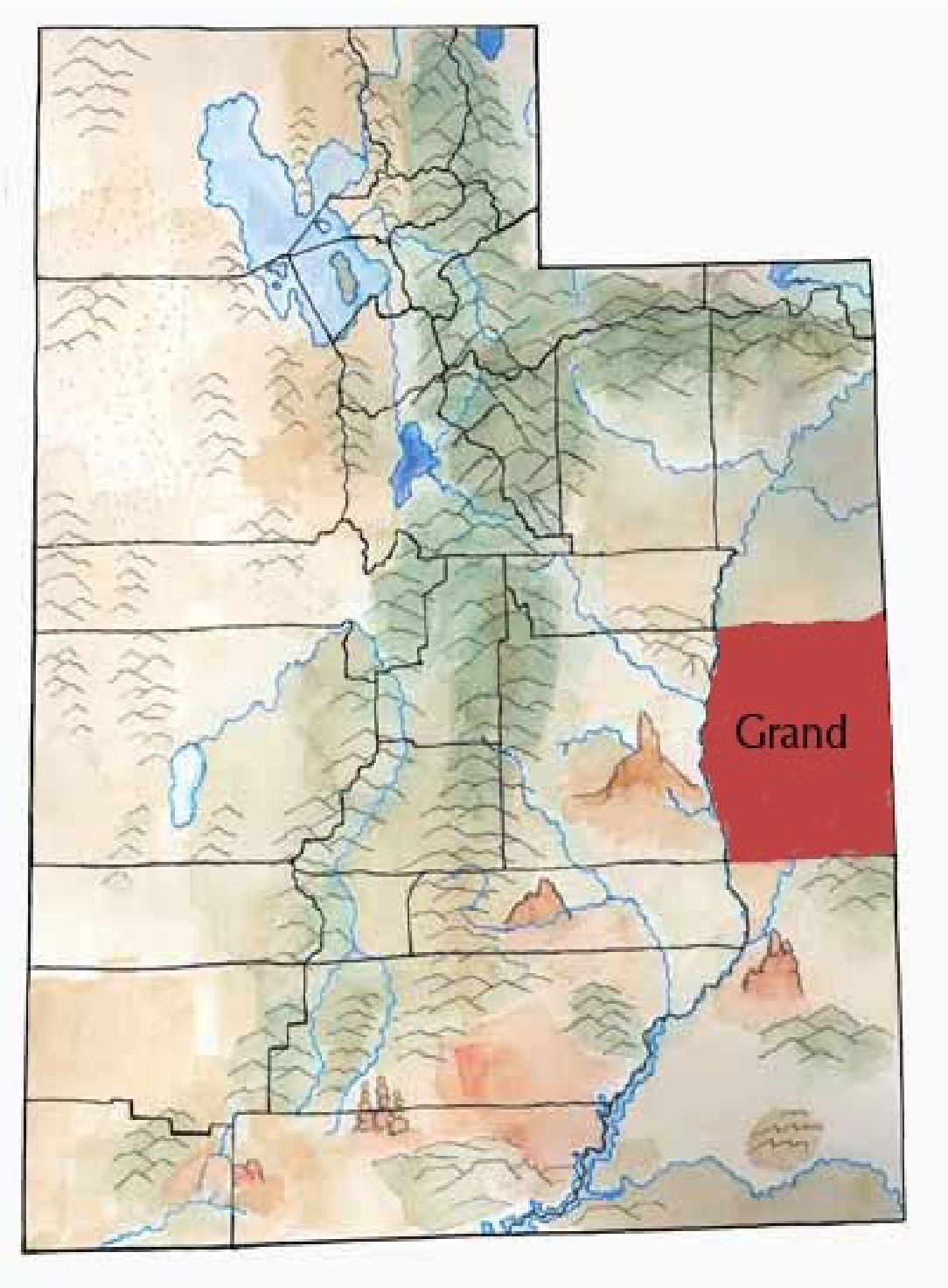
# Grand County Pre-Disaster Hazard Mitigation Plan 2018

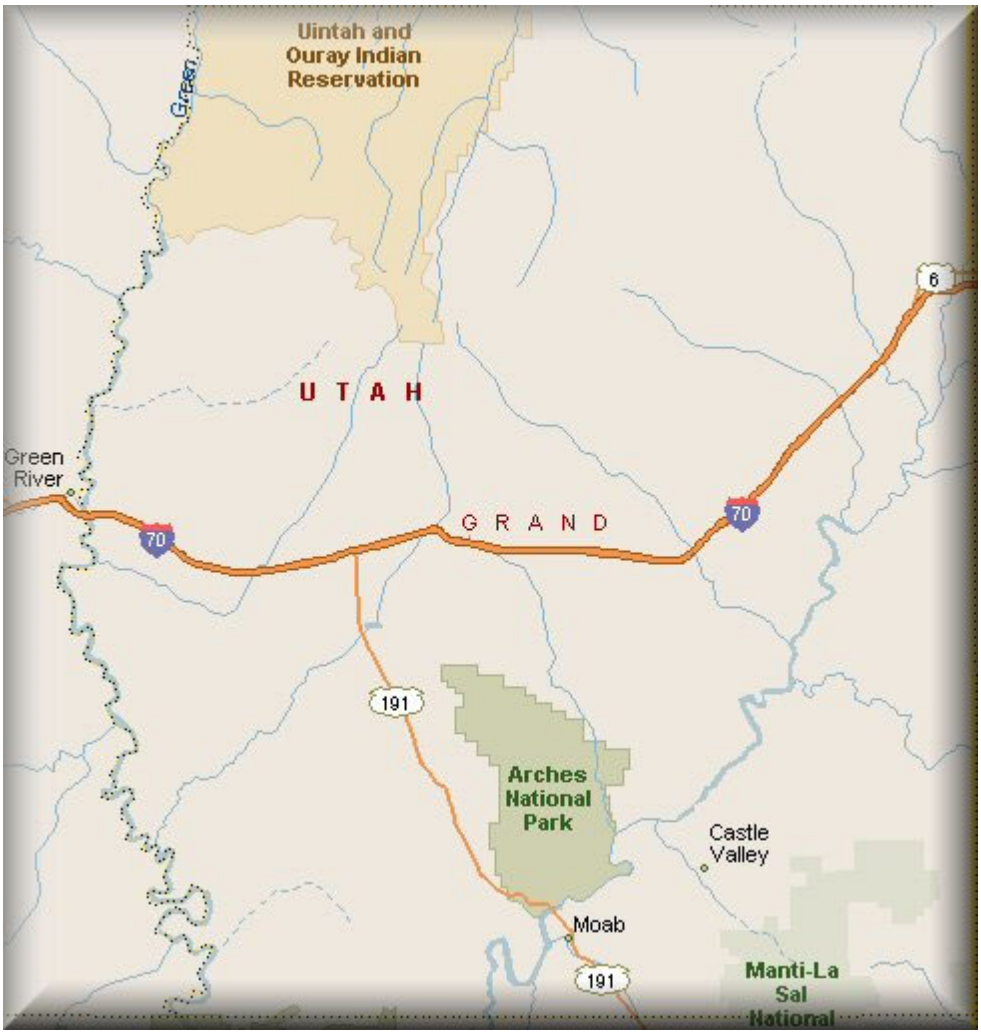


# Grand County Pre-Disaster Hazard Mitigation Plan 2018

| Table of Contents | |
|---|---|
| **Grand County** | **3** |
| **PDM Project Quick Reference** | **4** |
| **PDM Introduction** | **5** |
| Demographics and Population Growth | **12** |
| Economy | **13** |
| Transportation and Commuting Trends | **14** |
| Land Use and Future Development Trends | **15** |
| Risk Assessment (Working Group) | **18** |
| Critical Facilities | **19** |
| **Natural Hazards Profiles** | **25** |
| Flood | **28** |
| Wildland Fires | **37** |
| Landslides | **40** |
| Problem Soils | **44** |
| Dam Failure | **51** |
| Severe Weather | **52** |
| Earthquake | **54** |
| Drought | **57** |
| Infestation | **60** |
| Hazard History | **73** |
| **Mitigation Goals, Objectives and Actions** | **74** |
| Flood | **80** |
| Wildland Fire | **82** |
| Severe Weather | **83** |
| Landslides | **84** |
| Problem Soils | **85** |
| Earthquake | **86** |
| Drought | **Appendix 1** |
| **Plan Maintenance, Evaluation and Implementation** | **Appendix 2** |
| **PDM Planning Process** | **Appendix 3** |
| **Hazus** | **Appendix 4** |
| **Environmental Considerations** | **Appendix 5** |
| **Mitigation Strategies** | **Appendix 6** |
| **References and Resources** | **Appendix 7** |
| **Castle Valley PDM Plan** | **Appendix 8** |
| **Community Wildfire Preparedness Plan** | |

# Grand County

Grand County, located in southeastern Utah, was founded in 1890 with a population estimated in 2016 at 9,579 (*United States Census 2016 Quick Facts*). Named for the Colorado River—then known as the Grande River—the county is bounded by the Green River on the west and the state of Colorado on the east, covering a total area of 3,671.54 square miles according to the National Conservation Resource Service (NCRS). Grand County's natural features include its namesake river, which runs through its southeastern corner; Arches National Park just north of Moab in the south; and the northernmost portion of Canyonlands National Park in the southwest corner. The county seat is Moab City which, along with Castle Valley Town, are the two incorporated areas. Other communities include Thompson Springs, the Moab suburb of Spanish Valley, and Cisco—a ghost town with a population of approximately 10.



# Grand County Pre-Disaster Hazard Mitigation Plan 2018

Below is a quick reference of Grand County's past, present and future Mitigation projects

| Date Started | Project Name and Brief Description | Project Status |
|---|---|---|
| 2018-2019 | Jackson Street Storm Drainage Mitigation Project | New Project |
| 2014-2023 | Mitigate the effects of hillside floods in southwest Moab | On-Going |
| 2014-2023 | Support and Update the Grand County Storm Water Management Plan | On-Going |
| 2017-2019 | Support and encourage Grand County to develop a Pack Creek Map modification program | Anticipate completion in 2019 |
| 2013-2023 | Encourage 100% participation in the National Flood Insurance Program | On-Going |
| 2013-2023 | Protect the City of Moab's Water Reclamation Facility from flooding by the Colorado River | On-Going |
| 2014-2023 | Implement Grand County's Storm Drain Master Plan Priorities A, B, C, D, E, and F | On-Going |
| 2017-2020 | Upgrade Spanish Valley Water and Sewer mainline | Estimate completion in 2020 |
| 2016-2023 | Develop a culinary water source for Thompson Springs Special Service District | On-Going |

| | | |
|---|---|---|
| 2017-2023 | Mitigate flood damage on Highway 191 by participating in the Gateway Plan | On-Going |
| 2013-2023 | Participate in the Storm Ready Program | On-Going |
| 2013-2023 | Provide Avalanche Awareness educational materials to back country users | On-Going |
| 2018-2020 | Assess the probability of landslides and identify structures at risk | Anticipate assessment to be complete in 2020 |
| 2018-2023 | Use water conservation efforts to mitigate the shrinking/swelling around structures | On-Going |
| 2018-2020 | Identify critical transportation and utility infrastructure that may be impacted by an earthquake | Anticipate completion by 2020 |
| 2018-2023 | Distribute "Water Wise" information and post on County's social media | On-Going |
| 2018-2023 | Develop new water sources, encourage the use of gray water as modern technology comes on line, and develop new storage capacity | Proposed |

## Introduction

### Mission

The Grand County Pre-Disaster Natural Hazard Mitigation Plan was created with the goal of substantially and permanently reducing the County's vulnerability to natural hazards through sound public policy. By increasing public awareness of potential harm, documenting resources for risk reduction and loss-prevention, and identifying activities

to guide the development of less vulnerable and more sustainable communities, the Pre-Disaster Natural Hazard Mitigation Plan aims to protect citizens, critical facilities, infrastructure, private property, and the natural environment.

**Plan Review and Update 2018**

After an extensive review to incorporate the most current demographic data, maps, vulnerability assessments, and mitigation projects, this 2018 Grand County Pre-Disaster Natural Hazards Mitigation Plan (PDM) has been created to update the original PDM plan created in 2003, updated in 2013, which was approved by the county, the state, and FEMA. The review incorporates the revision of names, critical facilities, hazard history, and economic development throughout the region over the previous five years. Other changes include a reorganization of the mitigation goals, objectives, and actions for ease in reading and for more clearly identifying projects. There have been some minor changes to appendices and general maintenance parts, however there were no changes to background history and data which continues to accurately reflect the region.

**Organization**

As with the original Pre-Disaster Mitigation Plan (PDM), this updated version was developed and organized within the rules and regulations established under CFR Title 44, Part 201.6. Contained within the plan is a consideration of the purpose and methodology used in developing the plan, as well as a profile of communities within the county, and a vulnerability analysis of nine potential natural hazards. Several appendices are included to provide further detail on specific elements of the above content. This plan is intended to create a foundation that will enable Grand County and the communities within Grand County to develop projects that provide for both the safety of their populations and the protection of the environment.

**Plan Financing**

The Grand County Pre-Disaster Natural Hazard Mitigation Plan was financed and developed under the Pre-Disaster Natural Hazard Mitigation Program guidelines established by the FEMA and the Utah Department of Public Safety Division of Emergency Management.

**Plan Participation**

The 2018 Grand County Pre-Disaster Natural Hazards Mitigation Plan was completed through the collaborative efforts of the Utah Department of Public Safety Division of Emergency Management, Grand County Emergency Manager, Fire Departments, Grand County Sheriff's Office, Public Works Department, Planning Commission, Assessor's Offices, City, County, and State GIS Departments, Elected Officials, Public Employees,

Utah Division of Forestry, Fire and State Lands, and Citizens of the cities and towns within Grand County. Feedback was solicited through the Grand County Pre-Disaster Natural Hazard Mitigation Plan Working Group during the plan development. Public participation was also encouraged through a public hearing and review of the 2018 PDM Plan on the Grand County website. All comments, questions, and discussions resulting from these activities were given thoughtful consideration as the plan was developed.

**Purpose**

This plan exists to identify natural hazard threats to the community, prepare mitigation management strategies to address those threats, develop short-term and long-term goals and objectives for mitigation planning, and to fulfill federal, state, and local hazard mitigation planning obligations. The intention of this plan is to enhance awareness of, and provide mitigation strategies for, elected officials, agencies, and the public, develop actions which will minimize negative outcomes to Grand County's citizens, the economy, and the environment due to potential natural hazard threats. The well-being of the county and local communities' rests on reducing risks to life and property in the event of a natural hazard event.

**Community Capabilities**

Grand County and the municipalities of Moab City and Castle Valley Town face many challenges to improve the natural hazard mitigation efforts and sustain the Grand County Pre-Disaster Natural Hazards Mitigation 2018 Plan. The following capabilities have been identified for consideration for discussion and strengthening to implement and sustain the plan.

Financial:
Grand County nor Moab City or Castle Valley Town maintain a natural hazard mitigation specific fund or funding mechanism. Grand County, Castle Valley Fire Protection District and the Moab Valley Fire Protection District do participate in the Utah Wildland Suppression Fund and has developed the Community Wildfire Preparedness Plan (Appendix 8). The CWPP does provide for some mitigation funding for Urban Wildland Interface fire reduction programs. The challenge as acknowledged in the Grand County General Plan is 95% of the county is owned by other Federal, State government agencies or is Tribal land and only 5% of the county is providing the tax base for county and municipal services. Additionally, there is very large portion of the County that is not served by any of the Fire Districts. The two-fire protection special service districts have their own taxing authority and governing boards. The Thompson Springs Fire Department serves the towns of Crescent Junction and Thompson Springs but is limited by volunteers to the point that they generally do not have enough staff to respond. The County does have a Memorandum of Understanding (MOU) with the Lower Valley Fire

Protection District based in Loma, Colorado to provide some limited service into the Utah portion of the I-70 corridor.

Planning and Technical Services:
The planning and technical capabilities of Grand County and the municipalities are impacted by the limited tax base as the hiring of professional staff is often unobtainable. The elected officials and appointed staff perform many of the tasks normally completed by professional staff members. An example of a technical shortfall is that within Grand County there is not currently a GIS trained staff member. The county and municipalities will contract out for specific planning documents such as Master Plans, General Plans, and Zoning Ordinances. The Southeast AOG is an organization the county can reach out to for assistance with planning and technical services.

Administration:

Grand County has an elected seven-person County Council and an appointed County Council Administrator. The emergency manager is also overseeing the special projects such as the jail remodeling, county communication system, assisting the County Public Safety Answering Point (PSAP) dispatchers, and is responsible for the Community Wildfire Preparedness Plan. The county has three full time building inspectors and one full time staff person. The County provides the building inspection services for the City of Moab and the north part of San Juan County under contracts with these entities. This department also oversees the flood plain management program for the County. The County has a full-time staff for planning and zoning duties. The elected Sheriff provides law enforcement services throughout the county and unincorporated towns with a limited staff. The fire and EMS first responders are a mixture of paid staff and volunteers along with the County Search & Rescue organization within the county. The county does maintain a Public Works/Road Department.

Moab City and the Town of Castle Valley have an elected mayor and city council and Moab has a city administrator. The City of Moab does support a small police department. The City of Moab has a Public Works and Roads Department along with a Planning & Zoning Department and is considering hiring its own full time building inspector.

The ability of Grand County and the municipalities to expand the funding opportunities, roles and responsibilities beyond the current capability of implementing and sustaining the Pre-Disaster Natural Hazards 2018 Plan is constrained by the limited tax base.

# Grand County Pre-Disaster Hazard Mitigation Plan 2018

**Scope**

The plan provides comprehensive natural hazard identification, risk assessment, vulnerability analysis, mitigation actions, and an implementation schedule.

**Grand County Plan Goals and Objectives**

The goals of the Pre-Disaster Natural Hazard Mitigation Plan include coordinating with local governments to develop Grand County plans and processes that meet the planning components identified in the FEMA Region VIII Crosswalk document, as well as Utah DEM planning expectation, and public input from the local community. The overall objective is risk reduction from natural hazards in the State of Utah through implementing and updating county, regional, and the State of Utah mitigation plans.

**Short Term Goals*:***

These goals form the basis for the development of the Pre-Disaster Natural Hazard Mitigation Plan and are shown from highest to lowest priority.

1. Protection of life before, during, and after the occurrence of a natural disaster.
2. Preventing loss of life and reducing the impact of damage where problems cannot be eliminated.
3. Protection of emergency response capabilities (critical infrastructure).
4. Protect and/or create communication and warning systems.
5. Protect emergency medical services and medical facilities.
6. Ensure mobile resource availability and survivability.
7. Ensure the continuity of government.
8. Protect developed property, homes and businesses, industry, educational institutions and the cultural fabric of the community. While utilizing hazard loss reduction within the community's environmental, social and economic needs.
9. Protect natural resources and the environment, when considering mitigation measures.
10. Promote public awareness through education of community hazards and mitigation measures.
11. Preserve and/or restore natural features.

