City. Exploration techniques, like trenching, can be used by geologists to identify the specific locations of fault traces or the non-existence of a fault trace. When faults are recognized early in the planning phase of projects, it is easier to consider low-cost mitigation measures, such as fault avoidance.

Earthquake-Induced Liquefaction Hazard

A potential for liquefaction hazard exists in Eagle Valley, along the shores of Lake Tahoe, and possibly in some of the smaller basins in the Pine Nut Mountains and the Carson Range. Liquefaction occurs in places where groundwater is shallow and sediments, classically fine sands, are young and unconsolidated. When these types of saturated sediments are shaken strongly for a period of time, they can consolidate and expel the water from pore spaces, building up pore pressure. When pore pressure increases rapidly and cannot be dissipated, liquefaction can occur. During liquefaction, soil can behave as a liquid. When this happens, a sand-water mixture can be expelled out of the ground, the land surface can flow downhill or sideways, and the ground may no longer be able to support the weight of structures, like buildings. Buildings on liquefied ground can sink and break up. Other potential effects of liquefaction are violent oscillations that are potentially damaging to buildings and infrastructure.

There were reports of liquefaction in Carson Valley and probably Eagle Valley caused by the June 6, 1887 Carson City earthquake. The Nevada Tribune (6/6/1887) reported that, “In the corral, walking across either way, the ground seems as though all was hollow underneath, and by driving a pole down two or three feet, water flows immediately to the surface, and wherever a fissure is seen, black sand several inches deep has been thrown up," on the Boyd Property. This is a fairly clear description of liquefaction.

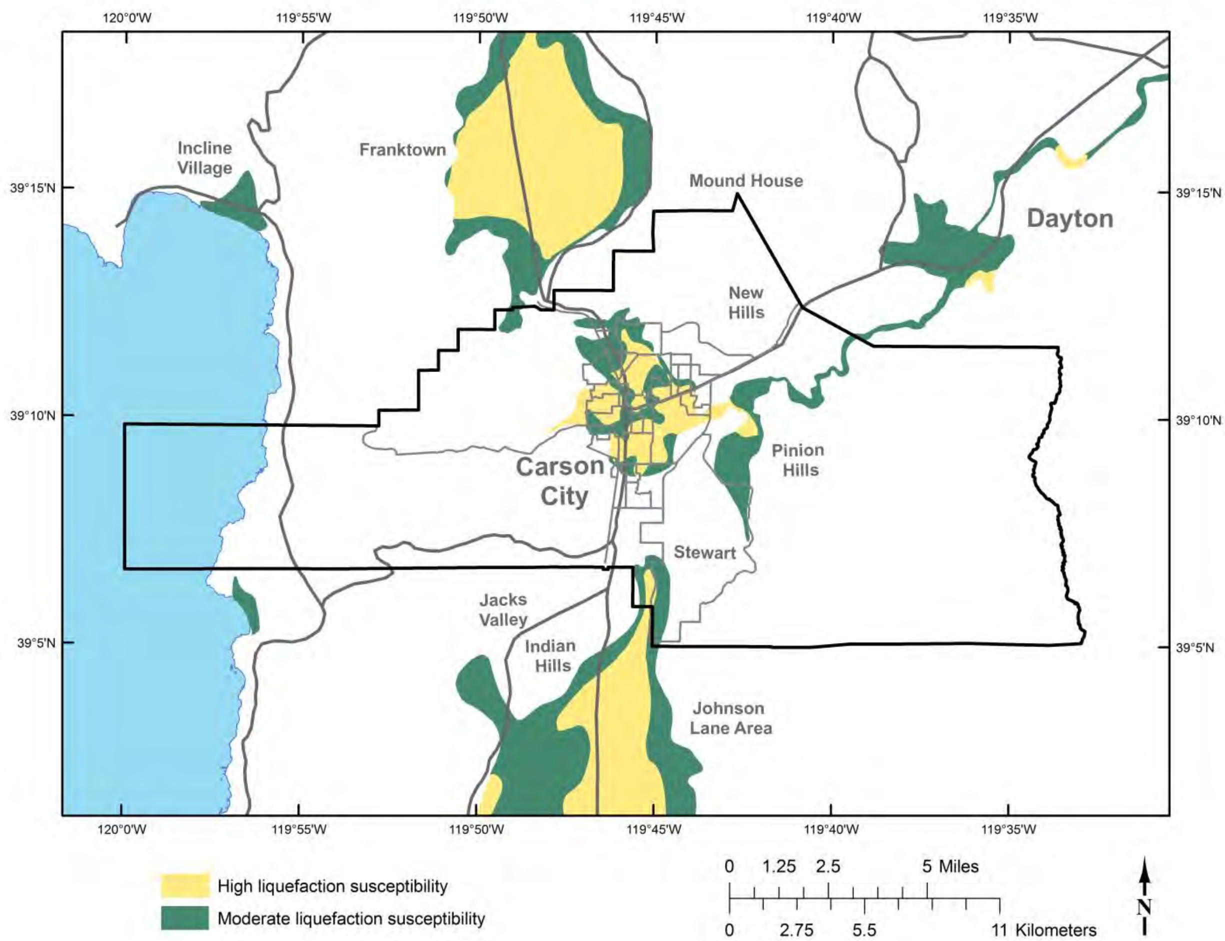

Figure 16. Liquefaction susceptibility in the Carson City region taken from dePolo and others (1996). These generalized areas are can have shallow groundwater and young sediments. When earthquakes occur, generally only a few locations within these areas will liquefy, and factors, such as frozen ground, can affect whether liquefaction occurs. All roads connecting Carson City to other communities cross over areas with some liquefaction potential. More detailed studies are required to define the liquefaction hazard at a specific location.

A preliminary representation of liquefaction was constructed for the 1996 Planning Scenario for a Western Nevada Earthquake (dePolo and others, 1996; shown in figure 16). The map was made with the information available at the time and was generalized, but illustrates the hazard. For planning and appropriate land use purposes a more detailed, county-wide liquefaction analysis is necessary.

Guidelines for building on lands that are potentially liquefiable would be useful. Structures can be constructed with the appropriate resistance to potential ground oscillation and soils or structures can be conditioned to prevent damage from potential settlement and/or lateral movement caused by liquefaction.

Earthquake-Induced Rock Fall, Landslide, and Snow Avalanche Hazards

Mountain and hill slopes can be subject to seismically induced rock falls, landslides, and snow avalanches. Depending on down slope vulnerabilities, some of these hazards can have potentially disastrous consequences and should be addressed with planning and mitigation. Potential consequences include rock and earth impact, inundation, and burial of people, homes, buildings, roadways, and other infrastructure.

Mitigation actions include the definition and characterization of potential landslides and rock falls in developed areas and planned expansion areas. These maps can be used to characterize the potential impact of landslides and rock falls. Based on the risk, possible mitigation actions might include warning signs with safety instructions and relocation or hardening of facilities. Some situations can be recognized but not be practically mitigated, such as large landslides or rock falls along roadways. In critical cases, useful planning can still take place. The potential amount of landslide debris, the equipment required for removal of this debris, and the location of this equipment can be developed and would be useful in an earthquake emergency. Snow avalanches are generally covered by contemporary snow avalanche planning, but emergency planners and responders should keep this potential hazard in mind during wintertime disasters; one of the primary impacts would be the blockage of mountainous roadways.

Earthquake Lake Tsunami and Lake Seiche Hazards

Earthquake-induced waves along the shores of Lake Tahoe are possible immediately following a large earthquake. The West Tahoe-Dollar Point fault has a large underwater section and an earthquake along the fault could down-drop the floor of Lake Tahoe within a matter of seconds. The column of water above this offset would be dropped, leading to an uneven water surface and a wave flowing towards the down-dropped side. This wave would move quickly across the lake and run-up on shoreline. In coves, the wave would potentially be concentrated and have a higher run-up. Lake tsunamis can be generated by fault offsets of the lake bottom, by large landslides into a lake, or by failure of submerged shelves of sediment. Tsunami wave heights in Lake Tahoe from different earthquake scenarios were modeled by Ichinose and others (2000), but run up distances were not generated by that study.

A seiche is an oscillatory wave that goes back-and-forth in an enclosed body of water. It is similar to the sloshing back-and-forth that can occur in a bath tub when the water is disturbed. Seiches can form from lake tsunamis or they can be induced by seismic waves from earthquakes that are farther away.