**Long Term Goals:**

1. Eliminate or reduce the long-term risk to human life and property from identified natural hazards.
2. Aid both the private and public sectors in understanding the risks they may be exposed to and find mitigation strategies to reduce those risks.

3. Avoid risk of exposure to identified natural hazards.
4. Minimize the impacts of those risks when they cannot be avoided.
5. Mitigate the impacts of damage because of identified natural hazards.
6. Accomplish mitigation strategies in such a way that negative environmental impacts are minimized.
7. Provide a basis for funding; prioritizing of natural hazard mitigation projects.
8. Establish a county platform to enable all the communities to take advantage of shared goals and resources.

**Objectives:**

The following objectives are meant to serve as a measure to evaluate natural hazard mitigation projects. The criterion becomes especially important when two or more projects are competing for limited resources.

1. Identification of persons, agency or organization responsible for implementation.
2. Project a time frame for implementation.
3. Explanation of how the project will be financed including the conditions for financing and implementing (as information is available).
4. Identifying alternative measures, should financing not be available.
5. Be consistent with, support, and help implement the goals and objectives of natural hazard mitigation plans already in place.
6. Projects should significantly reduce potential damages to public and/or private property and/or reduce the cost of state and federal recovery for future disasters.
7. Projects should have practical, cost-effective, and environmentally sound alternatives after options are considered.
8. Projects should address repetitive problem(s), or one that has the potential to have a major impact on a critical facility.
9. Projects should meet applicable permit requirements where development in hazardous areas is avoided.
10. Projects should contribute to both the short and long-term solutions to the hazard vulnerability risk problem assuring the benefits of a mitigation measure is equal to or exceeds the cost of implementation.
11. Projects should have manageable maintenance and modification costs when possible.
12. Projects should accomplish multiple objectives including improvement of life-safety risk, damage reduction, restoration of essential services, protection of critical facilities, and security of economic development, recovery, and environmental enhancement whenever possible.

**Authorities**

**Federal:**

Public Law 93-288 as amended, established the basis for federal hazard mitigation activity in 1974. A section of this Act requires—as prerequisite for state receipt of future disaster assistance outlays—the identification, evaluation, and mitigation of hazards. Since 1974, many additional programs, regulations, and laws have expanded on the original legislation to establish hazard mitigation as a priority at all levels of government. Several additional provisions were also included when PL 93-288 was amended by the Stafford Act that provide for the availability of significant mitigation measures in the aftermath of a Presidentially declared disaster. Civil Preparedness Guide 1-3, Chapter 6-Hazard Mitigation Assistance Programs places emphasis on hazard mitigation planning directed toward hazards with a high impact and threat potential.

The Disaster Mitigation Act of 2000 (DMA 2000) was signed into Law on October 30, 2000 by President Bill Clinton. Section 322, defines mitigation planning requirements for state, local, and tribal governments. Under Section 322, if states submit a mitigation plan (a summary of local/regional mitigation plans) identifying natural hazards, risks, vulnerabilities, and proposed actions to reduce those risks and vulnerabilities, the state is eligible for an increase in the Federal share of hazard mitigation.

**State:**

The Governor's Emergency Operation Directive, The Robert T. Stafford Disaster Relief and Emergency Assistance Act, amendments to Public Law 93-288, as amended, Title 44, CFR, Federal Emergency Management Agency Regulations, as amended, State Emergency Management Act of 1981, Utah Code 53-2, 63-5, Disaster Response Recovery Act, 63-5A, Executive Order of the Governor, Executive Order 11, Emergency Interim Succession Act, 63-5B.

**Local:**

Effective natural hazard mitigation is dependent upon local governments assuming a vital role. As such, each local government will review all present or potential damages, losses, and related impacts associated with natural hazards to determine what is required for mitigation action and planning. For Grand County and the Cities and Towns of Grand County, the local executives responsible for implementing plans and policies are the Grand County Council and City or Town Mayors. It is critical that local governments be prepared to participate in the post-disaster Hazard Mitigation Team process, as well as the pre-mitigation planning outlined in the Pre-Disaster Natural Hazard Mitigation Plan.

## Demographics and Population Growth

Demographics provide a way of understanding both the stability of a community (through determining the degree of change within the community [see Table 1] and showing the ethnic diversity within the community [see Table 2], as well as potential impacts any natural hazard may have. To that end, the following information regarding Population, Population Estimates, and Development Trends is provided.

In recent years, Grand County has seen a slight increase in population. According to the 2010 census, the population was 9,225, while the 2016 population count was estimated at 9,579. Over 50% of the population lives in the county seat of Moab City on the southern edge of the county. According to the 2010 census the population of Moab City was 5,062, while the 2016 census count was estimated at 5,242. Due to its proximity to nearby Arches and Canyonlands national parks, Moab attracts a large number of tourists during the year who uses the town as a base for hiking and climbing, mountain biking adventures along an extensive network of trails, including Slickrock Trail, and the off-roading at the annual Moab Jeep Safari.

**Table 1 Grand County Population**

| | Grand County | Moab City | Castle Valley |
|---|---|---|---|
| **2010 Population** | 9.225 | 5,062 | 319 |
| **2015 Population** | 9,516 | 5,235 | 343 |
| **2016 Population** | 9,579 | 5,242 | 348 |
| **2017 Population** | 10,292 | 5,584 | 367 |
| **2020 Population Projections** | 10,302 | 5,634 | 400 |

**(United States Census 2016 Quick Facts) (Town of Castle Valley Public Tableau.com)**
**(2017 Est. as of July 1, 2017 Utah Town Locator)**

**Table 1A Grand County, Utah Age Breakdown**

| Age Group | Number | Percent | National Avg. |
|---|---|---|---|
| **Under 5 Years** | 570 | 6.1% | 6.2 |
| **5 to 9 Years** | 716 | 7.6% | 6.4 |
| **10 to 14 Years** | 577 | 6.1% | 6.4 |
| **15 to 19 Years** | 428 | 4.6% | 6.7 |
| **20 to 24 Years** | 554 | 5.9% | 7.0 |
| **25 to 34 Years** | 1282 | 13.7% | 13.7 |
| **35 to 44 Years** | 1272 | 13.5% | 12.7 |
| **45 to 54 Years** | 1174 | 12.5% | 13.4 |
| **55 to 59 Years** | 670 | 7.1% | 6.7 |

| | | | |
|---|---|---|---|
| **60 to 64 Years** | 787 | 8.4% | 6.0 |
| **65 to 74 Years** | 797 | 8.5% | 8.6 |
| **75 to 84 Years** | 449 | 4.8% | 4.4 |
| **85 Years and Over** | 112 | 1.2% | 1.9 |

https://www.homefacts.com/demographics/Utah/Grand-County.html

**Table 2 Grand County Ethnic Breakout**

| Race | Number | Percent | National Avg |
|---|---|---|---|
| One Race | 9,287 | 98.9% | 96.9 |
| White | 8,714 | 92.8% | 73.1 |
| African American | 27 | 0.3% | 12.7 |
| American Indian | 336 | 3.6% | 0.8 |
| Asian | 128 | 1.4% | 5.4 |
| Asian Indian | 0 | 0.0% | 1.2 |
| Chinese | 14 | 0.1% | 1.3 |
| Filipino | 0 | 0.0% | 0.9 |
| Japanese | 13 | 0.1% | 0.2 |
| Korean | 58 | 0.6% | 0.5 |
| Vietnamese | 0 | 0.0% | 0.5 |
| Other Asian | 43 | 0.5% | 0.8 |
| Pacific Islander | 61 | 0.6% | 0.2 |
| Native Hawaiian | 0 | 0.0% | 0.1 |
| Guamanian | 0 | 0.0% | 0.0 |
| Samoan | 8 | 0.1% | 0.0 |
| Other Pac Islander | 53 | 0.6% | 0.1 |
| Other Races | 21 | 0.2% | 4.8 |
| Two or more Races | 101 | 1.1% | 3.1 |
| Hispanic | Number | Percent | National Avg |
| Latino | 945 | 10.1% | 17.6 |
| Mexican | 749 | 8.0% | 11.1 |
| Puerto Rican | 0 | 0.0% | 1.7 |
| Cuban | 0 | 0.0% | 0.7 |
| Other Hispanic | 196 | 2.1% | 4.1 |
| Non-Hispanic | 8443 | 89.9% | 82.4 |

https://www.homefacts.com/demographics/Utah/Grand-County.html

## Economy

Tourism is the heart of Grand County's economy. Visitors from around the world travel to the area to take advantage of mountain biking, rock climbing, jeep tours, river running, and the natural beauty of Arches and Canyonlands National Parks. In addition to tourism and recreation, the county has begun expanding the economy, moving forward by focusing on light manufacturing, the fine arts, educational programs, television and film production, agriculture, and the development of natural resources. As of December 2016, the unemployment rate for the county was 5.8 percent, with

slight gains in non-farm jobs, and tourism—proving the economy resilient in the post-recession years and well poised to grow as the nation's economy grows.

**Table 3: Grand County Employment Rates as Sept.2017**

| Employment | Grand County % |
|---|---|
| Mining | 13.2% |
| Construction | 21.5% |
| Manufacturing | 119.1% |
| Trade/Transport/Utilities | 3.7% |
| Leisure/Hospitality | 3.3% |
| Information | -10.4% |
| Financial Activities | 1.0% |
| Prof/Business Services | 19.0% |
| Education/Health/Social Services | -1.4% |
| Other Services | 0.0% |
| Government | -0.2% |

**(2017 Utah Department of Workforce Services)**

**Table 4: Grand County Residential Building Permits Issued During 2012-2017**

| Year | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|
| Number of Building Permits Issued | 55 | 45 | 76 | 25 | 160 | 155 |

**(2017 Workforce Services Research & Analysis)**

## Transportation and Commuting Patterns

Interstate 70 (I-70) and U.S. Highway 191 provide the principle transportation routes through Grand County. I-70 runs east-west through the center of the county to the Colorado border. U.S. Highway 191 is the north-south corridor through the county, travelling south from Crescent Junction off I-70 through Moab City and into San Juan County. State Route 128 parallels the Colorado River from US Highway 91 in Moab, crossing the Colorado River at Dewey and joining I-70 west of the Colorado border.

## Land Use

The early 1950's saw the rise of uranium mining in Grand County, leading to a jump in population to nearly 10,000 over three years. Potash, salt mining, and milling operations provided additional sources of economic prosperity. However, since the 1990's, the primary economic driver has been the tourism industry. Over 1 million visitors annually (according to *Grand County History*) visit the area to enjoy access to outdoor recreation such as mountain biking, river rafting, rock climbing, hiking, and off-road motorsports. Federal and State agencies including the Bureau of Land Management (BLM), the Forest Service (FS), the National Park Service (NPS), and the Utah Divisions of Forestry, Fire and State Lands (FFSL) own and maintain most of the county's land.

**Table 5: Land Ownership (Grand County Emergency Manager)**

| Grand County Land Ownership Acreage | |
|---|---|
| **BLM** | 1,539,313 |
| **Forest Service** | 57,292 |
| **Tribal** | 198,869 |
| **National Park Service** | 87,072 |
| **Military** | 3,200 |
| **State Lands** | 371,007 |
| **Private** | 101,699 |
| **Total Land Acreage** | **2,358,353** |
| **Land Ownership by Percentage** | |
| **BLM** | 65.3% |
| **Forest Service** | 2.4% |
| **Tribal** | 8.4% |
| **National Park Service** | 3.7% |
| **Military** | .1% |
| **State Lands** | 15.7% |
| **Private** | 4.4% |
| **Total Land Ownership** | 100% |

**Table 6: Land Use Acres**

| Grand County Acreage per Land Type | |
|---|---|
| **Developed** | 5,825 |
| **Forest** | 150,016 |
| **Grain Crops** | 6,100 |
| **Conservation Reserve Program** | 0 |
| **Grass/Pasture/Hay** | 1,664 |
| **Orchards/Vineyards** | 80 |
| **Row Corps** | 111 |
| **Shrub/Rangelands** | 137,270 |
| **Water** | 146 |
| **Wetlands** | 0 |

**(NRCS Report: Grand County Resource Assessment)**

The guiding document for current land use and future development since the 2013 Pre-Disaster Mitigation Plan is the 2012 Grand County General Plan Update. The number of residential building permits over the last five years (Table 4) reflects a steady increase in growth for Grand County. The growth has occurred primarily as single-family residences, townhomes, as overnight rentals. There are three major hotels and a convention center under construction scheduled for completion by 2019. The new developments fill in areas identified in the general plan and adhere to Grand County Flood Plain Ordinances and the adopted Building Code. The Grand County Building Inspector also provides the building inspection services to the City of Moab and is the Grand County Flood Plain Manager. Construction within identified problem soils areas require an engineering study be submitted to the building inspector.

The 2012 Grand County General Plan Update clearly states the priorities for development includes open space for the 100-year flood plain and geologic hazard areas. These priorities have been and will continue to be implemented by Grand County. The following list of priorities represent the priority level of each type of open space. The types of open space with the highest priority are encouraged to be set aside first to achieve development incentives, followed by the lower priority types of open space.

#1 Riparian Areas - A riparian area is a plant community contiguous to and affected by rivers, streams, drainage-ways or lakes that supports an ecosystem that is distinct from the surrounding areas not affected by hydrologic features.

# 2 100-Year Floodplain – The 100-year floodplain includes any land area along a river, stream, or drainage way that is susceptible to inundation. The 100-year floodplain is an area with a 1% probability of a flood occurring in any given year.

#3 Trail Corridors - Ready access to public lands contributes greatly to quality of life and prosperity in Grand County. Historic routes as well as new opportunities for accessing public lands were identified as a top priority for open space.

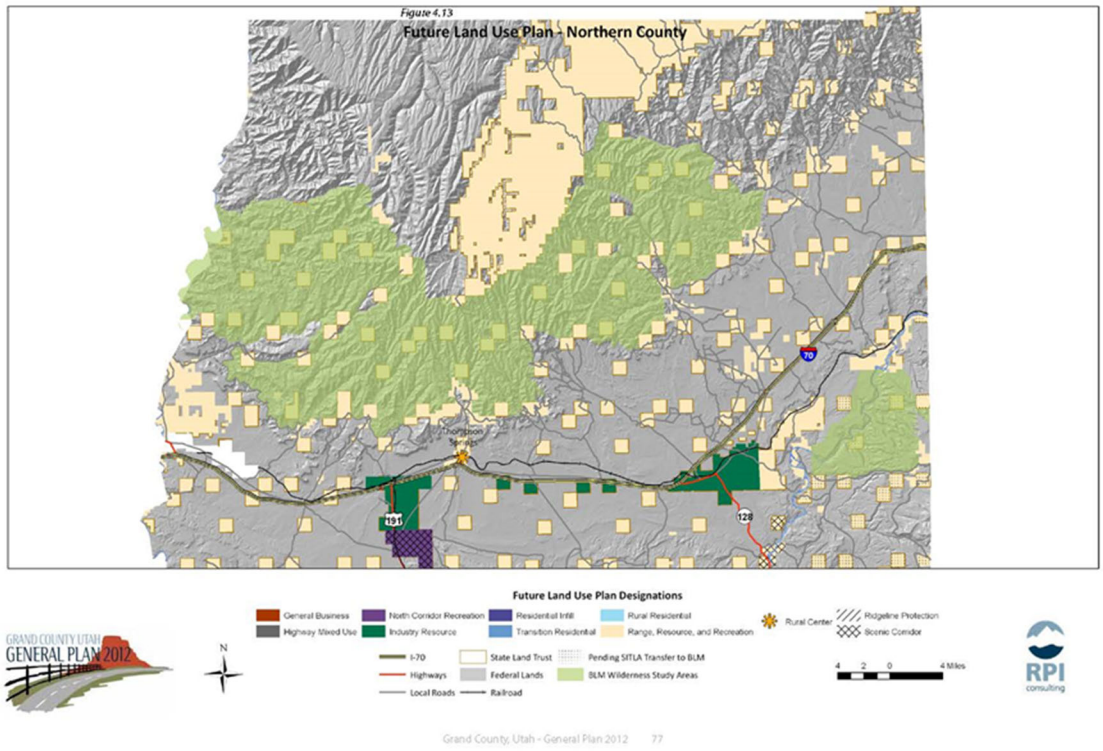
#4 Ridgelines – The FLUP focuses on ridgelines viewed from major public rights of way: US Highway 191, State Road 128, Mill Creek Road, Spanish Valley Drive and La Sal Loop Road. Skylines and prominent ridgelines in the foreground that define the natural form of the landscape are the highest priority for protection.

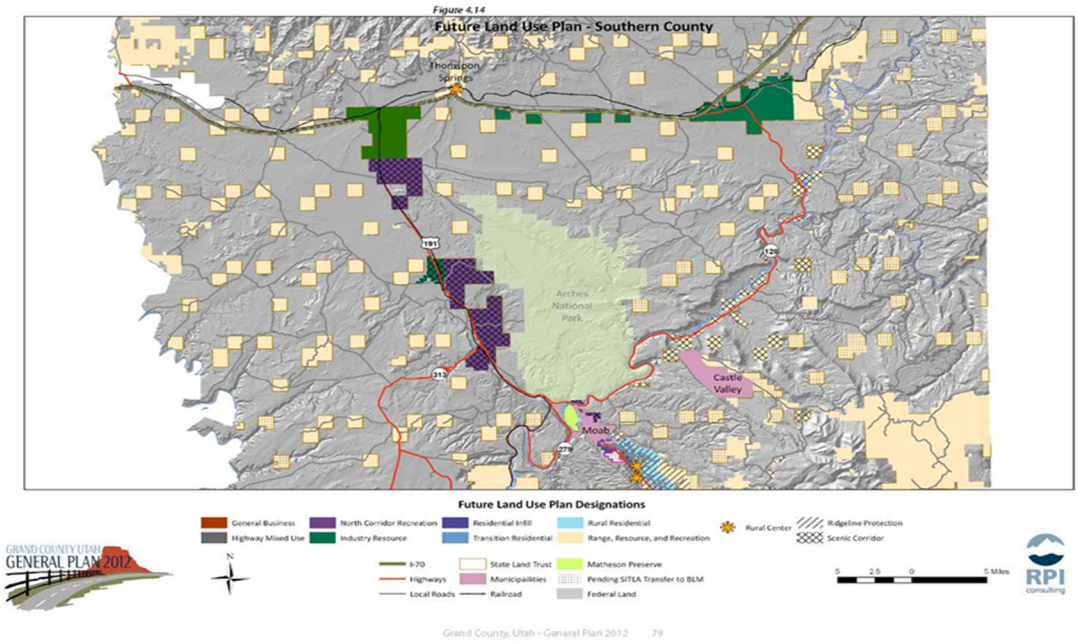
#5 Agricultural Land - Agricultural land uses include the cultivation of plants and raising of animals useful to humans.

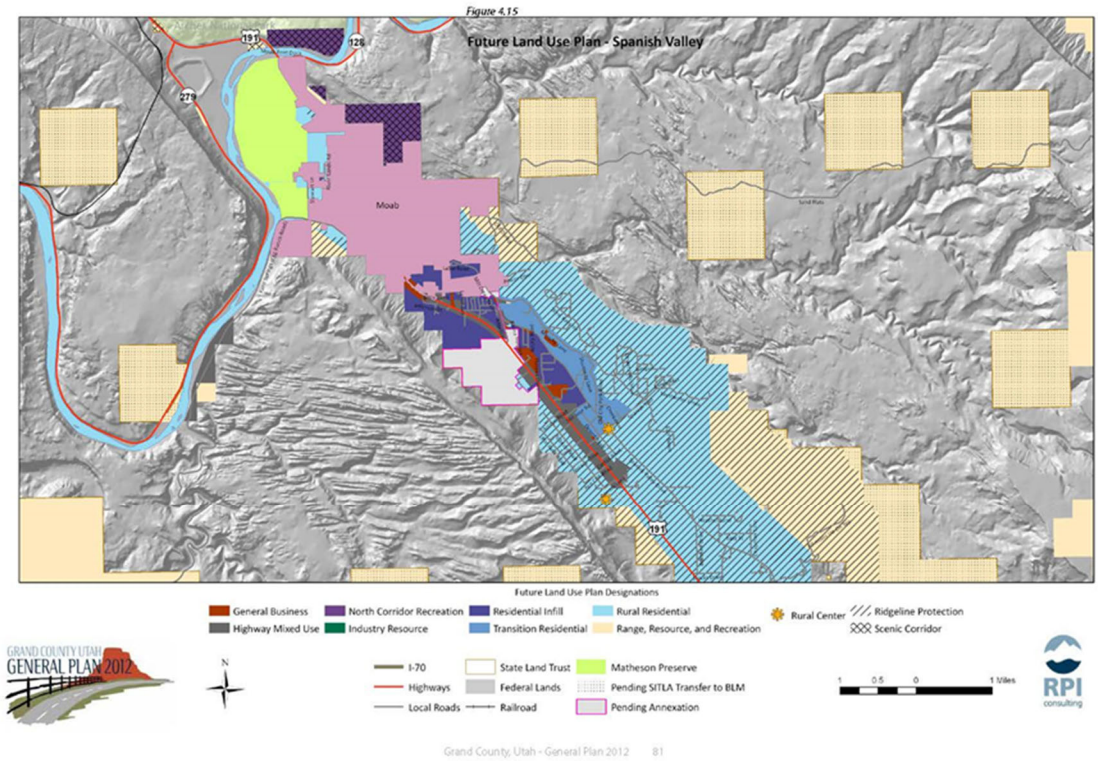
#6 Historic or Archeological Sites - Physical evidence of the county's history and pre-historic human settlement.

#7 Geologic Hazard Areas - Geologic hazards include rock-fall, landslides, debris flows, avalanches, expandable/ collapsible soils, and unstable slopes.

The following maps provide the current and future development plan for Grand County:






## Risk Assessment

The following risks were identified through the risk assessment process conducted by the Grand County Pre-Disaster Natural Hazard Mitigation Working Group: Drought, Flood, Wildfire, Severe Weather, Landslide, Earthquake, Problem Soil, Dam Failure, and Infestation. The Grand County Pre-Disaster Natural Hazard Mitigation Group conducted a further review of the identified hazards to establish probability, severity, and county ranking.

The Risk Assessment methodology for developing this updated plan included several steps to gather information from the whole community, prepare the input, analyze and discuss the data to provide information of the potential impacts of the nine natural hazards identified for Grand County. The Grand County Working Group primarily used available GIS maps for the identified natural hazards, historical data, local knowledge, and the potential impact on the critical facilities and infrastructure. The gathered information was shared with the appropriate subject matter experts for their review and input. The final compilation of data was discussed by the Working Group and the Risk Assessment for each of the nine identified natural hazards was reached by consensus of the Working Group.

**Table7: Risk Assessment**

| Type of Natural Hazard | Probability | Severity (Potential Magnitude) | County Ranking |
|---|---|---|---|
| Flooding | Highly Likely | Critical | 1 |
| Wildfire | Likely | Critical | 2 |
| Dam Failure | Not Likely | Critical | 3 |
| Severe Weather | Highly Likely | Limited | 4 |
| Drought | Highly Likely | Negligible | 5 |
| Landslide | Possible | Negligible | 6 |
| Infestation | Possible | Limited | 7 |
| Problem Soils | Possible | Limited | 8 |
| Earthquake | Not Likely | Limited | 9 |

## Grand County Critical Facilities

The Grand County Critical Facilities List was updated by the Grand County Pre-Disaster Natural Hazards Mitigation Working Group and coordinated through the Grand County Emergency Manager.

**Natural Hazard Impact Legend**:

Grand County's summary for the risk assessment for all the critical facilities by hazard (DF = Dam Failure, DR = Drought, EQ = Earthquake, FL = Flood, IN= Infestation, LS= Landslide, SW= Severe Weather, PS= Problem Soils, WF= Wildfire).

Each hazard has its own criteria for risk:

**Wildfire** categories of Very, Very Low (VVL), Very Low (VL), Low (L), Low-Moderate (L-M), Moderate (M), Moderate-High (M-H, High (H), Very High (VH), Extreme (E), and Urban, Agriculture, Water, or Barren (W).
(DNR for the Utah Wildfire Risk Assessment Portal has identified)

**Dam Failure** has High (H) = facility is in inundation area, Moderate (M) = facility is within 0.10 mile of inundation area, and Low (L) = facility is >0.10 mile of inundation area.

**Earthquake** Peak Ground Acceleration has High (H), Moderate (M) and Low (L) based on data from USGS.

**Landslide** has High (H), Moderate (M), Low (L) and Very Low (VL) based from USGS.

**Drought** has Exceptional Drought (D4), Extreme Drought (D3), Severe Drought (D2), Moderate Drought (D1), Abnormally Drought (D0), None: No Drought
National Integrated Drought Information System.

**Flood** has High (H), Moderate (M), Low (L), and Very Low (VL) based on flood maps and input from the Grand County Emergency Manager.

**Infestation** has High (H), Moderate (M), Low (L) and Very Low (VL).

**Severe Weather** has High (H), Moderate (M), Low (L) and Very Low (VL) NOAA.

**Problem Soils** High has (H), Moderate (M), Low (L) and Very Low (VL).

**Table 8 San Juan Critical Facilities**

| Grand County Critical Facilities | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Facility Name** | **DF** | **DR** | **EQ** | **FL** | **IN** | **LS** | **SW** | **PS** | **WF** |
| Water Treatment Plant<br>1007 W 400 N (400N & Colorado River) Moab<br>435-259-5577<br>38.579332 x -109.572144 | L | D2 | L | H | VL | VL | L | VL | VL |
| Moab City Shop<br>470 Kane Creek Blvd, Moab 435-259-7485 | H | D2 | L | H | N/A | VL | L | N/A | W |
| Grand Water & Sewer<br>3024 E. Spanish Trail Rd, Moab<br>435-259-8121<br>Fax 259-8122<br>38.53330970 x109.496646 | M | D2 | L | M | VL | VL | L | N/A | W |
| Solid Waste Special Waste District #1<br>1000 E Sand Flats Road<br>Moab 435-259-3867, 260-9978<br>www.solidwastessd1.com<br>gcswmss@gmail.com<br>38.564817 x-109.530916 | N/A | D2 | VL | VL | N/A | N/A | VL | VL | VVL |
| Klondike Landfill<br>38.812473 x-109.789940 | N/A | D2 | L | VL | N/A | N/A | M | N/A | L |
| Moab Landfill | N/A | D2 | L | N/A | N/A | VL | M | N/A | L |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 38.568268 x-109.523062 | | | | | | | | | |
| Thompson Water District<br>101 Firehouse Lane<br>Thompson Springs<br>435-285-9919<br>38.971082 x -109.713735 | L | D2 | L | L | VL | VL | M | | M-H |
| Water Source 1 (Moab) | L | D2 | L | L | VL | M | M | N/A | M |
| Grand W&S Storage Tank 1<br>Access off south end of David Court | L | D2 | L | L | VL | M | M | N/A | VL |
| Grand W&S Storage Tank 2<br>Access from S end of Moab Springs Ranch off N Hwy 191 | L | D2 | L | L | VL | M | M | N/A | W |
| Storage Tank<br>Off S. Spanish Valley Highway on Johnson's Up on Top Road (Cloud Rock | VL | D2 | L | VL | VL | M | M | N/A | M-H |
| Storage Tank<br>Arches NP behind Maintenance Yard | M | D2 | L | M | N/A | M | M | N/A | L |
| Pack Creek Ranch PUD<br>Above Ranch to East | L | D2 | L | L | VL | L | M-H | N/A | M-H |
| Grand County Road Dpt.<br>3500 S. Hwy 191<br>Moab 435-259-5308<br>FAX 259-3056 | H | D2 | L | H | N/A | VL | L | N/A | W |
| Moab Public Works<br>470 Kane Creek Blvd<br>Moab (435) 259-7485 | H | D2 | L | H | N/A | VL | L | N/A | W |
| UDOT Moab<br>424 Kane Creek Blvd.<br>Moab (435)259-5030<br>FAX 259.4616 | H | D2 | L | H | N/A | VL | L | N/A | W |
| UDOT Thompson Springs<br>Mile Marker 185 I 70 | L | D2 | L | L | VL | VL | M-H | N/A | VL |
| Region 4<br>210 West 800 South<br>Richfield Ut 840701<br>(435) 893-4799 Fax 896-6458 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Moab City Admin<br>217 E. Center<br>Moab (435) 259-5121 Fax 259-4135 | H | D2 | L | H | N/A | VL | L | N/A | W |
| Grand County EOC<br>2600 S. Hwy 191<br>Moab | L | D2 | L | L | N/A | VL | VL | N/A | M |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Grand County EOC Ware<br>East end Grand Ave off 100 E 439 S. 100 E. | L | D2 | L | L | N/A | VL | VL | N/A | W |
| Wesco<br>435-259-7171<br>Intrepidpotash.com | L | D2 | L | L | N/A | VL | L | N/A | L-M |
| Intrepid Potash Mine<br>West end of Highway 279<br>Evaporation ponds above Colorado River<br>(800) 451-2888<br>707 17th St Ste 4200 Denver CO 80202 | L | D2 | L | L | VL | VL | M | VL | VVL |
| Dominion Energy<br>2450 South Hwy 191<br>Moab (435)259-7137<br>CS (800) 324-5517 | L | D2 | L | L | N/A | VL | L | N/A | M |
| Pacific Corp Office<br>320 North 100 West<br>Moab<br>Pacificorp.com (435) 259-0128 | L | D2 | L | M | N/A | VL | VL | N/A | W |
| Fire Operations Center<br>2251 S Hwy. 191<br>Moab | H | D2 | L | H | N/A | VL | L | N/A | W |
| Castle Valley Fire 1<br>2 Castle Valley Drive<br>(435) 259-9828 or (435) 259-8115 | L | D2 | L | L | N/A | VL | M | N/A | L |
| Castle Valley Fire 2<br>Lasal Loop Road in Castleton above Castle Valley | L | D2 | L | L | N/A | VL | M-H | N/A | VVL |
| Moab Fire Dpt. 1<br>45 South 100 E Moab (435) 259-5557 | H | D2 | L | H | N/A | VL | L | N/A | W |
| Moab Fire Dpt. 2<br>East end of Beeman Road and Spanish Valley Drive | M | D2 | L | M | N/A | VL | M | N/A | VH |
| Moab Fire Dpt. 3<br>Spanish Trail at traffic circle, East side of Spanish Valley | L | D2 | L | L | N/A | VL | M | N/A | L-M |
| Thompson Fire Dpt.<br>101 Firehouse Lane<br>Thompson Springs<br>435-285-9919 | L | D2 | L | L | VL | VL | M-H | N/A | L |
| Grand County Sheriff<br>25 South 100 E<br>Moab 435-259-8115 | H | D2 | L | H | N/A | VL | L | N/A | W |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Grand County Jail<br>125 E Center, Moab<br>435-259-1399 | H | D2 | L | H | N/A | VL | L | N/A | W |
| Grand County Courthouse<br>125 E Center<br>Moab 435-259-1322 | H | D2 | L | H | N/A | VL | L | N/A | W |
| Moab Police Dpt.<br>217 E Center Moab<br>(435)259-8938 or thru dispatch<br>(435)259-8115<br>Facebook.com/moabpolice | H | D2 | L | H | N/A | VL | L | N/A | W |
| Utah Highway Patrol<br>125 E. Center (west side, basement) Moab<br>(435) 259-1035<br>Dispatched out of Price | H | D2 | L | H | N/A | VL | L | N/A | W |
| National Park Service<br>2282 Resource Blvd<br>Moab (435) 719-2100<br>Arches NP (435) 719-2299 or LE through dispatch (435) 259-8115 | L | D2 | L | L | N/A | VL | L | N/A | W |
| Utah State P&R<br>1165 S. Highway 191 Ste 7<br>Moab (435) 259-3750 or LE through dispatch (435) 259-8115 | M | D2 | L | M | N/A | VL | L | N/A | M-H |
| Manti Lasal Forest<br>62 E 100 N<br>Moab (435) 259-7155 or LE thru dispatch<br>(435) 259-8115 | M | D2 | L | M | N/A | VL | L | N/A | W |
| BLM Moab<br>82 East Dogwood<br>Moab (435) 259-2100<br>FAX 259-2105 or LE thru dispatch 9435) 259-8115 | M | D2 | L | M | N/A | VL | L | N/A | W |
| Grand County EMS Services<br>125 E. Center<br>(ambulance bays)<br>Admin 500 E 100 N Moab (435) 259-1341 or through dispatch (435)259-8115 | H | D2 | L | H | N/A | VL | L | N/A | W |
| Southeast Utah Health Department<br>575 S Kane Creek Blvd. Moab<br>435-259-5602 | H | D2 | L | H | N/A | VL | L | N/A | W |
| Moab Hospital<br>450 Williams Way | M | D2 | L | M | N/A | VL | L | N/A | W |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Moab<br>(435) 719-3500<br>Mrhmoab.org | | | | | | | | | |
| St Mary's Hospital<br>2635 N 7th St<br>Grand Junction CO 81501<br>(970) 298-2273<br>Classic Lifeguard helicopter | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Classic Medical<br>133 North Main, Moab<br>Based at EOC<br>2600 South Hwy 191<br>(435) 355-0085 (business)<br>Access through dispatch<br>(435)259-1135 | M | D2 | L | M | N/A | VL | L | N/A | W |
| Canyonlands Airport<br>110 W Aviation Way<br>Moab, UT 435-259-4849<br>16 Miles N of Moab on Hwy.191 | L | D2 | L-M | VL | N/A | VVL | M-H | N/A | VL |
| Willow Basin Communications Site (Microwave) Bald Mesa<br>38.528644x-109.324430 | L | D2 | L | VL | VL | M | M-H | N/A | VL |
| Frontier Communications<br>15 North 100 E<br>Moab (435) 259-5157<br>Frontiercommunication.com | H | D2 | L | H | N/A | VL | L | N/A | W |
| Moab Terminal Radio Tower<br>38.573726 x -109.550023 20 N. Main behind Times-Independent newspaper | H | D2 | L | H | N/A | VL | L | N/A | W |
| Sandflats Radio Tower<br>38.570277 x -109.527993 100' on East rim above town. | L | D2 | L | VL | N/A | L | M-H | N/A | VL |
| Water Tank Radio Tower<br>38.505499 x -109.451643 East side of Spanish Valley on road to Johnsons-up-on-Top | L | D2 | L | VL | N/A | M | M-H | N/A | VL |
| Lawson Radio Tower<br>38.486703 x -109.459091 Grand-San Juan Co line | L | D2 | L | VL | N/A | VL | M-H | N/A | M |
| Bald Mesa<br>38.528644 x -109.324430 LaSal Mtns above East end of Sandflats Road. (Microwave) SO repeater site | L | D2 | L | VL | VL | M | M-H | N/A | VL |
| KZMU KUER<br>38.527301 x -109.305077 | L | D2 | L | L | N/A | L | L | N/A | VL |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Castle Valley 1 38.632148 x -109.355046 Castle Valley | L | D2 | L | L | N/A | L | L | N/A | VL |
| Castle Valley Fire Station 38.644773 x -109.385491 Castle Valley | L | D2 | L | L | N/A | VL | L | N/A | VVL |
| Castle Valley Hardin 38.630796 x -109.410575 Castle Valley | L | D2 | L | L | N/A | VL | L | N/A | M |
| Castle Valley Dunton 38.650787 x -109.428.221 Castle Valley | L | D2 | L | L | N/A | VL | L | N/A | VVL |

## Grand County Natural Hazard Profiles

## Flood

### Hazard Profile

| | | | |
|---|---|---|---|
| Potential Magnitude | | Negligible | Less than 10% |
| | | Limited | 10-25% |
| | X | Critical | 25-50% |
| | | Catastrophic | More than 50% |
| Probability | X | Highly Likely | |
| | | Likely | |
| | | Possible | |
| | | Unlikely | |
| Location | Mainly near the major rivers of the Colorado and Green and their respective tributaries. | | |
| Seasonal Pattern or Conditions | Spring, Cloudburst Storms and Heavy Snowfall Runoff. | | |
| Duration | Flooding can last anywhere from hours to days and even months. | | |
| Analysis Used | Review of FIS, FIRM, Army Corp of Engineers Flood Study, Review of past flooding incidents, Hazard Analysis Plans, GIS data, Moab City Project Impact Application, Moab Hazard Mitigation Plan, and Utah DEM Flooding HAZUS Report 2016. | | |

### Description of Location and Extent

Regarding streams and rivers (Pack, Mill, Placer, Castle, Onion, Professor, Kane—tributaries to the Colorado River—and Tusher creek, a tributary to the Green River) creates a very high flood threat. Over half of the City of Moab is in a floodplain and subject to flash flooding from frequent thunderstorms and cloudbursts that occur in the steep slickrock canyons. Local roads, infrastructure, and residences are subjected to repeated flooding at Walker Canyon, Stewart Canyon, the Kelling Property, and Williams Way.

Since Moab City is the county seat and the largest community in the county, it has been designated as a Project Impact Community. As such, the Moab City Storm Water Master

Plan was created to identify flood control issues and put in place provisions for Pack Creek, Mill Creek, and the Colorado River.
Castle Valley is vulnerable to flooding in severe concentrated rain events, when the water comes over a longer period the multitude of drainages can handle the water quite well, however more and more isolated cloudbursts are affecting Castle Valley in very destructive short-lived storms.
The Town of Castle Valley does not have a second exit that can handle the volume of traffic that Castle Valley Drive does now. This creates a situation of significant isolation and safety concerns.
Currently the Town of Castle Valley is not participating in the National Flood Insurance Program.