A lake tsunami and seiche occurred following the 1959 M7.3 Hebgen Lake, Montana earthquake. Hebgen Lake is located in the hanging wall of the fault that generated the earthquake. The initial “surge” of water in Hebgen Lake overtopped the Hebgen Lake Dam by about a foot of water (30 cm; Myers and Hamilton, 1964). Oscillatory waves (seiche) continued for at least 12 hours and had a period of about 15 minutes (Myers and Hamilton, 1964). The dam was overtopped three to four times. The tsunami was the initial surge of water was the lake surface trying to equilibrate after being deformed. The seiche set up in the lake, which traveled from one end to the other for hours. Other examples are a tsunami formed in Owens Lake, following the 1872 Owens Valley, California earthquake (Smoot and others, 2000) and a probable seiche set up in Mono Lake, California from the 1932 Cedar Mountain, Nevada earthquake (Reno Evening Gazette, 12/23/1932). Similar tsunami and seiche phenomenon are expected in Lake Tahoe.

Wave heights of Lake Tahoe tsunamis have been modeled by Ichinose and others (2000) and are shown in Figure 17. Two scenarios are shown, a rupture on the North Tahoe-Incline Village fault (A – black triangles), and a rupture on the West Tahoe-Dollar Point fault zone (B – gray dots). In these model runs, wave heights of 15 to 23 feet were generated at the lake shore in Carson City, but to the south are wave heights of as high as 30 feet. These are reasonable wave heights to consider when developing ideas for the tsunami/seiche hazard along the Tahoe shoreline.

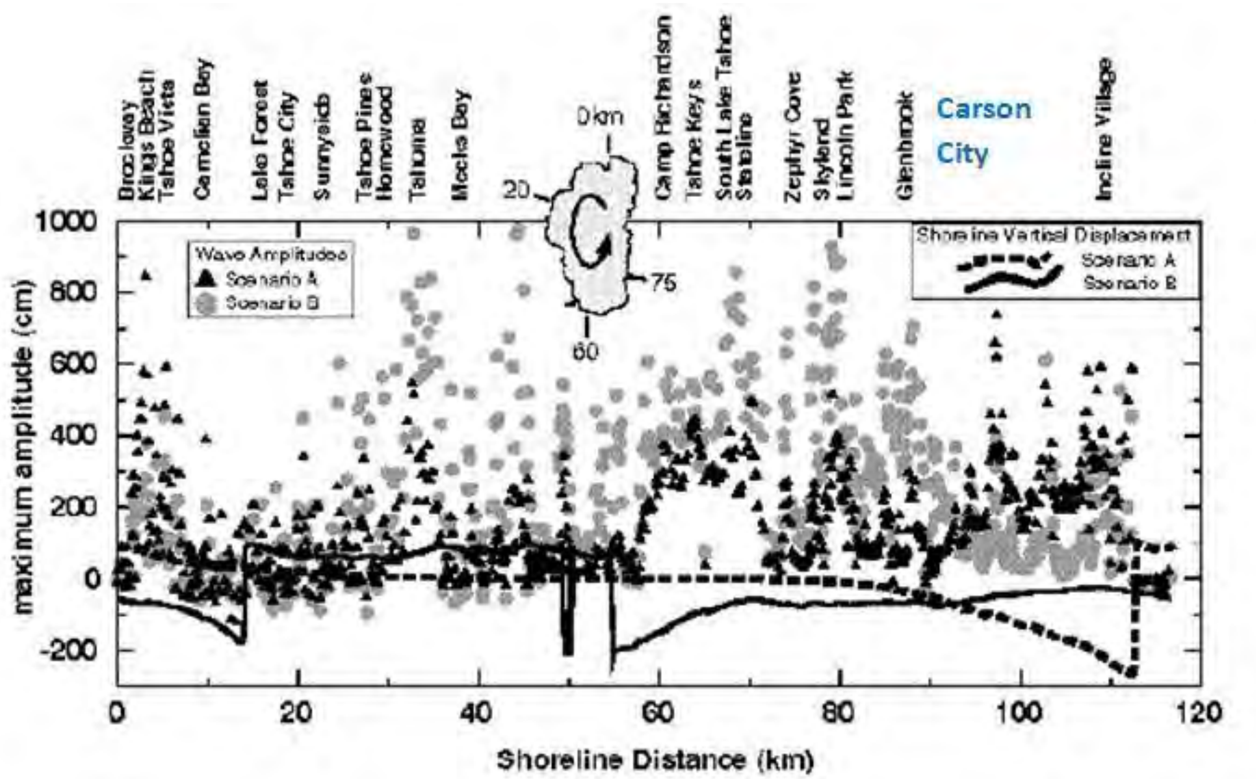

Figure 17. Potential tsunami wave heights around Lake Tahoe; the locations are indicated along the top of the figure with the area within the county labeled as "Carson City". From Ichinosa and others (2000).

Carson City's boundary along the lake includes a few privately owned structures. The road and utilities are at a high enough elevation that they would not be affected by a 30 foot wave. Because of the low exposure of the county to the impacts from a tsunami or seiche, this hazard is considered low in Carson City.

The potential run-up distance from tsunamis and seiches needs to be modeled and mapped so the distance that people are safe from such waves can be determined. Based on the potential waves, signs can be installed that indicate potential inundation areas, evacuation areas, and routes to safe elevations as information and guidance for citizens and visitors. An alternative to safe high ground evacuation route is to create vertical evacuation structures closer to the shoreline that can withstand a tsunami or seiche wave. These can be dual usage structures, such as an observation tower, and be blended into the landscape.

Vulnerabilities, Consequences, and Potential Earthquake Losses

Carson City Earthquake Scenarios

The impacts and the extent of the impacts from earthquakes are difficult to envision without modeling the potential effects. Although the computer modeling of earthquake impacts is based on generalizations of past earthquakes, they attempt to tailor those generalizations for a specific community, to produce more realistic results. The impacts of any specific earthquake is impossible to predict because each earthquake has unique characteristics (at least over the time frames we are considering) and there are a multitude of variables that determined what the ultimate impacts are, include soil properties and structural vulnerabilities. Nevertheless, response planning, emergency exercises, and recovery planning all benefit from using realistic earthquake impact estimates. The scenario earthquakes are considered to be maximum earthquakes that could occur (Fig. 18, Table 9). Plan for the worst and you can respond to any smaller magnitude events. The consequence estimates made using the FEMA HAZUS-MH program and are considered to be order-of-magnitude estimates (good to ± a factor of 10).

The earthquake scenario magnitudes range from M6 to M7.2 (Table 9). The magnitude 6 scenarios are for locations near the city that have had persistent background seismicity. These two locations are in northern Carson City and south of Prison Hill. The magnitude of the 2008 Wells earthquake was adopted for these scenarios representing a large, non-surface rupturing event. A maximum background earthquake (M6.5) was used for the Pine Nut Mountains. The northern Pine Nut Mountains has a high level of background earthquakes and several potential landforms that could be related to Quaternary faulting. It is important to consider the impacts of an earthquake in that area. The capitol suite is a range of earthquake magnitudes (M5 to M7) in the center of the city to explore the impacts of different sized events (Seelye and others, 2014). The other four scenarios are based on the maximum magnitudes estimated for the late Quaternary faults.