**Vulnerability Assessment**
The impact of a 100-Year flooding event on Grand County would likely see at least moderate damage to 56 buildings with 9 destroyed. 27 additional buildings would suffer minimal damage and at least two schools would suffer moderate damage or greater. Financial estimates for building-related losses are 23.02 million dollars, there would be approximately 189 displaced households and 284 persons will be seeking public sheltering. (*Hazus-MH: Flood Global Risk Report*, October 2017)

**Table 9 Grand County National Flood Insurance Policy, dtd. 11/29/16**

| | | | | |
|---|---|---|---|---|
| Grand County | Unincorporated | 6 Policies | 10/14/14 Entry into NFIP | 4/2/2009 Date of current Flood Plain Map, Level B |
| | Moab City | 90 Policies | 6/4/80 Entry into NFIP | 4/2/2009 Date of current Flood Plain Map. Level D |
| | Castle Valley Town | | Non-Participant | Do have a flood plain map on file 4/2/2009 |

**National Flood Insurance from The Utah Division of Emergency Management**
Note: Grand County and Moab City Flood Plain Maps are available at misc. FEMA.Gov/portal

**Grand County does not have any repetitive loss properties.**
**The City of Moab does not have any repetitive loss properties.**
**The Town of Castle Valley does not have any repetitive loss properties.**

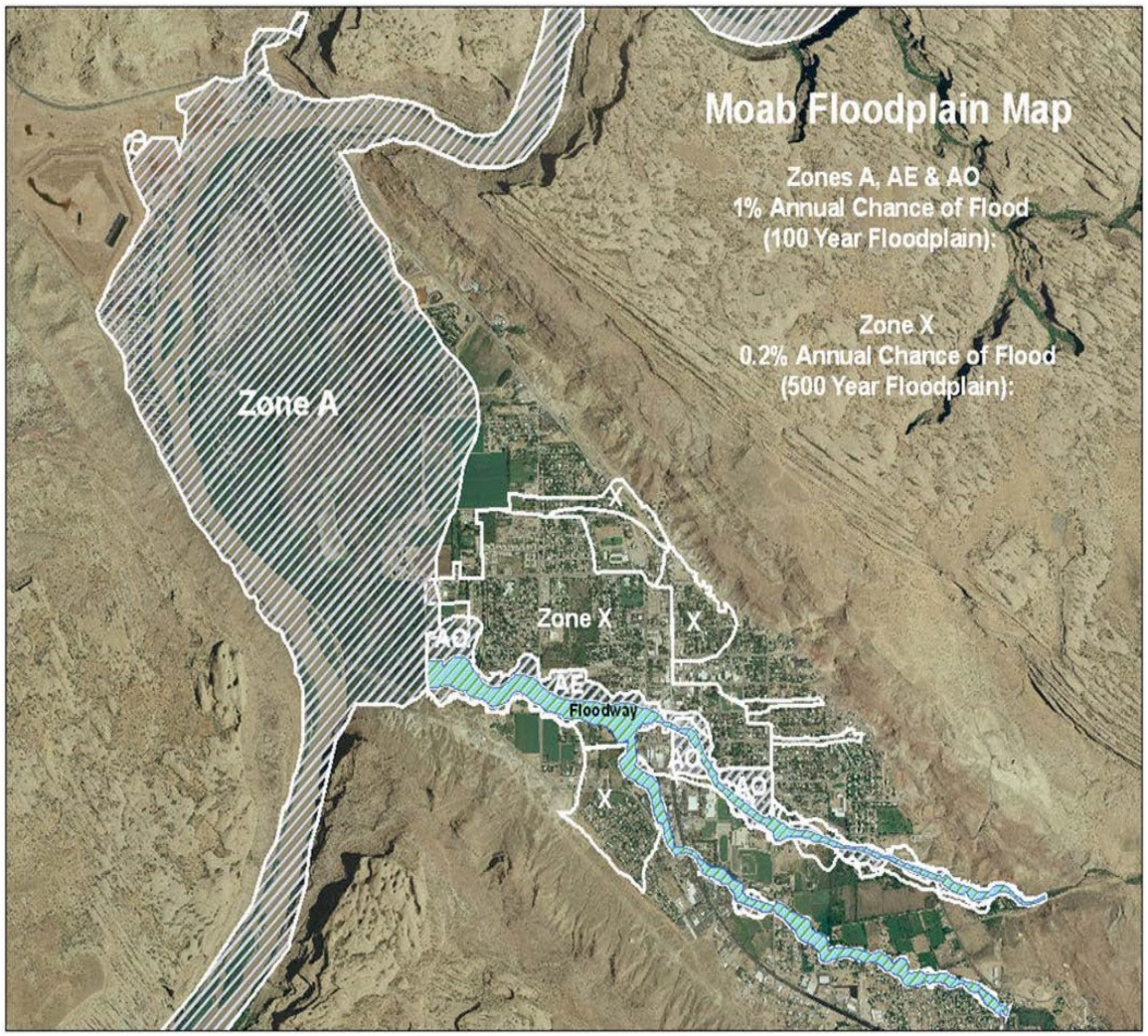
**Grand County and Moab City Floodplain Administrators**

The Grand County Floodplain Administrator is responsible by Ordinance to enforce the provisions of the Grand County Flood Damage Prevention Ordinance 526 adopted September 2014. The Grand County Floodplain Administrator has developed and submitted to FEMA a proposed revision of the Pack Creek Floodplain area as an update to the FEMA Flood Insurance Rate Map. The County is waiting for the approval from FEMA. (Grand County Website December 2017)

The Moab City Floodplain administrator has been enforcing the provisions of the Moab City Floodway Zoning Ordinance 17.33. The Ordinance was successfully updated and adopted November 2017.

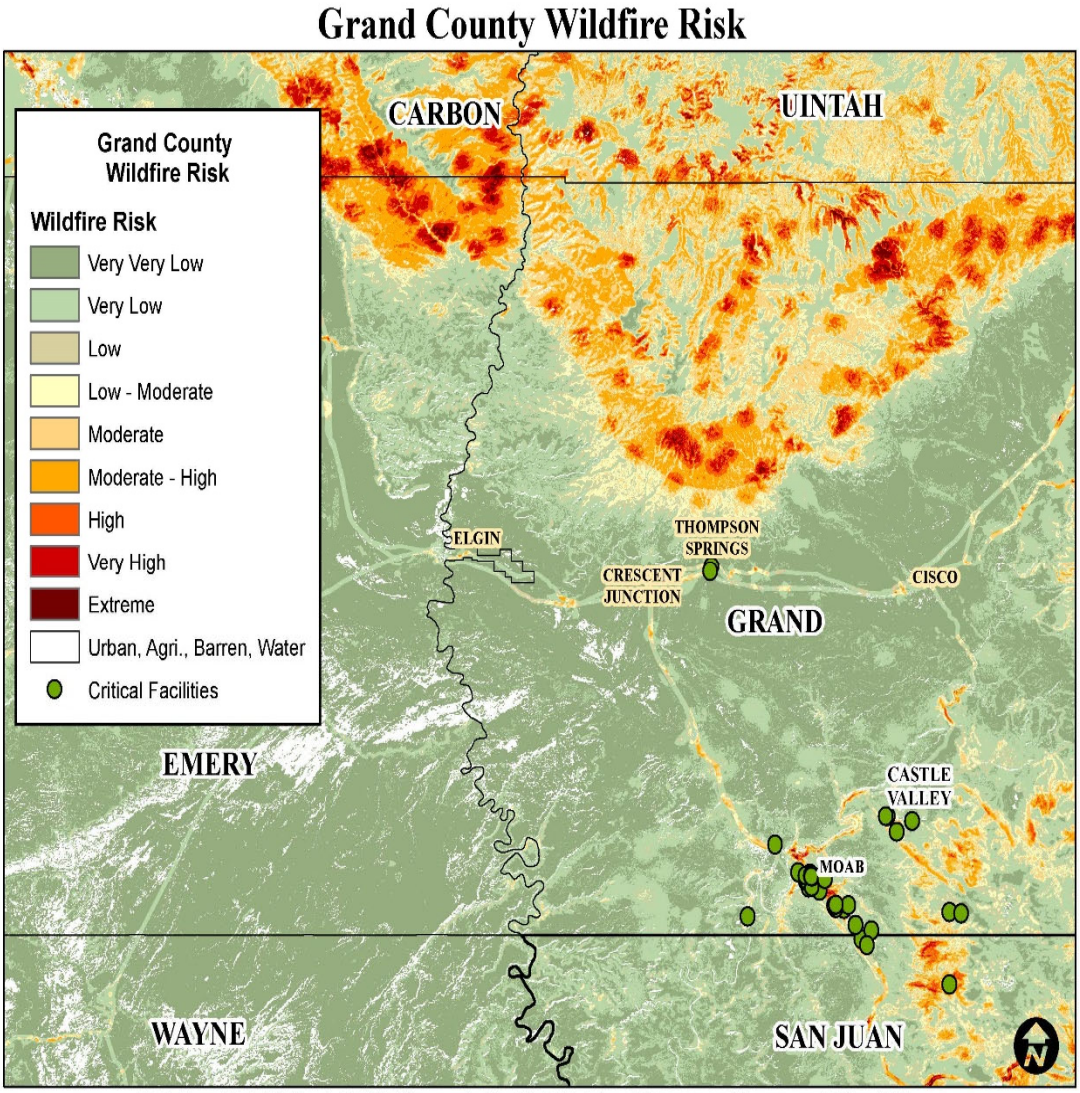
## Flood Plain

**Moab City Flood Plain Map**



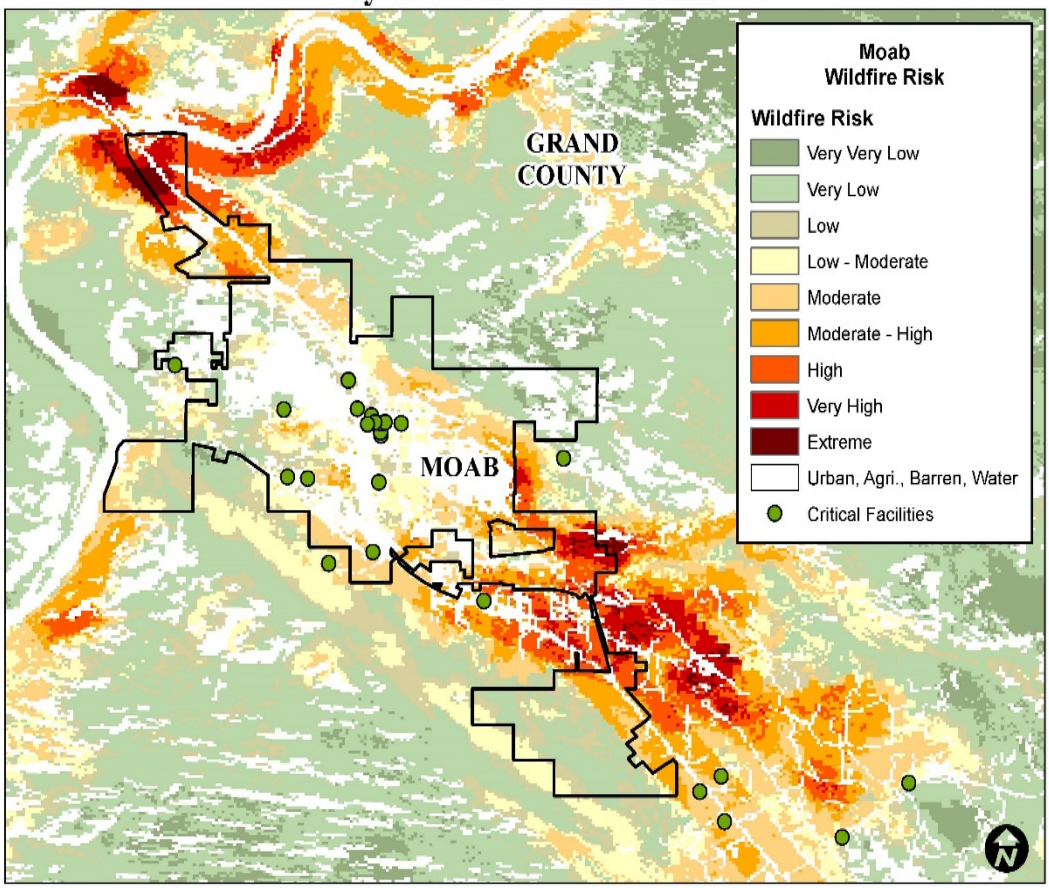

December 2017 Moab City Floodway Map

## Wildland Fire



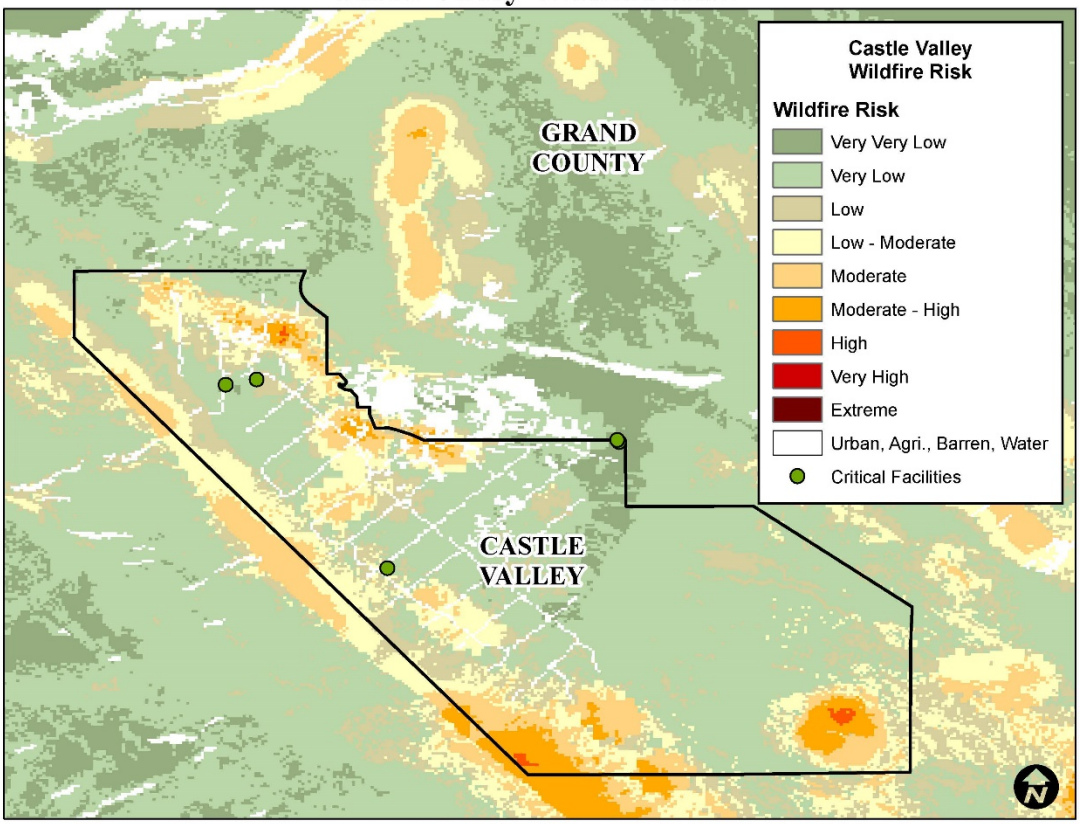

Data from Utah DNR and AGRC. Map created by Utah Division of Emergency Management, Dec. 2017.

City of Moab Wildfire Risk




Data from Utah DNR and AGRC. Map created by Utah Division of Emergency Management, Dec. 2017.

**Castle Valley Wildfire Risk**




Data from Utah DNR and AGRC. Map created by Utah Division of Emergency Management, Dec. 2017.

## Hazard Profile

| | | | |
|---|---|---|---|
| Potential Magnitude | | Negligible | Less than 10% |
| | | Limited | 10-25% |
| | X | Critical | 25-50% |
| | | Catastrophic | More than 50% |
| Probability | | Highly Likely | |
| | X | Likely | |
| | | Possible | |
| | | Unlikely | |
| Location | URWIN zones near the foothills and in forested areas. | | |
| Seasonal Pattern or Conditions | Summer months. Areas affected by drought and/or heavily overgrown and dry brush and debris. Lightning and human triggers. | | |
| Duration | Wildfires typically last days but can last months, depending on climate and fuel load as well as resources (financial, manpower) to extinguish the fire. | | |
| Analysis Used | Review of plans and data provided by US Forest Service, National Climate Center, FEMA, AGRC, County Hazard Analysis Plans, Community Wildfire Protection Plans. | | |

**Description of Location and Extent**

Five hazard categories were assigned by the Division of Forestry, Fire, and State Lands to the wildfire risk data provided in the statewide fire risk assessment—Extreme, High, Medium, Low, and Very Low. These ratings are based on the type and density of vegetation in each area (although factors influencing wildland fire behavior such as weather conditions, wind speed, and direction are not considered in this risk assessment) and cover all Grand County. For a history of wildfires in the county in the years 1984-2018 refer to Table 14.

**Vulnerability Assessment**

In order to complete loss estimates, wildland fire areas of extreme, high, and moderate risk within the county were identified and then overlaid with vulnerable areas drawn from a GIS database. Table 10 shows the population and number of both commercial and residential structures within Grand County that lie inside extreme, high, and moderate wildfire risk areas.

**Table 10 Structures and Population in Wildfire Area**

| Use Type | Extreme Risk | High Risk | Moderate Risk |
|---|---|---|---|
| Commercial Units | 0 | 40 | 22 |
| Residential Units | 0 | 452 | 260 |
| Population | 0 | 904 | 520 |

Potential Wildfire Loss Estimates

Annual sales for the businesses inside each wildfire risk area as well as the assessed value of residential property are included in Table 11. Contents are not included in residential loss estimates (doing so would increase the values listed by 50%). No businesses in Grand County are in the Extreme wildfire risk areas.

**Table 11 Inventory of Properties Located in Wildfire Risk Areas in Grand County**

| **Businesses** Number/Annual Sales | **Residential Units** Number/Replacement Cost | **Population** |
|---|---|---|
| 62 / $47,120,000 | 712 / $886,440,000 | 1402 |

Wildfire Risk within Municipal Boundaries

Table 12 lists the number of acres in each wildfire risk area contained within the municipal boundaries of the following cities in Grand County. Table 13 identifies the infrastructure found within wildfire areas.

### Catastrophic Wildfires Cascading Effects

The occurrence of a Catastrophic Wildfire in Grand County is fortunately a rare event. The post fire effect may produce a cascading series of events requiring immediate action and mitigation. The effect on the water shed may impinge upon the County or Communities' wells, springs, and the water delivery system. There may be landslides, mudflows, and debris flow in the burn scar that may impact streams and reservoirs or damage infrastructure such as roads and power transmission lines. Awareness of the potential and considering a plan of action to implement if a Catastrophic Wildfire should occur may mitigate the effects on the County and Communities of the cascading series of events.