Scenario Earthquake Epicenters

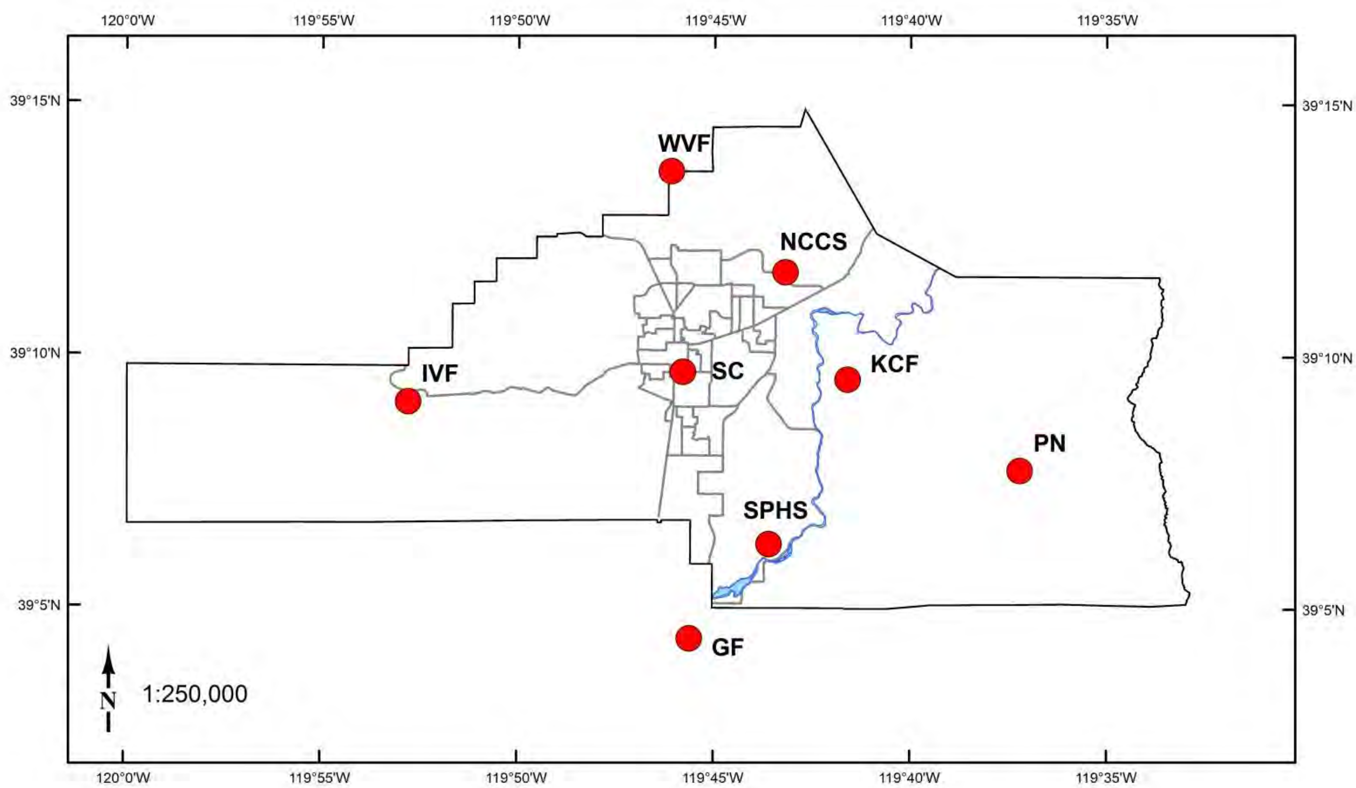

Figure 18. Scenario earthquake epicenter locations with the acronym of the scenario indicated in Table 9.

Table 9. Scenario Earthquakes for Carson City

Fault	Earthquake Magnitude	Fault Type	Scenario Epicenter Latitude	Longitude
Incline Village fault (**IVF**)	7.0	normal	39.1496	-119.8803
Washoe Valley fault (**WVF**)	6.9	normal	39.2284	-119.7715
N. Carson City swarm (**NCCS**)	6.0	strike-slip	39.2040	-119.7319
State Capitol (**SC**)	5.0 to 7.0	normal	39.1639	-119.7661
Kings Canyon fault (**KCF**)	6.9	normal	39.1595	-119.6992
S. Prison Hill swarm (**SPHS**)	6.0	strike-slip	39.1071	-119.7271
Genoa fault (**GF**)	7.2	normal	39.0698	-119.7583
Pine Nut faults (**PN**)	6.5	strike-slip	39.1322	-119.6254

The 12 scenarios include the largest earthquakes that might strike Carson City (events on the Kings Canyon fault, Washoe Valley fault, and Genoa fault). Earthquakes in the western part of the county (Incline Village fault) and in the eastern part (Pine Nut faults) give a spatial view of potential impacts. Several tables of the HAZUS results are presented. The Capitol suite of earthquakes estimations were taken from Seelye and others (2014) and are presented in five tables (Tables 10 - 14). The first two tables are the costs of the different magnitude earthquakes to Nevada (Table 10) and to Carson City (Table 11). Table 12 was taken from Seelye and others (2014) summaries and shows the relationship between several loss parameters and the different magnitude earthquakes between Carson City, Nevada Counties (Nevada), and all counties within 62 miles (100 km), including counties in California. This table clearly shows that the impact of an earthquake in Carson City can have a much wider impact than just the county. Tables 13 and 14 give details of the Capitol suite HAZUS model results for creating planning earthquake scenarios; one table is for Nevada and second is for Carson City. The scenario earthquakes are presented in Tables 15 through 18. The format and information is the same as the tables in the Capitol suite of events, except there is no table from Seelye and others (2014).

The Capitol suite of events presents a range of increasing impacts, as expected. Total costs and impacts to Nevada range from $8 million for a magnitude 5 earthquake to $1.3 billion with a magnitude 7 event. Total costs and impacts to Carson City range from $4 million for a magnitude 5 earthquake to $690 million with a magnitude 7 event. HAZUS modeling indicates that building damage begins at about M5.5 and may be substantial by magnitude 6. Building damage in Carson City becomes significantly worse at magnitude 6.5 and projected injuries jump as well with 48 people requiring hospitalization, 181 other injuries, and 12 people deceased. At magnitude 6 and 6.5 levels of damage, a recovery effort would have to be mounted by the city to repair or replace damaged buildings, restore economic vitality, and restore the quality of life to citizens. How long this recovery effort takes depends on the degree of recovery planning that has been done, the attitude of the citizenry, and circumstances surrounding the event, such as whether a disaster declaration has been issued at a Federal level. Shelter needs are estimated at a maximum of about 269 people, which seems low for a community of Carson City's size, but many people in Nevada stay with families, neighbors, or in regional hotels. The estimated number of fires following the earthquake is low for the larger events (M6.5 and M7); in reality several fires following earthquake might be anticipated for planning purposes. For example, chimneys are potentially damaged in all of these scenario events, which can lead to fires if used.

Table 10. State Capitol Scenario Earthquakes - Nevada

Earthquake Magnitude	Building Damage ($million)	Transportation Damage ($million)	Utility Damage ($million)	Total Cost Nevada Cos ($million)*
5.0	1	2	5	8
5.5	39	3	8	50
6.0	214	6	17	240
6.5	650	11	27	690
7.0	1246	17	50	1300

*values rounded to avoid perception of false precision

Table 11. State Capitol Scenario Earthquakes - Carson City

Earthquake Magnitude	Building Damage ($million)	Transportation Damage ($million)	Utility Damage ($million)	Total Cost Nevada Cos ($million)*
5.0	1	1	2	4
5.5	35	2	4	40
6.0	164	3	10	180
6.5	414	4	13	430
7.0	671	5	17	690

*values rounded to avoid perception of false precision

Table 12 Comparison of Capitol Earthquake Suite Results Between Different Study Regions

Carson City, Nevada

Epicenter at 119.76°W longitude, 39.16°N latitude

Results of earthquake scenarios using HAZUS, the loss-estimation model from the Federal Emergency Management Agency. All numbers are estimates; individual numbers may vary by a factor of 10, depending on the location, depth, and magnitude of the earthquake.

Study Region: **Carson City County**	Earthquake Magnitude				
	5.0	5.5	6.0	6.5	7.0
Number of buildings with extensive to complete damage	0	2	310	1,400	2,300
People needing public shelter	0	0	32	160	270
People needing hospital care	0	0	4	48	120
Fatalities	0	0	1	12	32
Total economic loss ($ million)	4	40	180	430	690

Study Region: **All Nevada counties**	Earthquake Magnitude				
	5.0	5.5	6.0	6.5	7.0
Number of buildings with extensive to complete damage	0	2	310	1,400	2,700
People needing public shelter	0	0	33	160	300
People needing hospital care	0	0	5	50	130
Fatalities	0	0	1	12	33
Total economic loss ($ million)	8	50	240	690	1,300

Study Region: **All counties within 100km**	Earthquake Magnitude				
	5.0	5.5	6.0	6.5	7.0
Number of buildings with extensive to complete damage	0	2	310	1,400	2,700
People needing public shelter	0	0	33	160	300
People needing hospital care	0	0	5	50	130
Fatalities	0	0	1	12	33
Total economic loss ($ million)	7	49	250	730	1,400

From Seelye and others (2014)

Table 13. HAZUS Results for Capitol Suite Scenarios Nevada Counties

	Capitol M 5.0	Capitol M 5.5	Capitol M 6.0	Capitol M 6.5	Capitol M 7.0
Bldgs. w/ Moderate Damage	0	155	1,717	3,726	6,567
Bldgs. w/ Extensive and Complete Damage	0	2	312	1,438	2,661
Hospitals	0	0	0	1	1
Schools	0	0	1	14	17
Fire Stations	0	0	0	2	3
Highway Bridges	0	0	0	0	4
Potable Water Facilities	0	0	0	0	0
Waste Water Facilities	0	0	1	1	2
Natural Gas Facilities	0	0	0	0	0
Oil Systems Facilities	0	0	0	0	0
Electrical Power Facilities	0	0	1	4	5
Communications Facilities	0	0	0	0	0
Potable Water Leaks	466	474	529	673	1,200
Potable Water Breaks	117	119	132	168	300
Waste Water Leaks	234	238	266	338	603
Waste Water Breaks	59	60	66	85	151
Natural Gas Leaks	2	2	3	5	13
Natural Gas Breaks	1	1	1	1	3
Oil Leaks	0	0	0	0	1
Oil Breaks	0	0	0	0	0
Households w/o water service @ 1 day	0	0	0	0	3,581
Households w/o Electric Power @ 1 day	2,974	6,689	23,303	45,769	72,367
Fires (# of ignitions)	0	0	1	1	1
Debris (million tons)	0.00	0.00	0.04	0.17	0.34
Shelter (# of people in need of)	0	0	33	159	296
Injuries (2pm) Level 1 *	0	3	39	207	472
Injuries (2pm) Level 2 & 3 **	0	0	5	50	130
Casualties	0	0	1	12	33

* Hospitalization not required
** Hospitalization required

Table 14. HAZUS Results for Capitol Suite Scenarios Carson City

	CCC M 5.0	CCC M 5.5	CCC M 6.0	CCC M 6.5	CCC M 7.0
Bldgs. w/ Moderate Damage	0	151	1,586	2,637	3,121
Bldgs. w/ Extensive and Complete Damage	0	2	311	1,394	2,325
Hospitals	0	0	0	1	1
Schools	0	0	1	13	15
Fire Stations	0	0	0	1	2
Highway Bridges	0	0	0	0	4
Potable Water Facilities	0	0	0	0	0
Waste Water Facilities	0	0	1	1	1
Natural Gas Facilities	0	0	0	0	0
Oil Systems Facilities	0	0	0	0	0
Electrical Power Facilities	0	0	1	4	5
Communications Facilities	0	0	0	0	0
Potable Water Leaks	2	7	30	95	250
Potable Water Breaks	1	2	8	24	62
Waste Water Leaks	1	3	15	48	126
Waste Water Breaks	0	1	4	12	31
Natural Gas Leaks	0	0	0	1	3
Natural Gas Breaks	0	0	0	0	1
Oil Leaks	0	0	0	0	0
Oil Breaks	0	0	0	0	0
Households w/o water service @ 1 day	0	0	0	0	3,539
Households w/o Electric Power @ 1 day	1,937	4,393	9,475	12,749	14,476
Fires (# of ignitions)	0	0	0	0	0
Debris (million tons)	0.00	0.00	0.04	0.14	0.25
Truckloads +	0	0	1,600	5,640	9,920
Shelter (# of people in need of)	0	0	32	155	269
Injuries (2pm) Level 1 *	0	3	36	181	383
Injuries (2pm) Level 2 & 3 **	0	0	4	48	120
Casualties	0	0	1	12	32

+ Debris tonnage converted to number of truckloads @25tons/truck
* Hospitalization not required
** Hospitalization required

Table 15. Scenario Earthquake Modeled Costs and Losses - Nevada

Scenario Earthquake	Earthquake Magnitude	Building Damage ($million)	Transportation Damage ($million)	Utility Damage ($million)	Total Cost ($million)*
Incline Village fault	7.0	1485	16	40	1541
Washoe Valley fault	6.9	2439	28	67	2534
North Carson City swarm	6.0	660	10	33	703
Kings Canyon fault	6.9	1504	20	60	1584
South Prison Hill swarm	6.0	514	9	27	550
Genoa fault	7.2	2603	29	71	2703
Pine Nut faults	6.5	687	13	33	733

*values rounded to avoid perception of false precision

Table 16. Scenario Earthquake Modeled Costs and Losses - Carson City

Scenario Earthquake	Earthquake Magnitude	Building Damage ($million)	Transportation Damage ($million)	Utility Damage ($million)	Total Cost ($million)*
Incline Village fault	7.0	353	3	8	360
Washoe Valley fault	6.9	826	5	17	850
North Carson City swarm	6.0	477	5	21	500
Kings Canyon fault	6.9	527	5	20	550
South Prison Hill swarm	6.0	362	4	21	390
Genoa fault	7.2	952	6	21	980
Pine Nut faults	6.5	261	3	11	280

*values rounded to avoid perception of false precision

Table 17. HAZUS Results for Fault and Swarm Area Scenarios

	IVF M 7.0	WVF M 6.9	NCCS M 6.0	KCF M 6.9	SPHS M 6.0	GF M 7.2	PNF M 6.5
Bldgs. w/ Moderate Damage	9,389	14,724	5,055	10,957	4,265	15,809	5,961
Bldgs. w/ Extensive and Complete Damage	1,645	4,367	1,530	3,394	1,014	5,381	1,495
Hospitals	0	0	0	0	0	1	0
Schools	0	8	1	3	1	7	0
Fire Stations	0	0	1	2	0	1	2
Highway Bridges	4	8	2	6	0	10	3
Potable Water Facilities	0	0	0	0	0	0	0
Waste Water Facilities	1	5	2	2	1	5	2
Natural Gas Facilities	0	0	0	0	0	0	0
Oil Systems Facilities	0	0	0	0	0	0	0
Electrical Power Facilities	13	37	9	21	7	19	7
Communications Facilities	0	0	0	0	0	0	0
Potable Water Leaks	514	739	148	776	128	1,222	422
Potable Water Breaks	129	185	37	194	32	305	106
Waste Water Leaks	258	371	74	390	64	614	212
Waste Water Breaks	65	93	19	97	16	153	53
Natural Gas Leaks	12	15	4	20	4	22	10
Natural Gas Breaks	3	4	1	5	1	6	2
Oil Leaks	1	1	0	1	0	1	0
Oil Breaks	0	0	0	0	0	0	0
Households w/o water service @ 1 day	0	695	0	375	0	6,339	0
Households w/o Electric Power @ 1 day	95,344	114,390	51,514	95,178	38,812	112,553	62,088
Fires (# of ignitions)	1	1	1	1	0	1	1
Debris (million tons)	0.34	0.67	0.19	0.42	0.14	0.74	0.18
Shelter (# of people in need of)	275	794	213	424	149	806	213
Injuries (2pm) Level 1 *	389	871	225	533	156	1,050	248
Injuries (2pm) Level 2 & 3 **	91	242	57	140	36	313	63
Casualties	21	61	13	33	8	81	15

Incline Village fault - IVF
Washoe Valley fault - WVF
North Carson City swarm - NCCS
Kings Canyon fault - KCF
South Prison Hill swarm - SPHS
Genoa fault - GF
Pine Nut faults - PNF