**Table 12 Wildfire Risk Area**

| City Name | Acres of Extreme | Acres of High | Acres of Moderate |
|---|---|---|---|
| Moab | 0 | 635 | 117 |
| Castle Valley | 0 | 1,253 | 2,888 |
| Green River | 0 | 0 | 0 |

**Table 13 Infrastructure in Wildfire Area**

| Item | Length (Miles) | Replacement Cost |
|---|---|---|
| Local Roads | 116.09 | $290,225,000 |
| State Highways | 41.38 | $103,450,000 |
| US Highways | 0.00 | $0 |
| US Interstates | 29.41 | $147,050,000 |
| Power Lines | 124.03 | $6,287,576 |
| Gas Lines | 26.33 | $6,673,588 |

**Table 14 Wildfire History (1984-2018)**

| Date | Fire Name | Cause | Acres (Approximate) | Cost Estimate Report from Forest Fire and State Lands Division/Comments |
|---|---|---|---|---|
| **June 19, 1984** | Agate Oilfield | Lightning | 300-999 | |
| **June 9, 1985** | East Cisco | Equipment | 300-999 | |
| **June 25, 1985** | Cottonwood | Lightning | 300-999 | |
| **July 4, 1985** | Sager 2 | Equipment | 300-999 | |
| **July 7, 1985** | Little Hole | Lightning | 300-999 | |
| **August 14, 1985** | Border R733 | Lightning | 300-999 | |
| **August 16, 1985** | Mile Post 222 | Lightning | 300-999 | |
| **August 31, 1985** | Brewster 1 | Incendiary | 300-999 | |

| Date | Fire Name | Cause | Acres (Approximate) | Cost Estimate Report from Forest Fire and State Lands Division/Comments |
|---|---|---|---|---|
| **June 8, 1986** | Westwater 2 | Debris Burn | 300-999 | |
| **June 19, 1986** | East | Railroad | 300-999 | |
| **July 6, 1986** | Harley | Lightning | 300-999 | |
| **August 5, 1986** | Bitter Creek | Lightning | 300-999 | |
| **July 1, 1989** | Diamond Peak | Lightning | >5000 | |
| **July 8, 1989** | Ryan Creek | Lightning | 1000-4999 | |
| **July 10, 1993** | Whipsaw Flat | Lightning | 300-999 | |
| **August 13, 1993** | Westwater 2 | Lightning | 300-999 | |
| **June 9, 1994** | Thompson | Equipment | 1000-4999 | |
| **July 23, 1994** | Mm 213 | Miscellaneous | 300-999 | |
| **August 30, 1994** | Westwater 3 | Lightning | 1000-4999 | |
| **June 19, 1995** | Valley City 2 | Lightning | 1000-4999 | |
| **June 24, 1995** | Valley City 3 | Miscellaneous | 300-999 | |
| **August 16, 1996** | One Eye | Lightning | 300-999 | |
| **July 1, 1999** | Little Hole | Lightning | 1000-4999 | |
| **May 28, 2000** | Fisher | Lightning | 300-999 | |
| **April 29, 2002** | Goose Island | Camp Fire | 40.00 | $3,146 |
| **June 6, 2002** | B099 | Lightning | 0.10 | $3,893 |
| **June 20, 2002** | Black Canyon | Lightning | 5,968.00 | $3,263,595 |
| **June 20, 2002** | Rattle | Lightning | 88,347.00 | $12,216,186 |
| **June 24, 2002** | Willow Flats | Lightning | 0.25 | $5,800 |
| **April 11, 2003** | Bridge | Miscellaneous | 40.00 | $8,160 |
| **May 27, 2003** | Chemical | Children | 0.10 | $1,070 |
| **June 12, 2003** | Pin Hook | Lightning | 0.25 | $1,105 |
| **July 13, 2003** | Westwater | Railroad | 16.00 | $8,758 |
| **July 17, 2003** | JB | Lightning | 1,064.00 | $1,025,721 |
| **July 23, 2003** | Cottonwood | Lightning | 157.00 | $213,977 |
| **August 2, 2003** | Fisher | Lightning | 0.50 | $4,458 |
| **September 1, 2003** | Trail Blazer | Lightning | 0.10 | $1,108 |
| **June 23, 2004** | Ruby Island | Lightning | 17.00 | $2,714 |
| **June 25, 2004** | Cedar Camp | Lightning | 0.10 | $2,296 |
| **July 17, 2004** | Hay Canyon | | 200 | |
| **June 27, 2005** | Gold Bar | Miscellaneous | 1.00 | $1,335 |
| **June 29, 2005** | Black Spot | Lightning | 2.50 | $1,000 |
| **July 6, 2005** | Bitter Creek | Equipment | 825.00 | $83,697 |
| **July 7, 2005** | Spanish Valley | Miscellaneous | 62.00 | $5,718 |

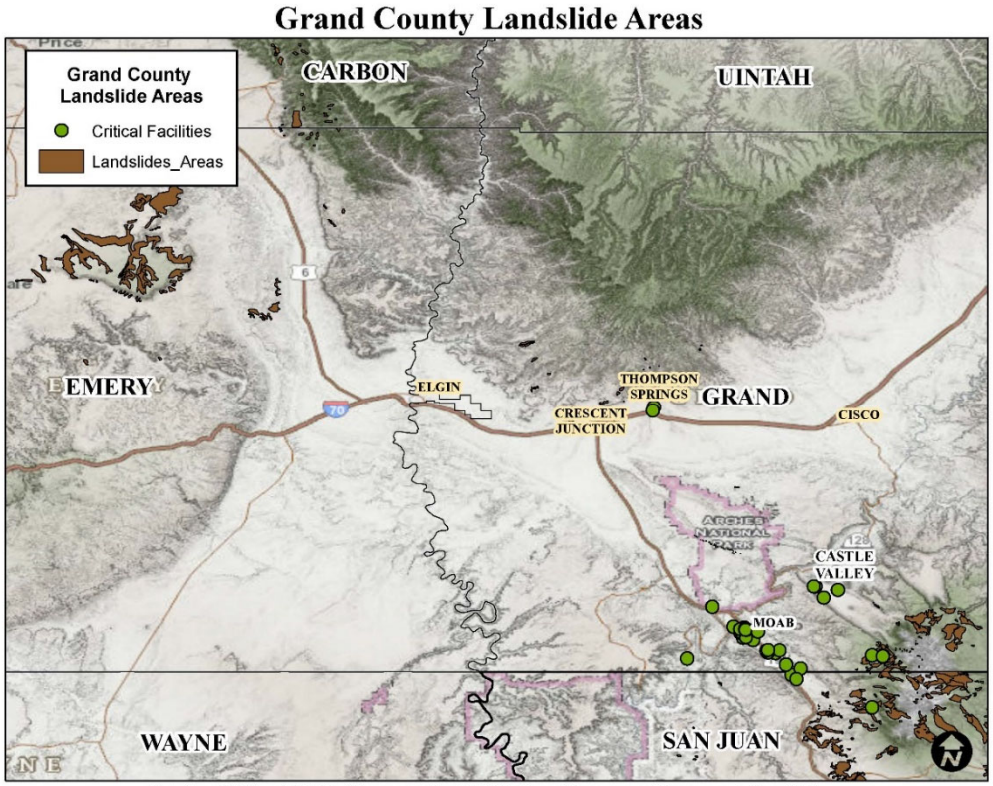
| Date | Fire Name | Cause | Acres (Approximate) | Cost Estimate Report from Forest Fire and State Lands Division/Comments |
|---|---|---|---|---|
| **July 16, 2005** | Power Line | Lightning | 22.00 | $1,337 |
| **July 17, 2005** | Rim | Lightning | 0.10 | $1,640 |
| **2006** | Bryson Wash Fire | | 855 | (2 miles north of *-70 & 3 miles west of Utah/Colorado border in Grand County. Contained July 1, 2006 |
| **April 20, 2006** | Mayberry | Debris Burn | 0.75 | $1,235 |
| **May 26, 2006** | Willow Creek | Lightning | 1,264.00 | $1,663,044 |
| **June 6, 2006** | Round Mountain | Lightning | 231.00 | $7,370 |
| **June 14, 2006** | Westwater 2 | Lightning | 2,850.00 | $35,500/ contained June 17, 2006 |
| **June 29, 2006** | Mill Creek | Miscellaneous | 2.00 | $13,900 |
| **July 1, 2006** | Spark Plug | Lightning | 0.10 | $1,200 |
| **July 22, 2006** | West Willow Creek | Lightning | 6.00 | $22,400 |
| **August 1, 2006** | Hole Canyon | Lightning | 0.10 | $2,800 |
| **August 25, 2006** | Preacher Ridge | Lightning | 4.90 | $2,600 |
| **March 11, 2007** | Wetlands | Miscellaneous | 0.25 | $2,462 |
| **June 10, 2007** | Old Highway | Debris Burn | 600.00 | $16,740 |
| **June 25, 2007** | Old Park | Debris Burn | 10.00 | $4,988 |
| **July 9, 2007** | Kelly Canyon | Lightning | 0.25 | $4,878 |
| **July 11, 2007** | Riley | Lightning | 0.49 | $3,785 |
| **July 16, 2007** | West Willow | Lightning | 16.00 | $63,784 |
| **July 23, 2007** | Lone Tree | Lightning | 0.10 | $1,492 |
| **September 9, 2007** | Sinbad Ridge | Lightning | 5.00 | $2,915 |
| **September 16, 2007** | Bailey | Children | 15.00 | $10,104 |
| **April 6, 2008** | Dewey Bridge | Children | 9.00 | $9,837 |
| **June 9, 2008** | Tater | Camp Fire | 0.50 | $1,976 |
| **June 11, 2008** | Castle Rock | Camp Fire | 5.00 | $5,772 |
| **June 30, 2008** | Arena | Equipment | 5.00 | $2,480 |
| **July 13, 2008** | Cisco Desert | Equipment | 2.00 | $4,672 |
| **July 22, 2008** | Slough | Lightning | 89.00 | $33,575 |
| **July 22, 2008** | Moon | Lightning | 0.10 | $1,461 |
| **July 23, 2008** | Cottonwood | Lightning | 0.20 | $3,067 |
| **August 2008** | Porcupine Fire | | 3500 | |

| Date | Fire Name | Cause | Acres (Approximate) | Cost Estimate Report from Forest Fire and State Lands Division/Comments |
|---|---|---|---|---|
| **August 5, 2008** | South Mesa | Lightning | 0.75 | $3,017 |
| **October 21, 2008** | Slough 2 | Miscellaneous | 435.00 | $153,638 |
| **March 4, 2009** | Lake Bottom | Miscellaneous | 83.00 | $10,793 |
| **June 16, 2009** | Valley City | Camp Fire | 0.10 | $1,489 |
| **July 6, 2009** | Pump Station | Lightning | 0.70 | $1,265 |
| **July 13, 2009** | Polar Mesa | Lightning | 0.20 | $4,279 |
| **July 28, 2009** | Westwater 1 | Lightning | 90.00 | $5,605 |
| **July 29, 2009** | East Willow Creek | Camp Fire | 2.00 | $11,208 |
| **July 30, 2009** | Cherry Mesa | Lightning | 0.10 | $3,739 |
| **July 30, 2009** | Cedar Camp | Lightning | 0.10 | $1,302 |
| **July 30, 2009** | Lookout | Lightning | 0.25 | $8,848 |
| **September 14,** | Gravel Pit | Lightning | 0.10 | $1,148 |
| **May 27, 2010** | Motor Home | Equipment | 0.50 | $1,090 |
| **June 9, 2010** | Dunham | Lightning | 2.75 | $3,823 |
| **July 5, 2010** | Mill Creek | Children | 1.00 | $2,389 |
| **August 18, 2010** | Cherry Mesa | Lightning | 0.10 | $2,138 |
| **September 2, 2010** | Sego | Lightning | 5.30 | $55,635 |
| **September 23,** | Floy | Lightning | 0.10 | $1,605 |
| **April 14, 2011** | Dunham | Debris Burn | 1.00 | $1,377 |
| **June 6, 2011** | Slough | Children | 43.00 | $65,000 |
| **June 18, 2011** | MM 15 Hwy 128 | Incendiary | 1.75 | $1,467 |
| **June 29, 2011** | Harley Dome | Lightning | 459.00 | $1,983 |
| **June 30, 2011** | Sand Arroyo | Lightning | 0.10 | $1,650 |
| **July 6, 2011** | Bitter Creek | Lightning | 3.00 | $4,070 |
| **August 6, 2011** | Sally's Hollow | Lightning | 444.00 | $2,910 |
| **August 28, 2011** | Bar X | Lightning | 0.20 | $1,928 |
| **August 29, 2011** | Long Mesa | Lightning | 1.00 | $2,331 |
| **Sept. 2, 2011** | Buckhorn | Lightning | 5.00 | $2,970 |
| **May 23, 2012** | Nash Wash | Equipment | 26.65 | $10,059 |
| **May 26, 2012** | Cabin | Miscellaneous | 13.9 | $5,397 |
| **June 3, 2012** | Fire Water | Lightning | 89 | $5,439 |
| **June15, 2012** | Golf Course | Equipment | 13.20 | $30,842.50 |
| **July 22, 2012** | Steer Ridge | Lightning | 8.72 | $14,842.30 |
| **Aug. 8, 2012** | Rockin A | Lightning | .20 | $1,080 |
| **Aug. 12, 2012** | WestWaterCliff | Miscellaneous | .27 | $4,900 |

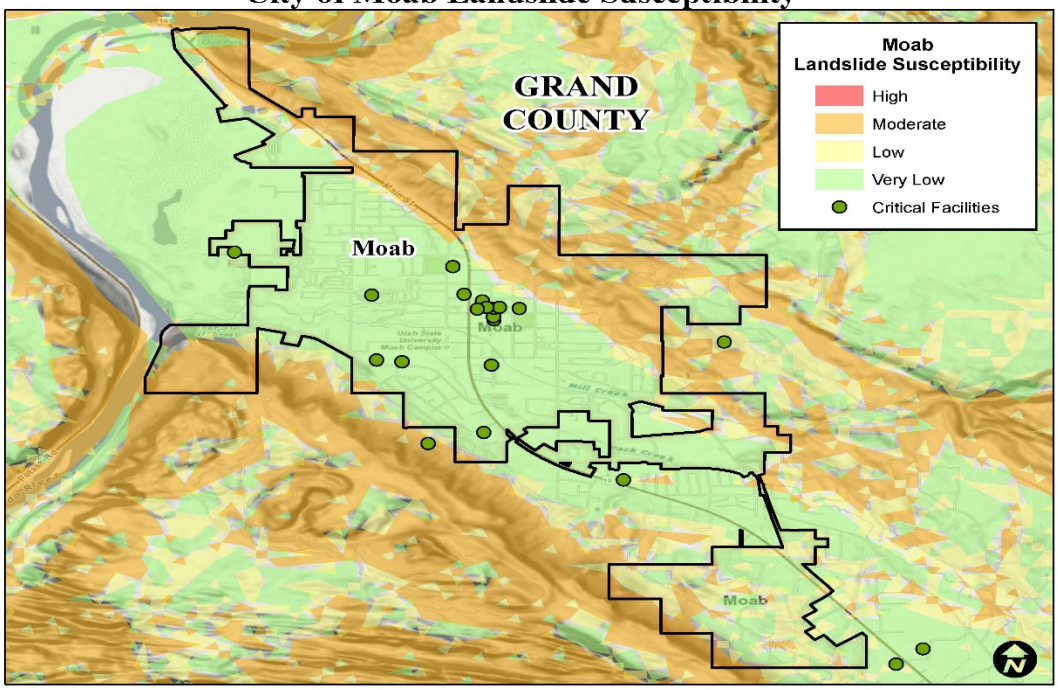
| Date | Fire Name | Cause | Acres (Approximate) | Cost Estimate Report from Forest Fire and State Lands Division/Comments |
|---|---|---|---|---|
| Sept.10, 2012 | Sally's | Lightning | 3.50 | $2,300 |
| Mar.6, 2012 | Steel Bender | Miscellaneous | 2.25 | $4,610 |
| April15, 2013 | Little Valley | Miscellaneous | 6.25 | $4,700 |
| June 16, 2013 | Power | Lightning | .10 | $1,260 |
| June 18, 2013 | Billie Brown | Lightning | 12 | $98,430 |
| June 29, 2013 | Floy 177 | Miscellaneous | .10 | $1,250 |
| July 7, 2013 | Sinbad | Lightning | 438.30 | $2,500 |
| July 15, 2013 | Star | Lightning | .20 | $9,349 |
| Aug. 3, 2013 | Corral | Lightning | .10 | $2,052 |
| Aug. 21, 2013 | Mahogany | Lightning | .10 | $5,500 |
| Aug. 23, 2013 | She Canyon | Lightning | .10 | $4,500 |
| Sept.21, 2013 | Deep Creek | Lightning | .10 | $4,302 |
| Sept.30, 2013 | Slough 2013 | Equipment | 3.70 | $1,874 |
| April 7, 2014 | Nelson | Debris Burn | 1.2 | $4,038 |
| June 15, 2014 | Full Moon | Miscellaneous | .12 | $1,382 |
| June 22, 2014 | Kerby Lane | Miscellaneous | 8.9 | $12,688.50 |
| June 25, 2014 | Moon Ridge | Lightning | 1.0 | $5,152 |
| July 30, 2014 | Horse Thief | Lightning | .10 | $1,740 |
| Aug. 1, 2014 | Went Ridge | Lightning | .10 | $7,075 |
| Aug. 25, 2014 | Castleton | Lightning | .10 | $1,257 |
| Oct. 18, 2014 | Tammy | Miscellaneou | .10 | $1,561 |
| April13, 2015 | Farm | Incendiary | 46.29 | $19,384 |
| April13, 2015 | HWY191mm14 | Miscellaneou | .50 | $1,776 |
| April14, 2015 | Cisco Desert | Equipment | .25 | $5,617 |
| May 29, 2015 | Willow Springs | Miscellaneou | .25 | $1,070 |
| July 9, 2015 | Jack Springs | Lightning | .10 | $1,008 |
| Aug. 1, 2015 | Round Mtn. | Lightning | .10 | $1,545 |
| May 29, 2016 | Big Bend | Camp Fire | .64 | $1,260 |
| June 2, 2016 | HWY191mm13 | Equipment | .10 | $1,047 |
| June 29, 2016 | I70 mm138 | Equipment | 1.40 | $2,240.08 |
| July 8, 2016 | Yellow Jacket | Equipment | .45 | $1,583 |
| July 10, 2016 | Power House 2 | Miscellaneou | .25 | $1002 |
| July 25, 2016 | Red Springs | Lightning | 19 | $9,216.92 |
| Aug. 9, 2016 | RockSpringsMe | Lightning | .25 | $9,734.50 |
| Sept.12, 2016 | 192 Fire | Equipment | 1.11 | $1,695 |

| Date | Fire Name | Cause | Acres (Approximate) | Cost Estimate Report from Forest Fire and State Lands Division/Comments |
|---|---|---|---|---|
| Oct. 24, 2016 | Lost Springs | Lightning | 13.40 | $8,937.50 |
| April 25, 2017 | Grand | Equipment | 0 | $2240 |
| Aug. 3, 2017 | Little Hole | Lightning | Private Land | $44,263 |
| Aug. 6, 2017 | Nash | Lightning | 5.30 | $1516 |
| Aug. 22, 2017 | Danish Flat | Lightning | 141 | $3107 |
| Sept. 22, 2017 | River Road | Camp Fire | 1.50 | $1174 |
| Nov. 9, 2017 | MM 169 | Misc. | 2.10 | $1294 |
| 2018 | | | | |

## Landslide

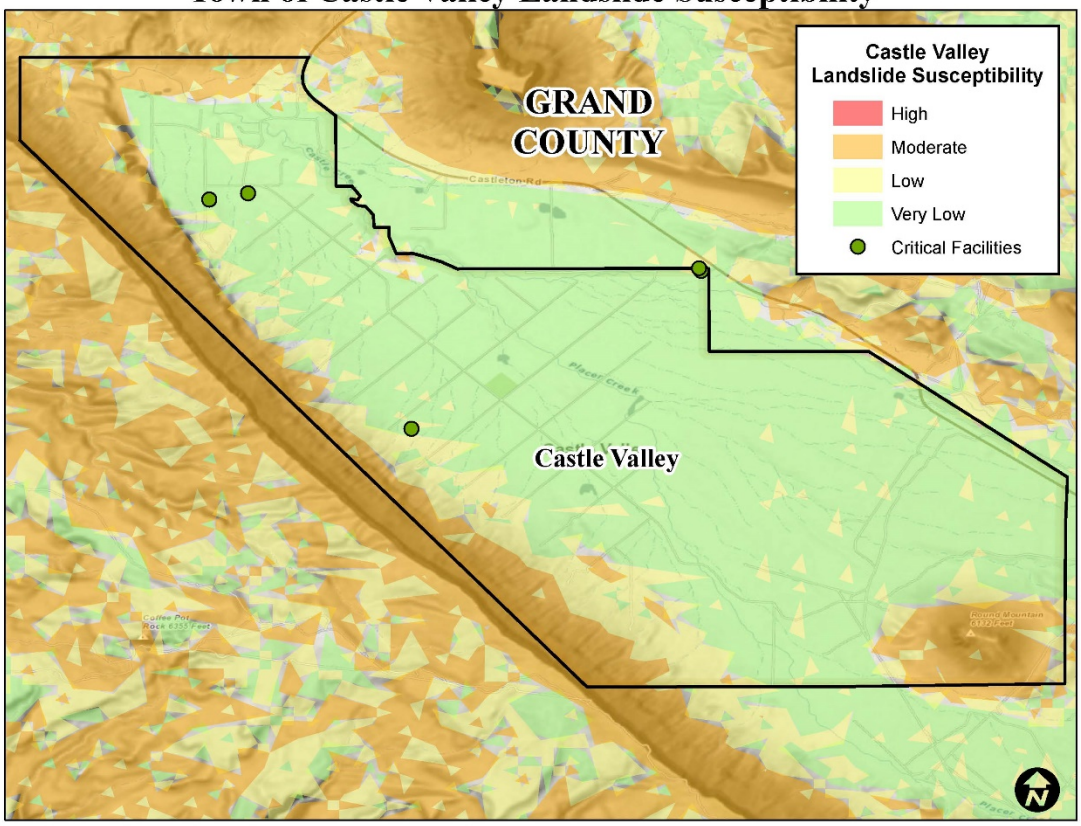


City of Moab Landslide Susceptibility




Data from UGS and AGRC. Map created by Utah Division of Emergency Management, Dec. 2017.

Town of Castle Valley Landslide Susceptibility




Data from UGS and AGRC. Map created by Utah Division of Emergency Management, Dec. 2017.

**Hazard Profile**

| | | | |
|---|---|---|---|
| Potential Magnitude | X | Negligible | Less than 10% |
| | | Limited | 10-25% |
| | | Critical | 25-50% |
| | | Catastrophic | More than 50% |
| Probability | | Highly Likely | |
| | | Likely | |
| | X | Possible | |
| | | Unlikely | |
| Location | Landslides generally, occur in canyon mouths and foothill areas. Manti-La Sal National Forest, near foothills on steep slopes, cliff faces, canyon walls. | | |
| Seasonal Pattern or Conditions | Spring and Summer usually caused by the stress release of over-weighted soils and or loosening of rock and debris. | | |
| Duration | Landslides generally last hours or days, but some can last weeks. | | |
| Analysis Used | Information and maps provided by UGS, DEM, AGRC. | | |

**Description of Location and Extent**

The map "Grand County Landslide Hazard" shows the locations of high-risk landslide areas by identifying historical landslide locations. The main historical landslides in Grand County occurred in the Southeastern portion of the Manti-La Sal National Forest, just east of Green River. Generally, landslides are in well-defined, localized areas. The identified historical areas will most likely be the location of future landslides.

The impacts of Rockfall/Landslides on the community of Castle Valley would depend on the location and severity of the event. Rockfalls can cause damage to structures, roads, and can alter drainages which could negatively impact other properties and roads. Rockfalls will mostly happen higher up on the rim side of the valley.

**Vulnerability Assessment**

The hazard analysis indicates that there are no business or critical facilities in Grand County that are located within the high landslide risk area. There are residential units as well as general infrastructure within the risk area (Tables 15,16).

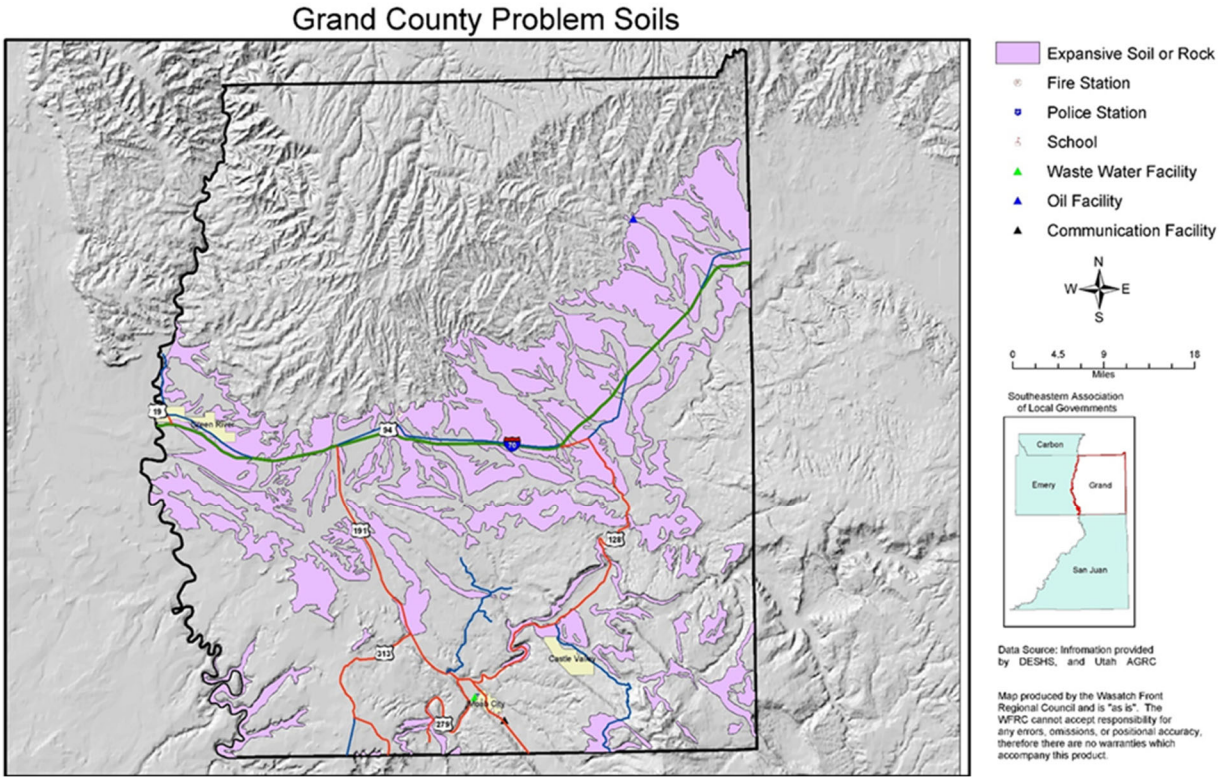
**Table 15 Inventory of Properties Located in Landslide Risk Areas in Grand County**

| Businesses | Residential Units | Population |
|---|---|---|
| Number\Annual Sales | Number\Replacement Cost | |
| 0 /$0 | 102 \ $12,801,000 | 147 |

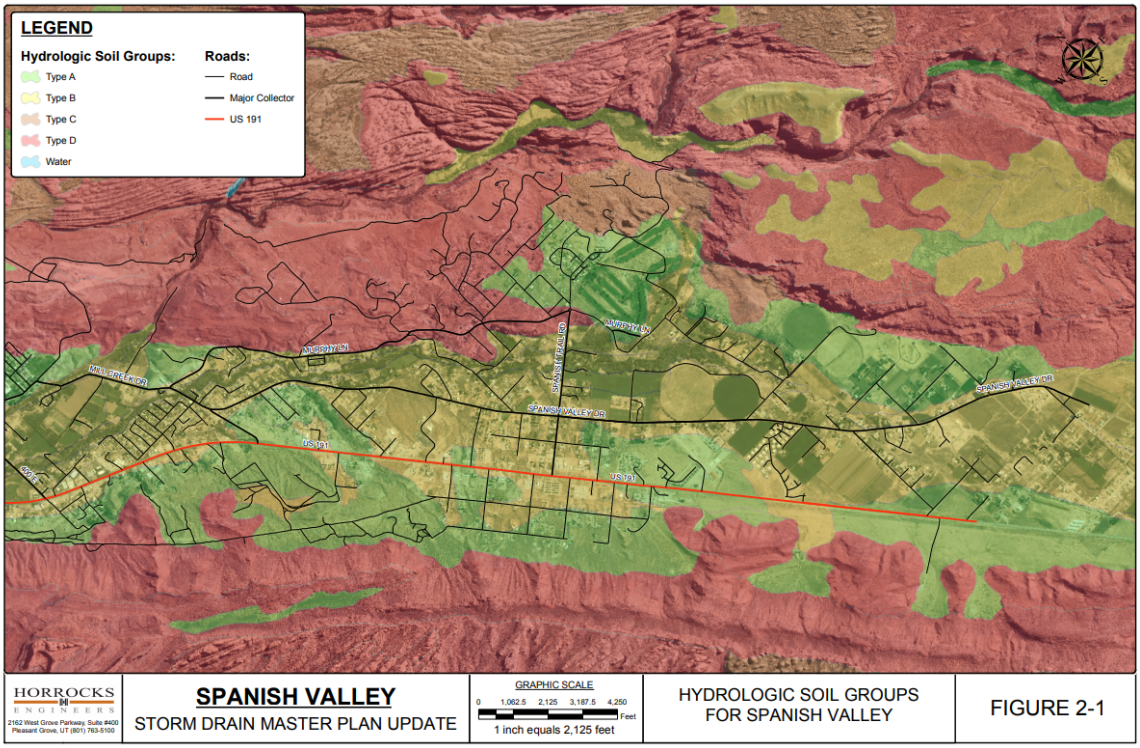
**Table 16 Infrastructure in Landslide**

| Item | Length (Miles) | Replacement Cost |
|---|---|---|
| Local Roads | 5.77 | $14,425,000 |
| State Highways | 0.00 | $0 |
| US Highways | 0.00 | $0 |
| US Interstates | 0.00 | $0 |
| Power Lines | 2.56 | $136,265 |
| Gas Lines | 0.00 | $0 |

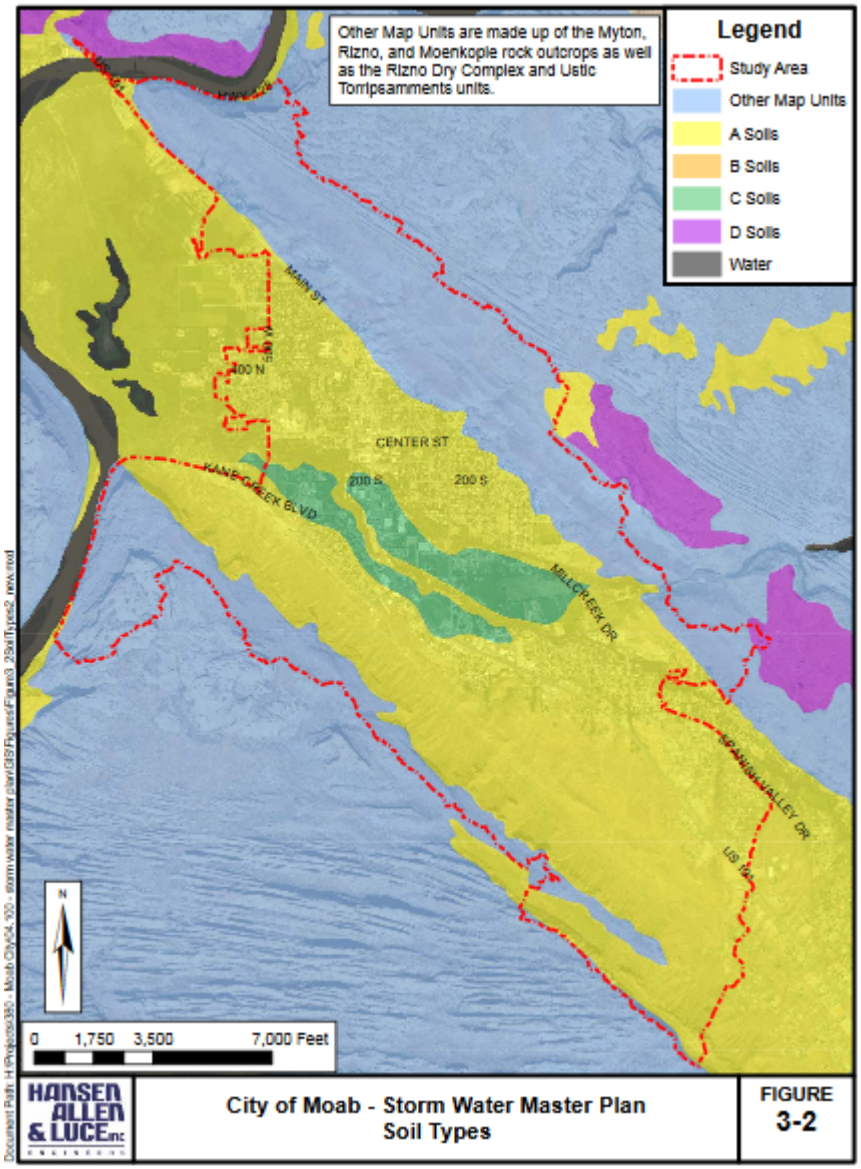
## Problem Soil




Soil Types Map from Grand County's Storm Drain Master Plan Update.



Soils type map from the City of Moab Storm Water Master Plan




Explanation of Soil Types:

The hydrologic soil group is a general indication of a soil's infiltration capacity and is a key determinant of runoff behavior. The Natural Resources Conservation Service (NRCS) has classified soils into four hydrologic groups: A, B, C, and D. Soils of group A have the highest infiltration rate and therefore produce the least amount of runoff. Group A soils include permeable gravels and well-drained sands. Group B soils have moderate infiltration rates and moderately fine or coarse textures. Developed portions of each study area were assumed to have a minimum of nonnative group B soils to represent the desert landscaping common on developed parcels. Group C soils have a lower infiltration rate and finer textures, sometimes with a layer that impedes infiltration. Soils of group D have the lowest infiltration rate and produce the highest amount of runoff. Group D soils include fine silts, fine clays, and other soils with low infiltration

rates. Soil groups are described in TR-55 (NRCS, 1986). Soil data were retrieved from the Natural Resource Conservation Service's (NRCS) Web Soil Survey. Some map units defined in the soil data required the use of the Soil Survey of Grand County to determine corresponding curve numbers (Soil Conservation Service, 1989).
Group A soils are the most prevalent in the City of Moab.

**Hazard Profile**

| | | | |
|---|---|---|---|
| Potential Magnitude | | Negligible | Less than 10% |
| | X | Limited | 10-25% |
| | | Critical | 25-50% |
| | | Catastrophic | More than 50% |
| Probability | | Highly Likely | |
| | | Likely | |
| | X | Possible | |
| | | Unlikely | |
| Location | Generally located in the central and southern portions of the county. | | |
| Seasonal Pattern or Conditions | Spring and Summer | | |
| Duration | Constant problem | | |
| Analysis Used | Review of information and maps provided by County soil classification books, Soil Conservation Service, local input, USGS, DEM, and AGRC. | | |

**Description of Location and Extent**

To determine runoff conditions, the Soil Conservation Service (SCS) investigated the Canyonlands area, just south of the Grand County border. The soil makeup of the area ranged from well-drained silty soils to impervious rock, and SCS found permeability in the bluffs of the southeastern portion of the county to be generally moderate, setting the stage for conditions of medium to rapid runoff. In the Moab City Developed area, SCS findings show the soil to have moderate to rapid permeability indicating slow to medium runoff. In the mid-southern portion of the county SCS found minor amounts of silica dune, while expansive soil and rock affect the central and southern portions of the county.

In September 2015, a sinkhole developed in Moab City. As a result, one home was condemned. According to the Grand County Building Inspector, "sinkholes typically occur naturally because of percolating water and the gradual removal of soluble bedrock. This process creates a void that ultimately results in a collapse of the overlying cave roof. Though most often occurring in regions with heavy limestone deposits, sinkholes also appear in areas of chalk, gypsum, basalt, and where there are underlying salt beds.

"Human activities such as mining, groundwater over-extraction, drainage diversion and failing infrastructure – such as water main leaks, or the collapse of sewer systems and other buried pipes – can also create sinkholes".

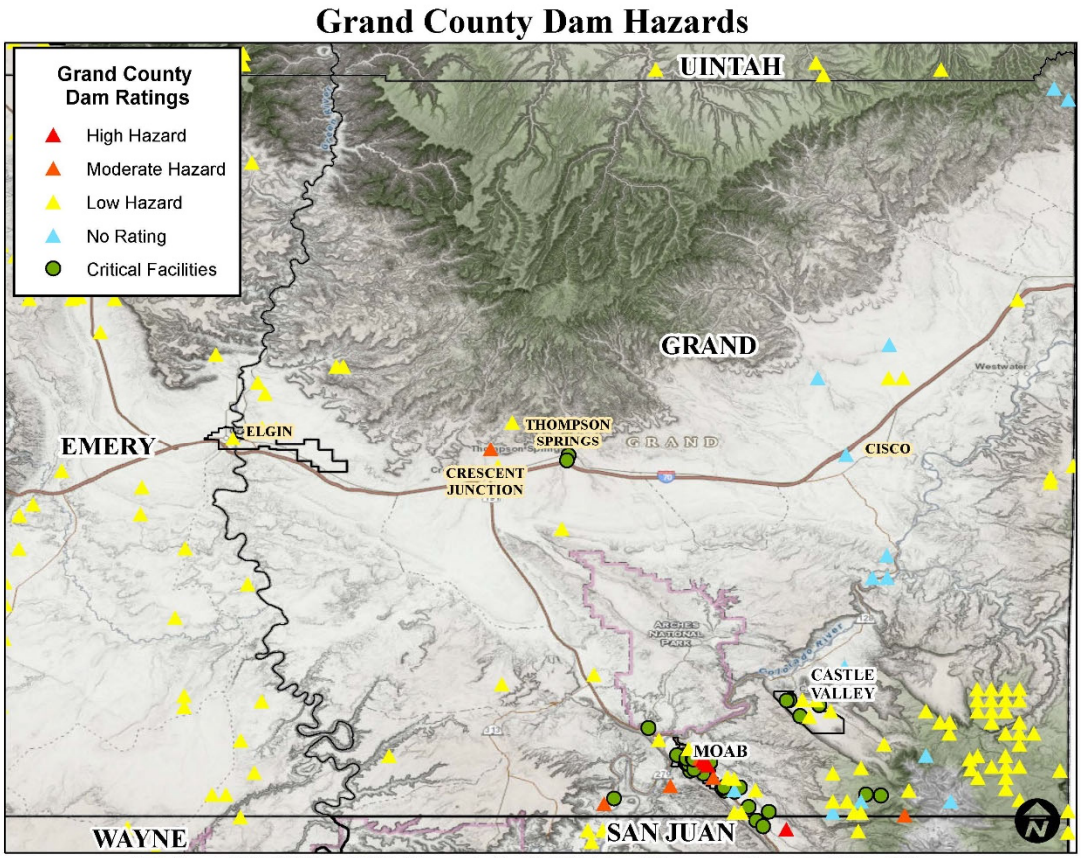
Present day subsidence and sinkholes have yet to make a significant impact on the Castle Valley community however the larger concern could be directed at the reason why they appear or increase in size. Many of the activities that are responsible for creating sinkholes could be very detrimental to the holistic health of Castle Valley. Over-mining water in the valley could lead to drought and seriously impact the community. Other activities such as mining in the region could affect Castle Valley's Sole Source Aquifer if sinkholes begin to appear from mining practices.