* Hospitalization not required
** Hospitalization required

Table 18. HAZUS Results for Fault and Swarm Area Scenarios Carson City

CCC	IVF M 7.0	WVF M 6.9	NCCS M 6.0	KCF M 6.9	SPHS M 6.0	GF M 7.2	PNF M 6.5
Bldgs. w/ Moderate Damage	2,100	4,635	3,322	3,630	2,842	4,932	2,222
Bldgs. w/ Extensive and Complete Damage	491	2,225	1,295	1,653	855	2,691	597
Hospitals	0	1	1	1	1	1	0
Schools	1	15	14	15	7	15	2
Fire Stations	0	1	1	1	1	1	0
Highway Bridges	0	2	2	2	0	2	2
Potable Water Facilities	0	0	0	0	0	0	0
Waste Water Facilities	1	1	1	1	1	1	1
Natural Gas Facilities	0	0	0	0	0	0	0
Oil Systems Facilities	0	0	0	0	0	0	0
Electrical Power Facilities	2	7	8	10	7	7	5
Communications Facilities	0	0	0	0	0	0	0
Potable Water Leaks	105	165	70	140	55	226	106
Potable Water Breaks	26	41	18	35	14	56	26
Waste Water Leaks	53	83	35	70	28	113	53
Waste Water Breaks	13	21	9	18	7	28	13
Natural Gas Leaks	1	4	2	8	2	5	3
Natural Gas Breaks	0	1	1	2	0	1	1
Oil Leaks	0	0	0	0	0	0	0
Oil Breaks	0	0	0	0	0	0	0
Households w/o water service @ 1 day	0	550	0	122	0	2,555	0
Households w/o Electric Power @ 1 day	10,379	15,423	14,677	16,550	15,847	16,100	13,846
Fires (# of ignitions)	0	0	0	0	0	0	0
Debris (million tons)	0.09	0.28	0.15	0.18	0.10	0.33	0.08
Truckloads +	3,680	11,040	5,840	7,240	4,160	13,160	3,040
Shelter (# of people in need of)	69	364	193	246	133	439	146
Injuries (2pm) Level 1 *	104	410	185	251	122	509	111
Injuries (2pm) Level 2 & 3 **	28	130	51	74	31	166	31
Casualties	7	35	12	19	7	45	8

Incline Village fault - IVF
Washoe Valley fault - WVF
North Carson City swarm - NCCS
Kings Canyon fault - KCF
South Prison Hill swarm - SPHS
Genoa fault - GF
Pine Nut faults - PN

* Hospitalization not required
** Hospitalization required
+ Debris tonnage converted to number of truckloads @25tons/truck

These 12 scenarios can be used for exercises and planning purposes. These scenario impacts are meant to give some examples of what could happen should a strong earthquake strike the Carson City. They are only general estimates. For exercises and planning purposes, it is reasonable to increase some of the numbers of incidences or impacts of these scenarios to test certain response capabilities and resource planning. For example, the number of damaged schools might be increased to test backup sheltering capability.

Unreinforced Masonry Buildings

Unreinforced masonry buildings (URM) are among the most dangerous buildings to be in or around during an earthquake. These types of buildings are associated with loss of life and extensive property damage from moderate or larger earthquakes. When the 2008 magnitude 6 earthquake struck, there were 19 URM or partial URMs buildings in Wells, Nevada. All these buildings had cracking and minor damage, and 12 of them (63%) had major damage following the earthquake (dePolo, 2011). Earthquake damage to URM buildings from earthquakes includes parapet failures, collapse of floors, ceilings, and walls, and the partial or total collapse of the buildings themselves. Bricks and other debris fall from URM buildings and can cause injuries to bystanders and occupants trying to escape the structure. The unreinforced nature of these buildings allows them to break apart and lose cohesion when stressed by earthquake waves. Many unreinforced buildings were built in the late 1800s and early 1900s. The mortar was commonly poor in quality and has weakened with time. Today this older mortar can be disintegrated or eroded away entirely if not maintained, making these buildings even more susceptible to damage. In earthquake country, such as Nevada, it is also common for older earthquake damage not to be completely repaired if the building wasn't badly damaged and these damaged buildings may be in a weakened state from prior shaking.

Knowing the number and locations of URMs is the first step towards understanding the magnitude of this hazard in terms of type and usage of buildings, potential economic losses, and for rapid, prioritized emergency response and damage assessments. A preliminary statewide assessment was made based on a selection criteria and extracting potential URMs from county assessor's data and the Nevada Public Works (Price and others, 2012). The study collected information on buildings that were built before 1974 and were constructed of brick, stone, or block masonry. Price and others (2012) caution that there are errors in the database, such as missing URMs that were not recorded, were incorrectly recorded, are on Federal or Native American lands, and buildings that have had their vulnerability altered by seismic retrofit or have been removed. Price and others (2012) concluded there were potentially 23,597 URMs in Nevada, 7,354 buildings are residential and 16,243 buildings are commercial or public.

URM homes (Fig. 19) are of particular concern because of the long occupancy times, but homeowners rarely consider seismic rehabilitation because of cost. Commercial and public buildings may have ornamentation, such as parapets and crowning bond beams (Fig. 20), that are falling hazards around URMs even if the building doesn't collapse during an event (Fig 21).

Figure 19. Unreinforced masonry residence. The home is built on an inhomogeneous rubble-rock foundation, is likely not tied to the foundation, is made of ridged brick that break apart with strong earthquake forces, and has a topple hazard, the tall chimney. Possible secondary hazards include gas leaks and fire if the gas meter or hoses are damaged or further damaged by aftershocks. Shelter would likely be required for the residents following a major earthquake.

Figure 20. Unreinforced masonry commercial building with an unsupported parapet and crowning bond beam. The wheelchair-bound man below would have a difficult time getting out of the way during the shaking from an earthquake.

Figure 21. Bricks and crowning bond beam that fell on a car during the 2008 Wells, Nevada earthquake. Unreinforced masonry buildings can shed debris like this on sidewalks, alleys, and other buildings around them.

Price and others (2012) estimated that there were potentially 734 URM buildings in Carson City, of which 487 were commercial or public, 175 were residential, and 72 were state owned. In 2015, Carson City began reviewing this list of buildings to gain a better understanding of the number of URM buildings there are in the county and what their potential seismic vulnerabilities are. The study is ongoing, but is indicating the actual number of potentially dangerous buildings will be significantly lower than initial estimates. For example, the results of a windshield survey indicated about 150 buildings on the list of potential URM structures from Price and others (2012) are of cinder block construction (~20%), which would be anticipated to perform better in an earthquake than an older unreinforced brick building. Current estimates are that there are a little over 100 URM brick buildings in Carson City.

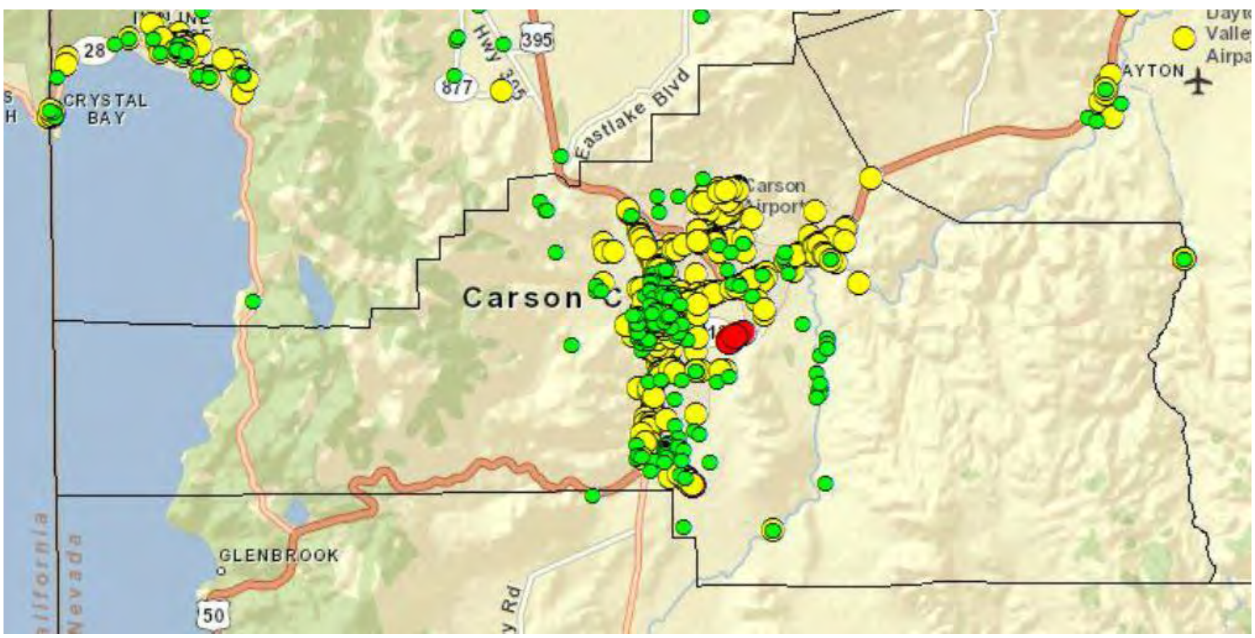

Figure 22. Locations of the possible unreinforced masonry buildings identified by Price and others (2012) in the county. Most of these are in downtown Carson City which has been built and settled since the mid-1800s. New surveys are being conducted to verify the results of this initial study and will substantially lower the number of recognized URM buildings in the county.

The unreinforced masonry building hazard is a very difficult engineering and social problem. These buildings commonly have a significant historical value and there is a strong desire to maintain their original appearance. But they are challenging to work with, even for non-seismic issues, such as installing utilities. If their seismic weakness is not considered, they could fail or shed debris that can kill or injure many people and be lost entirely when an earthquake occurs. The monetary resources needed to rehabilitate URMs are difficult to find and usually are obtained on a building-by-building basis, which is significant, but slow, progress. Communities that have URM buildings and have been through earthquakes, such as Napa and the 2014 South Napa earthquake, have decided it is worth pursuing the seismic rehabilitation or elimination and replacement of URM buildings. Sometimes this can be done with outside contributions, such as from FEMA mitigation grants. A community has to have a conversation about seismically dangerous buildings and what the best approach is. It takes time for a community to collectively decide. Some decisions are easier than others, such as repurposing a building to lower its occupancy versus the more costly structural rehabilitation of a building.

Earthquakes and Carson City Citizens

Earthquake preparedness is a personal and governmental responsibility. How an individual survives an earthquake is largely a function of the ability of an individual to react safely during an earthquake and the preparedness and mitigation they have done before the event. Every person in Carson City should know how to Drop, Cover, and Hold On when an earthquake occurs and the location of safety spots, the safest place to take cover from falling objects. This could dramatically decrease the number of injuries and deaths that could occur in the next major earthquake in the county.

Signing up for and participating in the ShakeOut reinforces the earthquake hazard in lieu of having a damaging earthquake. The ShakeOut is designed to engage participants and offer useful information on how to get prepared for earthquakes. This is why an important action for Carson City is to increase the participation in the annual Great Nevada ShakeOut, which is held in October. This can dramatically increase the ability of the county’s citizens to respond to an earthquake and can generate a greater awareness and support for community projects that reduce earthquake risk.

In 2015, fewer than 7% of the population of Carson City participated in the Great Nevada ShakeOut. Table 19 indicates the number of Carson City participants in the Nevada ShakeOut for each category for the years 2013, 2014, and 2015. Figure 23 shows the 2014 participation as a percentage by county throughout the state to show how Carson City ranks with other counties. Unfortunately, the trend of participants has been decreasing in Carson City and in 2015 there were 69% fewer participants than in 2013 (3,678 versus 11,757 people). Most of this difference can be attributed to the school district not registering. There are several categories that have had modest increases in participants and Healthcare, an important category to be earthquake ready, did increase over 300% from 2014 to 2015. Nevertheless, there is a lot of opportunity for Carson City to increase its participation in the ShakeOut.

The annual ShakeOut drill is scheduled for the third Thursday in October of each year. However, individuals or organizations may have a ShakeOut drill/activity within two weeks of this date to be counted in this participation number. There is value in promoting participants to visit the ShakeOut website for more specific preparedness information. ShakeOut categories that Carson City residents have not yet signed up include: Tribes, Hotels and Other Lodgings, Senior Facilities/Communities, Disability/AFN Organizations, Neighborhood Groups (Community Emergency Response Teams), Preparedness Organizations, Faith-Based Organizations, Museums/Libraries/Parks, Volunteer/Service Clubs, Youth Organizations, Animal Shelter/Service Providers, Agriculture/Livestock, Volunteer Radio Groups, Science/Engineering Organizations, and Media Organizations. These groups are strategic targets for promoting the ShakeOut in Carson City and increasing the number of people and the breadth of society getting earthquake ready. Social cueing is one of the greatest ways to influence people. If someone sees others participating they are much more likely to participate themselves. This is why it is important to get a large breadth of society involved. Also, each category that has not been involved has an important role in the event of an earthquake – one they might not currently realize.

Table 19. Carson City Participants in the Great Nevada ShakeOut

Category	2013*	2014*	2015*	2014-2015 Change
Individuals/Families	44	20	22	+
Childcare and Preschool	0	114	0	-
K-12 Schools and Districts	9315	7865	1395	- -
Colleges and Universities	0	1400	1154	-
Local Government	46	74	54	-
State Government	731	436	559	+
Federal Government (+military)	40	27	12	-
Businesses	120	92	102	+
Healthcare	30	85	365	+ +
Non-Profit Organizations	31	0	15	+
Total Participants	11,757	10,113	3678	- -

* Number of people registered.

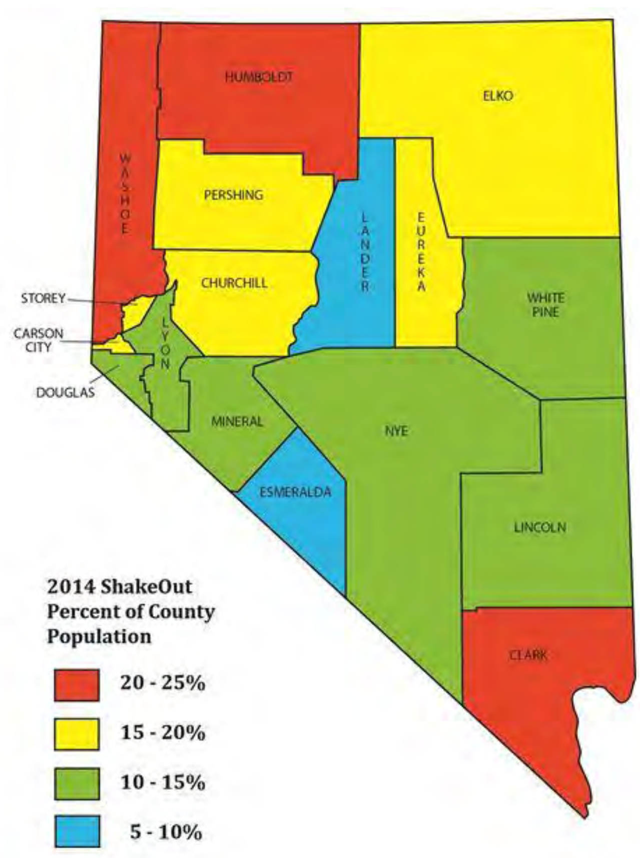

Figure 23. Percentage of population by county of ShakeOut participation in Nevada (from dePolo, 2015). In 2015, Carson City participation dropped to the 5-10% category. This is not commensurate with the high earthquake hazard. Ideally, Carson City would be in the highest category of participation.

Most people do not fully appreciate the threat posed by earthquakes. This is due to the less frequent occurrence of events compared with other hazards. Few earthquakes are desirable, but earthquakes still occur from time-to-time and people are quickly humbled when they strike. People realize why it is so important to prepare for this potentially deadly hazard after the event. The key is to take the earthquake threat to heart, always know how to react safely when an earthquake occurs wherever you are, prepare for earthquakes by making rooms safer by eliminating content and nonstructural hazards, and keep earthquakes in mind when making changes or additions to buildings. The goal is to survive future Carson City earthquakes with few or no injuries and minimize economic loss.

The Nevadan's guide on how to prepare for earthquakes and mitigating seismic risks is "Living with Earthquakes in Nevada" produced by the Nevada Bureau of Mines and Geology and available on the Internet at:
http://data.nbmg.unr.edu/public/freedownloads/sp/sp027.zip

The guide will come as a "zipped" file to save space - If you can open it in Windows Office, it should automatically unzip and open. It is a large file so please be patient.

Carson City Earthquake Mitigation Goals and Action Items

The overarching objective of these mitigation goals and actions is to make Carson City an earthquake resilient county that can experience earthquakes with no loss of life, minimal property damage, and a rapid and full recovery from earthquakes. It is inadequate to separate mitigation, preparedness, and policy issues as they are inextricably intertwined to produce effective earthquake resilience; therefore all three are included in these goals. Because of the importance of this opportunity to address the earthquake hazards of Carson City, these goals and actions go beyond the five-year operational life of the mitigation plan. They should not be considered "exhaustive" and can be prioritized as appropriate.