Table 17 shows the results from an analysis in which the problem soils and major roadways map developed for the State of Utah and a map of Census block data were overlaid to indicate where households and roadways were in relation to problem soil areas (no households were identified in problem soil areas). Potential roadway replacement was calculated assuming a cost of $5 Million per mile. Areas of problem soils within Grand County are indicated by the map "Grand County Problem Soils."

**Table 17 Roadways in Grand County located on Problem Soil Areas**

| Roadway | Miles | Estimated Replacement Cost |
|---|---|---|
| I-70 | 42.53 | $212,650,000 |
| West Main St. | 0.41 | $2,050,000 |
| East Main St. | 0.53 | $2,650,000 |
| Main St. | 0.19 | $950,000 |
| South Main St. | 0.51 | $2,550,000 |
| North Main St. | 0.32 | $1,600,000 |
| State Route 10 | 40.91 | $204,550,000 |
| State Route 155 | 5.64 | $28,200,000 |
| State Route 24 | 4.78 | $23,900,000 |
| State Route 29 | 4.87 | $24,350,000 |
| State Route 31 | 4.50 | $22,500,000 |
| State Route 57 | 9.74 | $48,700,000 |
| U.S. Highway 6 | 35.69 | $178,450,000 |

## Dam Failure




Data from AGRC, DWR, and BOR. Map created by Utah Division of Emergency Management, Dec. 2017.

**Hazard Profile**

| | | | |
|---|---|---|---|
| Potential Magnitude | | Negligible | Less than 10% |
| | | Limited | 10-15% |
| | X | Critical | 25-50% |
| | | Catastrophic | More than 50% |
| Probability | | Highly Likely | |
| | | Likely | |
| | | Possible | |
| | X | Unlikely | |
| Location | Grand County has 141 Dams and Retention Ponds (See Table 18) | | |
| Seasonal Pattern or Conditions | Rainy Day Failure happens mainly during heavy precipitation events, can have some warning time. Sunny Day Failure happens with no warning at all can happen at any time. | | |
| Duration | The release is normally intense and of short duration but may last days | | |

| Analysis Used | Utah Water Rights Dam Safety, Bureau of Reclamation and DWR |
|---|---|

**Description of Location and Extent**

Downstream uses, size, height, volume, and incremental risk/damage assessments determine hazard ratings, which are: Low-insignificant property loss; Moderate-significant property loss; High-possible loss of life. For the record, dam safety hazard classifications are only in the event of a dam failure. Just because a dam is classified as a high hazard does not mean there is a high failure probability. See Table 18.

**Table 18 Dams in Grand County**

| Grand County Dam Hazard Ratings<br>All Dams | | |
|---|---|---|
| | **Dam Name** | **Hazard Rating** |
| 1 | MOAB CITY - TUSHER CANYON DETENTION | HIGH |
| 2 | MOAB CITY - WALKER CANYON DB | HIGH |
| 3 | MOAB CITY - WHITE CANYON RETENTION | HIGH |
| 4 | CRESCENT WASH | MOD |
| 5 | GRAND COUNTY | MOD |
| 6 | LAKE OOWAH | MOD |
| 7 | MOAB CITY JOHNSON CANYON LOWER | MOD |
| 8 | MOAB CITY JOHNSON CANYON RETENTION DAM | MOD |
| 9 | MOAB SALT POTASH STOCKPILE DAM | MOD |
| 10 | B.L.M./LITTLE VALLEY RESERVOIR | LOW |
| 11 | B.L.M./MINERAL POINT TANK RESERVOIR | LOW |
| 12 | BASTIAN, JACOB M. | LOW |
| 13 | BATES, KENNETH E. | LOW |
| 14 | BUREAU OF LAND MANAGEMENT | LOW |
| 15 | CASTLE VALLEY INC. RESERVOIR NO. 4 | LOW |
| 16 | CASTLE VALLEY INC. RESERVOIR NO.2 | LOW |
| 17 | CASTLE VALLEY INC. RESERVOIR NO.3 | LOW |
| 18 | CASTLE VALLEY INCORPORATED, RESERVOIR 1 | LOW |
| 19 | DANISH FLAT ENVIRONMENTAL #2 | LOW |
| 20 | DANISH FLAT ENVIRONMENTAL #3 | LOW |
| 21 | DANISH FLAT ENVIRONMENTAL #4 | LOW |
| 22 | DANISH FLAT ENVIRONMENTAL #5 | LOW |
| 23 | DANISH FLAT ENVIRONMENTAL #6 | LOW |
| 24 | DANISH FLAT ENVIRONMENTAL #7 | LOW |
| 25 | DANISH FLAT ENVIRONMENTAL #8 | LOW |
| 26 | DANISH FLAT ENVIRONMENTAL SERVICES #1 | LOW |
| 27 | DAVID L. & JAN M. MEFRET | LOW |
| 28 | DAVID L. & JAN M. MEFRET | LOW |

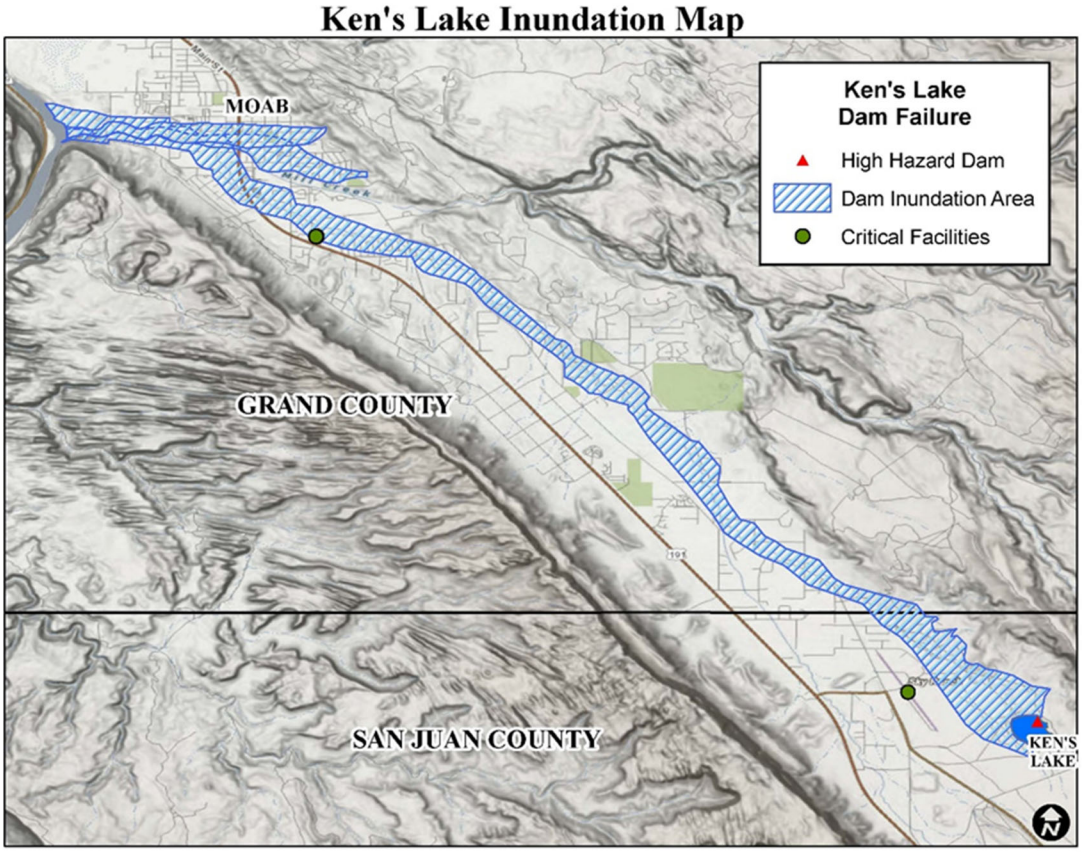
| | | |
|---|---|---|
| 29 | DICKSON, ROY A. 71R2 | LOW |
| 30 | DON`S LAKE | LOW |
| 31 | GRAMLICH, PHILIP F. 86R70 | LOW |
| 32 | GRAMLICH, PHILIP F. 86R71 | LOW |
| 33 | GRAMLICH, PHILIP F. 86R72 | LOW |
| 34 | GRAMLICH, PHILIP F. 86R73 | LOW |
| 35 | GRAND COUNTY | LOW |
| 36 | GRAND COUNTY 98-05-09MD | LOW |
| 37 | GRAND COUNTY 98-05-11MD | LOW |
| 38 | GRAND COUNTY - CENTRAL BASIN | LOW |
| 39 | GRAND COUNTY - UPPER EAST | LOW |
| 40 | GRAND COUNTY - UPPER WEST #1 | LOW |
| 41 | GRAND COUNTY - UPPER WEST #2 | LOW |
| 42 | GRAND COUNTY 98-05-10MD | LOW |
| 43 | GREEN RIVER FARMS, LLC POND 3-1 | LOW |
| 44 | GREEN RIVER FARMS, LLC POND 3-2 | LOW |
| 45 | HIDDEN LAKE | LOW |
| 46 | HOGAN & ASSOCIATES CONSTRUCTION | LOW |
| 47 | LONGSHOT MINE #2 86R71 | LOW |
| 48 | LONGSHOT MINE #4 86R73 | LOW |
| 49 | LONGSHOT MINE 86R70 | LOW |
| 50 | MOAB SALT POTASH POND DAM 2G | LOW |
| 51 | MOAB SALT POTASH POND DAM 2N | LOW |
| 52 | MOAB SALT POTASH POND DAM 3A | LOW |
| 53 | MOAB SALT POTASH POND DAM 3B | LOW |
| 54 | PACE | LOW |
| 55 | PINON MESA, INC. 71R6 | LOW |
| 56 | POND NO. 1 | LOW |
| 57 | POND NO. 2 | LOW |
| 58 | ROGERS, DANA J. & SABERA | LOW |
| 59 | SAN ARROYO ENVIRONMENTAL/POND #1 | LOW |
| 60 | SAN ARROYO ENVIRONMENTAL/POND #2 | LOW |
| 61 | SAN ARROYO ENVIRONMENTAL/POND #3 | LOW |
| 62 | SAN ARROYO ENVIRONMENTAL/POND #4 | LOW |
| 63 | SAN ARROYO ENVIRONMENTAL/POND #5 | LOW |
| 64 | SITLA | LOW |
| 65 | SITLA | LOW |
| 66 | SITLA /LONE CONE POND #1 | LOW |
| 67 | SITLA/LONE CONE POND #2 | LOW |
| 68 | SPRING CREEK RANCH - NORTH POND | LOW |
| 69 | SPRING CREEK RANCH - SOUTH POND | LOW |

| | | |
|---|---|---|
| 70 | SYNERGY CONSULTANTS | LOW |
| 71 | U.S. DEPARTMENT OF ENERGY | LOW |
| 72 | US FOREST SERVICE /S BEAVER POND 1 | LOW |
| 73 | US FOREST SERVICE/ANDY MESA POND | LOW |
| 74 | US FOREST SERVICE/BEAVER POND SEC 21 | LOW |
| 75 | US FOREST SERVICE/BUNCH GROUND POND | LOW |
| 76 | US FOREST SERVICE/COW HEAD POND | LOW |
| 77 | US FOREST SERVICE/D. L . POND | LOW |
| 78 | US FOREST SERVICE/DOUBLE POND=1 | LOW |
| 79 | US FOREST SERVICE/DOUBLE POND=2 | LOW |
| 80 | US FOREST SERVICE/FENCE LINE POND | LOW |
| 81 | US FOREST SERVICE/N BEAVER 2 SEC 22 | LOW |
| 82 | US FOREST SERVICE/N BEAVER MESA RES 1 | LOW |
| 83 | US FOREST SERVICE/N BEAVER MESA RES 2 | LOW |
| 84 | US FOREST SERVICE/N BEAVER POND | LOW |
| 85 | US FOREST SERVICE/N BEAVER POND 2 | LOW |
| 86 | US FOREST SERVICE/N BEAVER SEC 17-1 | LOW |
| 87 | US FOREST SERVICE/N BEAVER SEC 21 - 1 | LOW |
| 88 | US FOREST SERVICE/N BEAVER-1- SEC 22 | LOW |
| 89 | US FOREST SERVICE/N. BEAVER ,2 SEC 15 | LOW |
| 90 | US FOREST SERVICE/N. BEAVER 1 SEC. 8 | LOW |
| 91 | US FOREST SERVICE/N. BEAVER 2 SEC 10 | LOW |
| 92 | US FOREST SERVICE/N. BEAVER 2 SEC 11 | LOW |
| 93 | US FOREST SERVICE/N. BEAVER 4 SEC 11 | LOW |
| 94 | US FOREST SERVICE/N. BEAVER 5 SEC 11 | LOW |
| 95 | US FOREST SERVICE/N. BEAVER SEC 11 - 1 | LOW |
| 96 | US FOREST SERVICE/N. BEAVER SEC 11-3 | LOW |
| 97 | US FOREST SERVICE/N. BEAVER SEC 15-1 | LOW |
| 98 | US FOREST SERVICE/N. BEAVER SEC 4-2 | LOW |
| 99 | US FOREST SERVICE/N. BEAVER SEC 5-1 | LOW |
| 100 | US FOREST SERVICE/N.BEAVER 1 SEC 16 | LOW |
| 101 | US FOREST SERVICE/N.BEAVER 2 SEC 17 | LOW |
| 102 | US FOREST SERVICE/N.BEAVER PND 9-2 | LOW |
| 103 | US FOREST SERVICE/N.BEAVER PND SEC 10-1 | LOW |
| 104 | US FOREST SERVICE/OVERFLOW POND | LOW |
| 105 | US FOREST SERVICE/POLAR MESA 1 | LOW |
| 106 | US FOREST SERVICE/POLAR MESA 2 | LOW |
| 107 | US FOREST SERVICE/POLAR MESA 3 | LOW |
| 108 | US FOREST SERVICE/POLAR MESA RES. | LOW |
| 109 | US FOREST SERVICE/S BEAVER POND 2 | LOW |
| 110 | US FOREST SERVICE/SLICK ROCK | LOW |

| | | |
|---|---|---|
| 111 | US FOREST SERVICE/SPRING POND | LOW |
| 112 | US FOREST SERVICE/UNPAYED POND | LOW |
| 113 | US FRST SER./FISHER VALLEY OVERLOOK | LOW |
| 114 | US FRST SER/FOREST BOUNDRY POND | LOW |
| 115 | US FRST SERVICE/BEAVER PND SEC 9 -1 | LOW |
| 116 | US FRST SERVICE/N. BEAVER PND 1 SEC 4 | LOW |
| 117 | VETERE POND #1 NORTHERN | LOW |
| 118 | VETERE POND #1-2A WEST | LOW |
| 119 | VETERE POND #1-2B EAST | LOW |
| 120 | VETERE POND #2-1A NORTH | LOW |
| 121 | VETERE POND #2-1B BIG WASH SOUTH | LOW |
| 122 | VON ZASTROW, DAVID & JEAN | LOW |
| 123 | WARNER LAKE | LOW |
| 124 | ATLAS MINERAL 01 | LOW |
| 125 | BUREAU OF LAND MANAGEMENT 98-01-37MD | |
| 126 | BUREAU OF LAND MANAGEMENT 98-01-38MD | |
| 127 | CARTER, GEORGE & ANN 96-05-67MD | |
| 128 | CARTER, GEORGE B. & E. ANN 96-05-68MD | |
| 129 | CARTER, GEORGE B. & E. ANN 96-05-69MD | |
| 130 | CHRIS STEVEN RUSSEL PE 98-01-23MD | |
| 131 | CHRIS STEVEN RUSSELL PE 98-01-13MD | |
| 132 | FRYER, COLIN 95-05-06MD | |
| 133 | JONES, DARWIN & CINDY 96-01-60MD | |
| 134 | JONES, MIKE 92-01-06MD | |
| 135 | JONES, MIKE 92-01-07MD | |
| 136 | JONES, MIKE 92-01-11MD | |
| 137 | LONGSHOT MINE #3 86R72 | |
| 138 | POND #1 - EAST 96-05-12MD | |
| 139 | POND #2 - WEST 96-05-13MD | |
| 140 | PVR INC., A UTAH CORP. 99-05-01MD | |
| 141 | TEN MILE WASH | |

Dam data from Utah Division of Water Rights. Includes only dams in Grand County.