Goal 1: Encourage Earthquake Preparedness and Mitigation Activities at All Levels in Carson City

There is not a finishing point, or end, to being aware, being prepared, and mitigating for earthquakes. It is a continuous effort for leaders, managers, and citizens. People need to know how to react right away to an unusual, relatively rare, and commonly frightening situation. There is abundant evidence that the earthquake hazard and threat in Carson City is real and imminent. The actions of becoming aware of the hazard, preparing for, and mitigating seismic threats will help people stay in control and make wise decisions when a strong earthquake occurs.

Action Item 1: Create an earthquake hazard web page for Carson City that includes information on earthquakes, earthquake preparedness, seismic mitigation, and many helpful internet links. Specific information and guidance for individuals, neighborhoods, businesses, and communities should be included, as well as clear and convincing messaging of the earthquake hazard potential of Carson City for residents and newcomers. All county residents should know what to do during an earthquake and assist family, friends, customers, and visitors in the aftermath of an event. Part of the web page should be used to convince citizens of the earthquake threat Carson City faces. [POLICY - PROJECT]

Action Item 2: Advertise, participate, and use as a motivational vehicle the Great Nevada ShakeOut exercise, setting high goals for participation with the supporting strategies to make this work. For example, Carson City can become the first county in the state to have a 50% participation rate. Encourage County Commissioners, the Mayor, the Fire Chief, and the County Manager to act as public champions for the ShakeOut. [POLICY - SMALL PROJECTS]

Goal 2: Assess Earthquake Vulnerabilities of Existing Buildings and Create Strategies to Reduce Earthquake Risks from these Buildings

Action Item 1: Assess the seismic vulnerability of emergency facilities, hospitals, fire and sheriff offices, and lifeline utilities, including the local airport. Recommend any needed actions to reduce seismic vulnerabilities for these facilities. Ideally emergency facilities should survive and be operational following a strong earthquake. [PROJECT]

Action Item 2: Assess the seismic vulnerability and potential content and nonstructural hazards of schools, county buildings and facilities, high-occupancy buildings, and historical buildings. Schools and public facilities are commonly used as shelters following an earthquake disaster. [PROJECT]

Action Item 3: Promote the proper anchoring of homes and buildings to their foundations, especially structures that were built prior to the adoption of anchorage practices in the building code. Instructions on how to evaluate anchoring and anchor if needed should be provided on the earthquake web page. [POLICY - SMALL PROJECTS]

Action Item 4: Continue assessing the number of buildings and facilities that are vulnerable to earthquakes and can cause casualties, injuries, or large property losses. The most vulnerable buildings include unreinforced masonry buildings and non-ductile concrete buildings. The survey that was recently conducted can be further refined to include a prioritization with respect to seismic risk. In addition to the most vulnerable buildings, other types of construction and construction practices that can have seismic weaknesses should be reviewed, including older wood-frame buildings that may not be tied to their foundations, tilt-up concrete buildings that may have inadequate ties between the walls and the roof, and soft-story construction that may lack enough lateral resistance for earthquakes. A tool that can be used in this survey is the Rapid Visual Screening of Buildings for Potential Seismic Hazards (FEMA 154, http://www.fema.gov/library/viewRecord.do?id=3556). Potential economic losses can be estimated to give a perspective of the impact of potential building damage and for understanding the benefit-cost analyses of seismic rehabilitation. A ranking of public and non-public buildings and facilities by earthquake risk would be useful, so that the highest risk structures can be easily identified. This is important for long-term planning and an emergency response. [PROJECT]

Action Item 5: Compile strategies or techniques for the seismic rehabilitation of public buildings and estimate the mitigation costs. Strategies can include sequencing rehabilitation with maintenance to help lower costs and impact, developing possible funding sources and partnerships, and potential incentives for the seismic rehabilitation of private buildings with high occupancy levels. These strategies and techniques can be made readily available on the earthquake web page. [PROJECT - POLICY]

Action Item 6: Seismically rehabilitate the highest earthquake risk public buildings in Carson City and continue to rehabilitate the next highest priority buildings until all buildings, new and old are seismically resistant or reach an acceptable level of earthquake risk. This would likely be done on a project-by-project basis over a period of years. [PROJECTS]

Goal 3: Reduce Content and Nonstructural Hazards in Homes, Businesses, and Public Buildings

Action Item 1: Create an awareness and motivation campaign in Carson City to reduce building content and nonstructural hazards, some of the largest causes of earthquake injuries and economic losses. Use the county website, the Great Nevada ShakeOut activity, and public gatherings, such as the county fair, to promote and reinforce the nonstructural earthquake safety message. Encourage hardware stores to stock mitigation supplies for securing contents. Hold "how to" workshops to promote simple mitigation projects. Making sure water heaters are properly secured for shaking is an excellent place to start for safety and emergency water supply purposes. [POLICY - SMALL PROJECTS]

Action Item 2: Encourage assistance for individuals who might not be able to do nonstructural mitigation themselves. Possible programs include neighbors-helping-neighbors, community mitigation volunteers, or possibly Community Emergency Response Team (CERT) activities (training through mitigation). [POLICY]

Action Item 3: Promote an awareness campaign and mitigation activity to properly secure nonstructural items that are of an engineering nature, such as overhead light fixtures. Annual awards advertising the safety of buildings that have been mitigated can be given out as an incentive. [POLICY - SMALL PROJECTS]

Goal 4: Encourage the Purchase of Earthquake Insurance

Action Item 1: Encourage the purchase of earthquake insurance to cover vulnerable buildings and to protect major assets from earthquake losses, especially in areas with specifically identified hazards, such stronger shaking areas, liquefaction areas, and areas of potential lake tsunami or seiche inundation. Earthquake insurance has to be specifically purchased and is not part of general insurance packages. Consequently, most homes and private buildings in Carson City currently do not have earthquake insurance. Add information and web links to information and insurance carriers, which offer earthquake insurance. Currently, government buildings are covered and the school district has earthquake insurance. [POLICY]

Goal 5: Continue to Adopt and Enforce Current Building Codes and their Seismic Provisions

Action Item 1: Continue adopting and enforcing the current International Building Code and its seismic provisions for new buildings, facilities, and construction in Carson City. [POLICY]

Action Item 2: Encourage the incorporation of earthquake resistance to mobile home installation guidelines. This will reduce overturning, foundation displacement, and the compromise of utilities including water, sewer, gas, and electricity. [POLICY]

Action Item 3: Evaluate the impact of different site velocity classes to input values for construction in Carson City. If significant, create earthquake shaking site class maps of the urban and urban expansion areas based velocity measurements of the upper 100 feet of site material. This can be accomplished using Refraction Microtremor measurement of shallow ground velocity measurements and/or velocity-calibrated geologic mapping, and/or slope mapping. The site velocity maps can be used as input for the seismic provisions of the International Building Code, requiring more earthquake resistance to buildings in areas that are prone to more shaking, such as unconsolidated young sediments. [PROJECT]

Goal 6: Encourage and Plan for Appropriate Land Use to Minimize Earthquake Damage and Losses

Action Item 1: Create earthquake and fault hazard maps at a scale of 1:24,000 or larger for the Carson City, including: 1) an earthquake fault trace map with recommended set-back zones or other mitigation alternatives, 2) a potential earthquake liquefaction hazard map, 3) a landslide hazard map with possible run-out areas, and 4) a lake tsunami/seiche inundation map for the Late Tahoe shorelines with potential water run-up areas and water heights. These should be readily available to the public on the earthquake web page. [PROJECTS]

Action Item 2: Avoid construction over late Quaternary fault zones. Develop a strategy to avoid building structures for human occupancy and high-value structures across late Quaternary fault traces. For example, fault traces could be identified and a set-back zone of 50 to 60 feet either side of the main late Quaternary fault trace could be used as a guideline. Important structures that must cross faults should characterize and mitigate potential surface offset. [PROJECT - POLICY]

Action Item 3: Establish guidelines for appropriate design and construction in areas of potential liquefaction, landslides, and rock fall areas. Develop seismic guidelines for construction of buildings and other structures such that damage from liquefaction is acceptable and not life threatening. Include guidelines for avoidance of potential damage areas from seismically induced landslides/rock falls and landslide run-out areas in and around areas of habitation or infrastructure. [PROJECT - POLICY]

Action Item 4: Study the paleoearthquake history of local earthquake faults to better characterize the potential magnitude and occurrence of earthquakes in Carson City. These studies are scientifically detailed and expensive, and Federal grants are usually used in Nevada to help support them. A monetary match is often required for these grants and the development of local funds to use as match would facilitate paleoseismic studies in the county. Cooperation in land access to conduct paleoearthquake studies is another way communities can encourage these studies. The better defined the earthquake hazard is the easier it is to appropriately mitigate earthquake risks. [PROJECTS]

Goal 7: Plan for a Successful Earthquake Disaster Emergency Response and Recovery

Action Item 1: Prepare a detailed Earthquake Disaster Planning Scenario for the county, so that consequences, inter-related incidents, and compounding elements can be recognized and anticipated. Planning scenarios can be used to enhance emergency response and recovery plans and as a tool to help officials and the public visualize the earthquake threat. This visualization aids in evaluating and engaging in effective mitigation. Using real buildings and inventories in the scenario emphasizes the earthquake risk to people. [PROJECT]

Action Item 2: Create a semi-detailed recovery plan to restore the function and quality of life in the county within three years or less following a large earthquake disaster. Successful recoveries have a distinct time variable and recovery is harder to achieve if it is unorganized or progresses slowly. The recovery phase of a disaster is also an opportunity to engage in mitigation and there are potential funding sources for mitigation projects. Recovery needs to begin immediately following the emergency response and needs clear strategies that can be engaged rapidly to help protect businesses, community function, and individuals. A good recovery plan will facilitate these activities. [PROJECT]

Prioritization of Earthquake Resiliency Actions

Table 20 is a suggested prioritization for the earthquake resiliency actions proposed in this study. It includes an abbreviated benefit of taking these actions in the table. The table can be a starting point for discussions on what the leaders and citizens of Carson City feel are the most appropriate and effective actions. The list can be dynamic, with completed actions falling off the list or being lowered in rank and new focus areas rising in importance.

Table 20. Suggested Prioritization of Actions for Earthquake Resiliency

Rank	Goal & Action	Title	Benefit
1	G1A1/G1A2/G3A1/G4A1	Public Awareness Campaign	reduce eq injuries
2	G2A1	Emergency facility assessment	emerg response
3	G2A2	School and county bldg. assess	safety and ER
4	G5A2	Mobile home guidelines	reduce eq losses
5	G2A3	Encour foundation anchoring	reduce eq losses
6	G2A4	Eq risk bldg assess	assess vulnera
7	G7A1	Eq disaster Scenario	motivation & vuln
8	G2A5	Seis rehab tech strategy costs	decision tool
9	G5A3	Site velocity eval & map	IB code tool
10	G3A3	Engineering nonstructural mit	reduce eq risk
11	G2A6	Rehab highest risk bldgs.	reduce eq risk
12	G7A2	Eq recovery plan	facilitate recov
13	G6A1	Seismic hazard maps	plan reduce risk
14	G6A2	Eq fault avoidance	reduce eq risk
15	G6A4	Paleoseismic studies	eq hazard charac
16	G6A3	Other eq haz mitigation	reduce eq risk
17	G3A2	Assist w/bldg. content mitigation	increase eq safety
18	G5A1	Continuing using IBC	reduce eq risk

Conclusions

Carson City has a high level of earthquake hazard. Fortunately there has been an investment in the county in terms of strong building codes and earthquake insurance that will help reduce damage and losses during the next earthquake. Carson City is poised to become an earthquake resilient county, but there are many actions that still need to be taken. For example, the strength of older, weaker buildings needs to be investigated and seismic risks mitigated over time. Perhaps the most important and time effective action that can be taken is the wholesale education of Carson City citizens on how to react and protect themselves when strong shaking occurs. The proper response to an earthquake can literally save people's lives and needs to be practiced to be effective. When the next damaging earthquake occurs in Carson City, or anywhere else, we want people to emerge unharmed. This requires the proper reaction to an earthquake and some thought and action on securing seismically threatening contents in rooms. This can result in protecting your loved ones, friends, employees, customers, and self from falling objects.

An earthquake safety web page and leadership will help facilitate personal preparedness. People need to understand their earthquake hazards and risk, and be motivated to mitigate the negative impacts. It takes a specific commitment to be proactive, have a conversation about earthquake risks, and sustain this effort into the future. With time, earthquake preparedness will become more folklore to be followed, reinforced by occasional earthquakes. This will help make harder efforts, such as repurposing or rehabilitating seismically dangerous buildings, easier to consider. Long-term planning should continue to include earthquakes and related hazards and opportunities to lower earthquake risk.

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Appendix -

Modified Mercalli Intensity Levels and Descriptions

Intensity I **Not Felt**

Not felt except by a few people under especially favorable circumstances.

Intensity II **Scarcely Felt**

Felt only by a few people at rest, especially in the upper floors of buildings.

Intensity III **Weak Shaking**

Felt quite noticeably indoors, especially on the upper floors of buildings, but many people do not recognize it as an earthquake. Hanging objects swing.

Intensity IV **Moderate, Widely Observed Shaking**

During the day, felt indoors by many, outdoors by few. At night some awakened, especially light sleepers. Dishes, windows, doors disturbed; walls make creaking sound.

Intensity V **Strong Shaking**

Felt by nearly everybody indoors, felt by many outdoors, awakened many if not most. Frightened a few people. Some dishes and windows broken. Overturned vases or small unstable objects.

Intensity VI **Slightly Damaging Shaking**

Felt by all, many to all frightened and run outdoors. Some alarm among individuals. Awakened all. People move about unsteadily during the event. Damage slight in poorly built buildings. Small amounts of fallen plaster, cracked plaster and walls, broken dishes and glassware in considerable quantities, also some broken windows, fall of knickknacks, books, pictures, some heavy furniture moved and overturned.

Intensity VII **Moderately Damaging Shaking**

Frightened all, general alarm, all run outdoors, some or many find it difficult to stand. Waves in ponds, lakes, running water, water turbid from being stirred up. Suspended objects made to quiver. Some rock falls. Damage considerable in poorly built or weak buildings, adobe buildings, unreinforced masonry buildings, old walls, and spires. Chimneys cracked to a considerable extent. Fall of plaster in large amounts. Numerous windows broken. Loosened brickwork and tiles shaken down. Fall of cornices, bricks and stones dislodged. Damage considerable to concrete irrigation ditches.

Intensity VIII **Heavily Damaging Shaking**

General fright, alarm approaches panic. Trees shaken strongly, branches and trunks broken off. Liquefaction occurs locally accompanied by ejected sand or mud in small amounts. Changes in levels and temperatures of springs. Many rock falls and landslides. Damage slight in well-built structures designed with earthquake resistance, considerable in ordinary substantial buildings, weak structures partially collapsed, racked, and tumbled down. Fall of walls. Seriously cracked and broken stone walls. Twisting, fall of chimneys, columns, monuments, factory stacks, and towers. Very heavy furniture moved conspicuously or overturned.

Intensity IX **Destructive Shaking**

General panic. Conspicuous cracked ground. Damage considerable in specifically designed structures, great in substantial masonry buildings with some collapse. Buildings wholly shifted off foundations. Well-designed frame structures thrown out-of-plumb and racked. Reservoirs damaged and underground pipes are sometimes broken.

Intensity X **Very Destructive Shaking and Ground Displacement**

Cracked ground, especially when loose and wet. Parallel fissures along canal and stream banks. Landslides considerable along stream banks and steep cliffs. Changed levels in many water wells. Water thrown on the banks of canals, lakes, and rivers. Some well-built structures destroyed. Most masonry structures destroyed along with their foundations. Rails bent slightly. Serious damage to dams, dikes, and embankments.

Intensity XI **Devastating Shaking and Ground Displacement**

Widespread ground disturbance, broad fissures, earth slumps, and land slips in soft, wet, ground. Ejection of large amounts of water charged with sand and mud. Few, if any masonry structures remain standing. Severe damage to wood-framed structures. Great damage to dams, dikes, and embankments. Bridges destroyed by wracking of support piers or pillars. Rails bent greatly. Underground pipes completely out of service.

Intensity XII **Complete Devastation from Shaking and Ground Displacement**

Damage total. Waves seen on ground surface. Objects thrown up in the air. Ground greatly disturbed. Waterways blocked by landslides. Large rock masses loose. Fault displacement of surface with notable horizontal and vertical displacements.