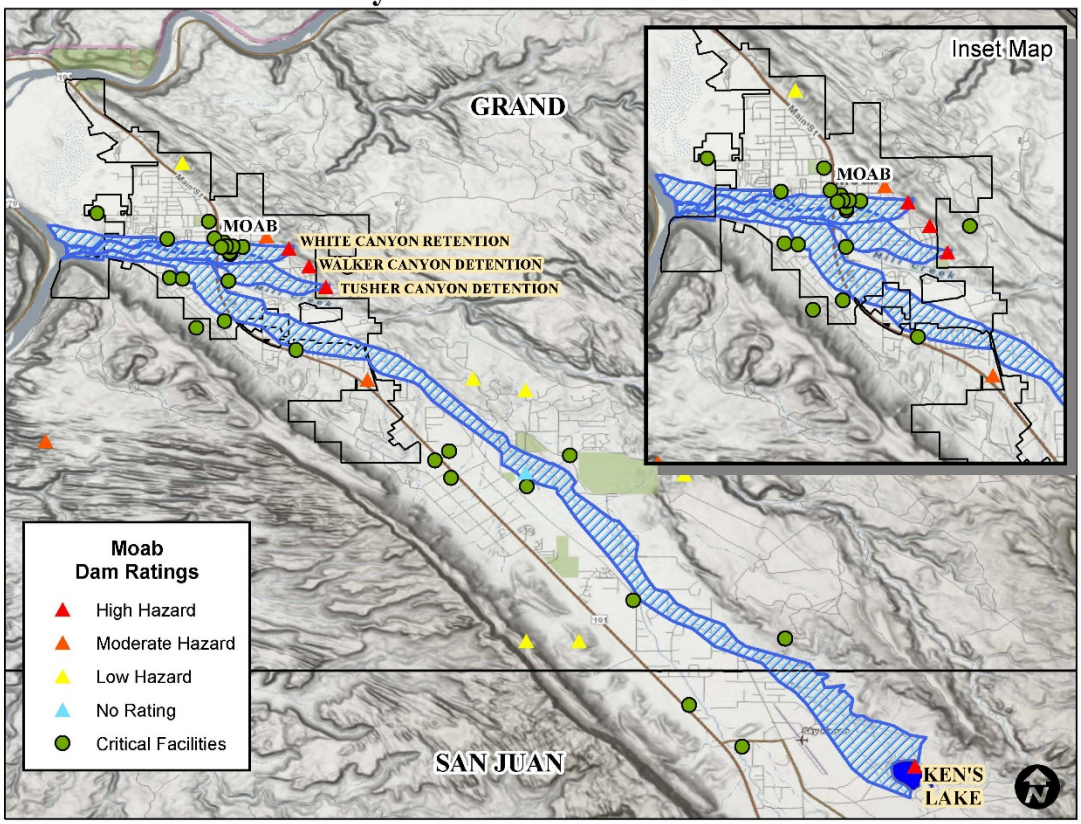
**Vulnerability Assessment**




Data from AGRC, DWR, BOR. Map created by Utah Division of Emergency Management, Nov. 2017.

A high hazard threat to Grand County comes from Ken's Lake Reservoir. While Ken's Lake Dam is in San Juan County, the risk is in both San Juan and Grand Counties. Built in 1981, the dam is owned by the Grand County Water Conservancy District. The reservoir storage at spillway crest is 2,820 acre-feet and the reservoir storage at dam crest is 2,620 acre-feet. The dam's spillway type is open channel and the maximum dam breach flow is 64,000 cfs with a 3-square mile drainage basin area. A failure of Ken's Lake Dam would have a major effect on Moab City, 6 miles away and the first downstream town. Because of this potential, the possible failure of Ken's Lake Dam in San Juan County raises the magnitude for Dam Failure to critical for Grand County.

## City of Moab Dam Hazards




Data from AGRC, DWR, and BOR. Map created by Utah Division of Emergency Management, Dec. 2017.

## Severe Weather

### Hazard Profile

| | | | |
|---|---|---|---|
| Potential Magnitude | | Negligible | Less than 10% |
| | X | Limited | 10-15% |
| | | Critical | 25-50% |
| | | Catastrophic | More than 50% |
| Probability | X | Highly Likely | |
| | | Likely | |
| | | Possible | |
| | | Unlikely | |
| Location | Countywide | | |
| Seasonal Pattern or Conditions | The occurrence of severe weather is generally snow, hail, and fog during the winter months, lightning and thunderstorms late spring, summer, and early fall | | |
| Duration | The storms may be hours or days | | |
| Analysis Used | NOAA Reports | | |

### Description of Location and Extent

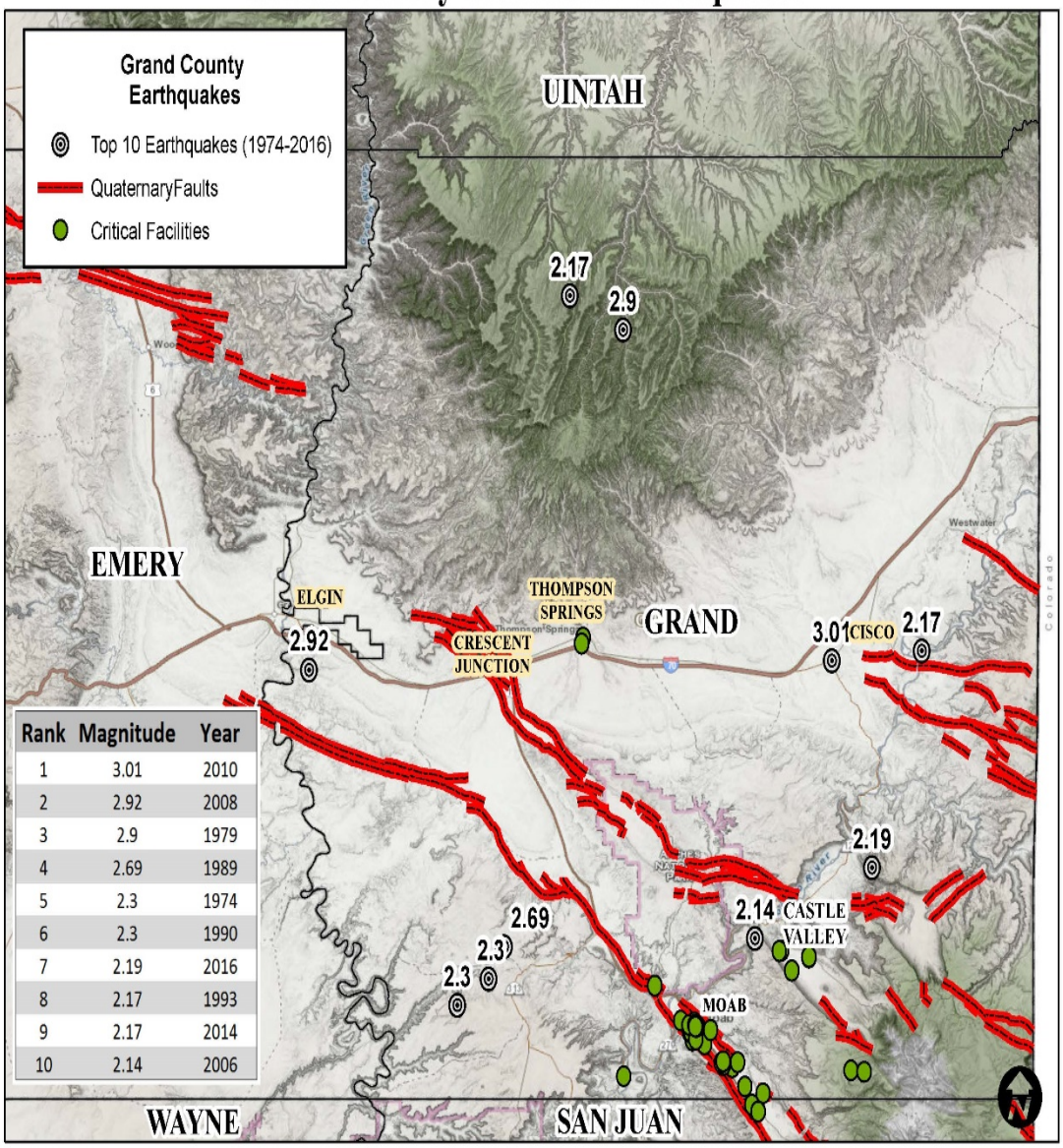
The severe weather is generally a countywide event also affecting the City of Moab and the Town of Castle Valley. The National Parks within Grand County are also impacted with Severe Weather events isolating tourists and causing park closures.

### Vulnerability Assessment

The historical record indicates Grand County, The City of Moab, and the Town of Castle Valley experience a wide variety of severe weather from thunderstorms with heavy rainfall and lightning, tornadoes, dense fog, hail, and heavy snowfall. The heavy rains impact the transportation system with road flooding causing road damage and road closures in the County, City of Moab, Town of Castle Valley and the National Parks.

## Earthquake

### Grand County Historical Earthquakes




Data from University of Utah Seismograph Stations and AGRC. Map created by Utah Division of Emergency Management, Dec. 2017.

**Hazard Profile**

| | | | |
|---|---|---|---|
| Potential Magnitude | | Negligible | Less than 10% |
| | X | Limited | 10-15% |
| | | Critical | 25-50% |
| | | Catastrophic | More than 50% |
| Probability | | Highly Likely | |
| | | Likely | |
| | | Possible | |
| | X | Unlikely | |
| Location | Countywide | | |
| Seasonal Pattern or Conditions | Earthquakes may occur at any time. | | |
| Duration | Event may be short, recovery may be days or months | | |
| Analysis Used | USGS Report, HAZUS MH: Earthquake Global Risk Report OCT 2017 DEM (Appendix 3) | | |

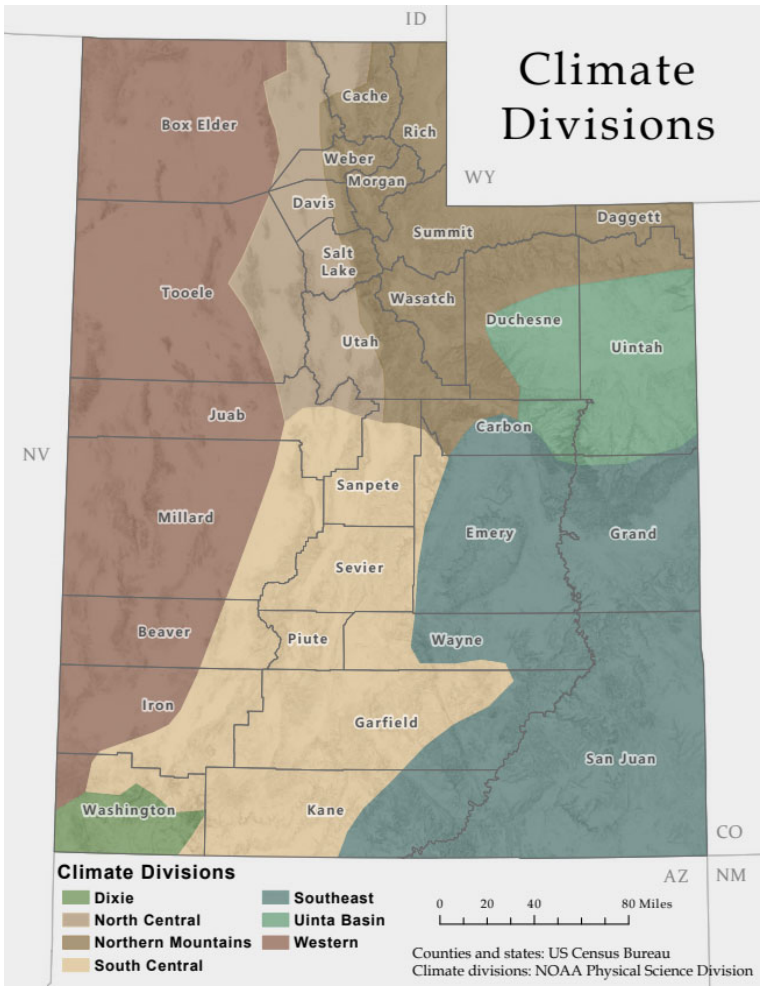
**Description of Location and Extent**

There have been 3 recorded earthquakes in Grand County: May 2010, 2.9 MAG, 19 miles from Thompson Springs; March 2012, 2.7 MAG, 11.41 miles from Moab; April 2014, 2.2 MAG, 24.73 miles from Thompson Springs. There was no reported damage or injuries from these earthquakes.

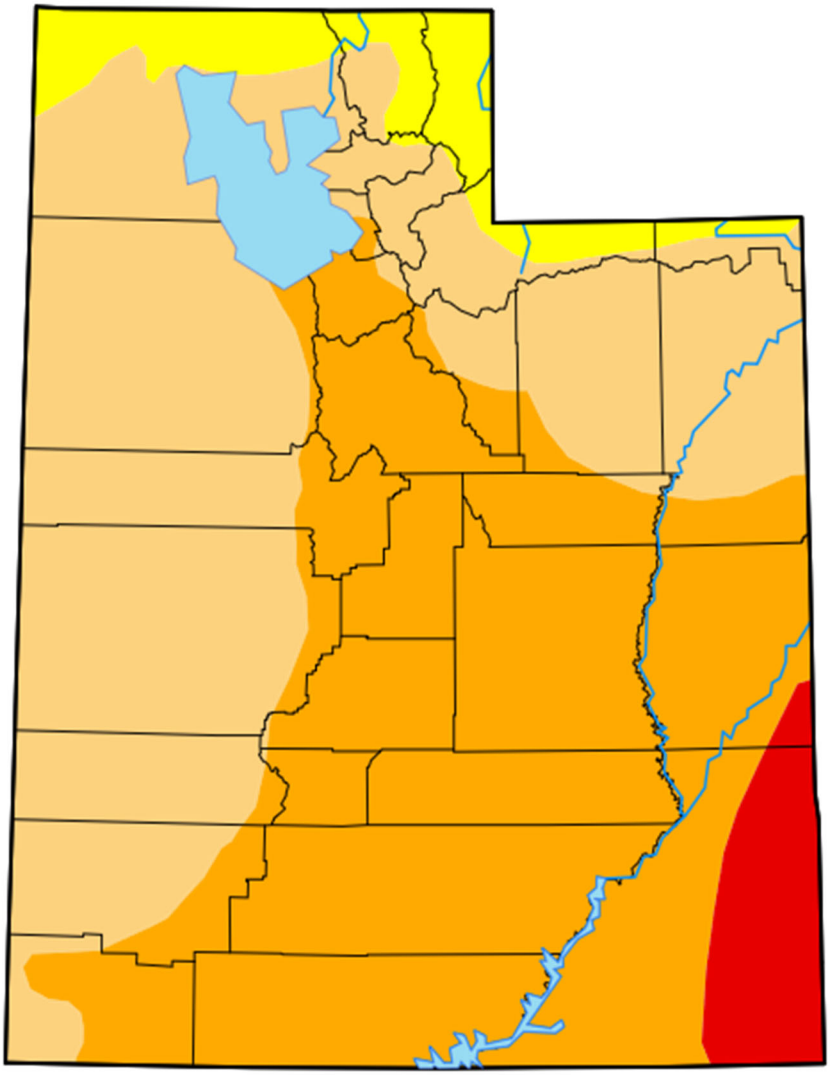
**Vulnerability Assessment**

The Hazus Earthquake Global Risk Report, Oct. 2017, based on a 6.5 MAG Earthquake indicates 480 buildings will be damaged, of those 4 buildings will be damaged beyond repair and 11 households will be displaced. Six citizens will seek public shelter. The transportation systems will be at more than 50% functionality after day 1. The total economic loss is estimated at 40.06 million dollars.

## Drought


Climate Divisions
ID
WY
NV
AZ
NM
CO
Box Elder
Cache
Rich
Weber
Morgan
Davis
Summit
Daggett
Salt Lake
Tooele
Wasatch
Duchesne
Uintah
Utah
Juab
Carbon
Sanpete
Millard
Emery
Grand
Sevier
Beaver
Piute
Wayne
Iron
Garfield
San Juan
Washington
Kane
Climate Divisions
Dixie
North Central
Northern Mountains
South Central
Southeast
Uinta Basin
Western
0 20 40 80 Miles
Counties and states: US Census Bureau
Climate divisions: NOAA Physical Science Division

## U.S Drought Monitor- Utah 2018



National Integrated Drought Information System Feb 2018

## Drought Intensities

| | | |
|---|---|---|
| | None | No Drought |
| | D0 | Abnormally Drought |
| | D1 | Moderate Drought |
| | D2 | Serve Drought |
| | D3 | Extreme Drought |
| | D4 | Exceptional Drought |

**Hazard Profile**

| | | | |
|---|---|---|---|
| Potential Magnitude | X | Negligible | Less than 10% |
| | | Limited | 10-15% |
| | | Critical | 25-50% |
| | | Catastrophic | More than 50% |
| Probability | X | Highly Likely | |
| | | Likely | |
| | | Possible | |
| | | Unlikely | |
| Location | Countywide | | |
| Seasonal Pattern or Conditions | Generally summer and early fall | | |
| Duration | Can be a month to several months | | |
| Analysis Used | National Integrated Drought Information System, Utah State University Utah Climate Information | | |

**Description of Location and Extent**

Countywide; Grand County, the City of Moab, and the Town of Castle Valley are in the southeast climate division of Utah and are affected with periodic drought events. The culinary water supply, irrigation water, and stock ponds are depleted during the drought events. Grand County has signed a Drought Disaster Declaration in April 2018 and resigned each month since. The drought has impacted the economic, social, and environmental fabric of Grand County.

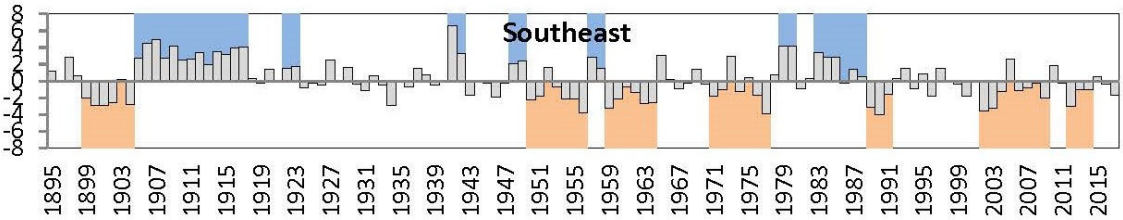
**Vulnerability Assessment**

Grand County is located on the Colorado Plateau an historically arid area of the State of Utah. There have been 10 recorded drought events since 2002 according to the National Weather Service records. Grand County is currently in the 11th drought event categorized as a Severe Drought event.
This Bar Graph shows the Palmer Drought Severity Index (PDSI) values from 1895 – 2017 for the Southeast Climate Division of Utah. Data from:
https://www.ncdc.noaa.gov/temp-and-precip/drought/historical-palmers/
Definition of Drought based on "Drought in Utah" report:

1. A drought was considered to have started with two consecutive years of annual average PDSI values less than or equal to -1.0.

2. A drought was terminated with two consecutive years of near of above normal conditions (annual average PDSI greater than -0.5).

The orange areas indicate drought years. The blue areas indicate exceptional wet periods.




Major Drought Years for Grand County. 8 major drought events.
1899 – 1904
1950 – 1954
1959 – 1964
1971 – 1977
1989 – 1991
2002 – 2009
2012 – 2014
Current

## Infestation

### Hazard Profile

| | | | |
|---|---|---|---|
| Potential Magnitude | | Negligible | Less than 10% |
| | X | Limited | 10-25% |
| | | Critical | 25-50% |
| | | Catastrophic | More than 50% |
| Probability | | Highly Likely | |
| | X | Likely | |
| | | Possible | |
| | | Unlikely | |
| Location | Countywide agricultural lands, forested areas, areas of extreme drought. | | |
| Seasonal Pattern or Conditions | Summer, drought related | | |
| Duration | Months to years | | |
| Analysis Used | Reviewed information provided by UGS, DEM, AGRC, Utah Forestry Fire and State Lands, Utah Forest Service, Utah State University Extension Service, and local input. | | |

**Description of Location and Extent**

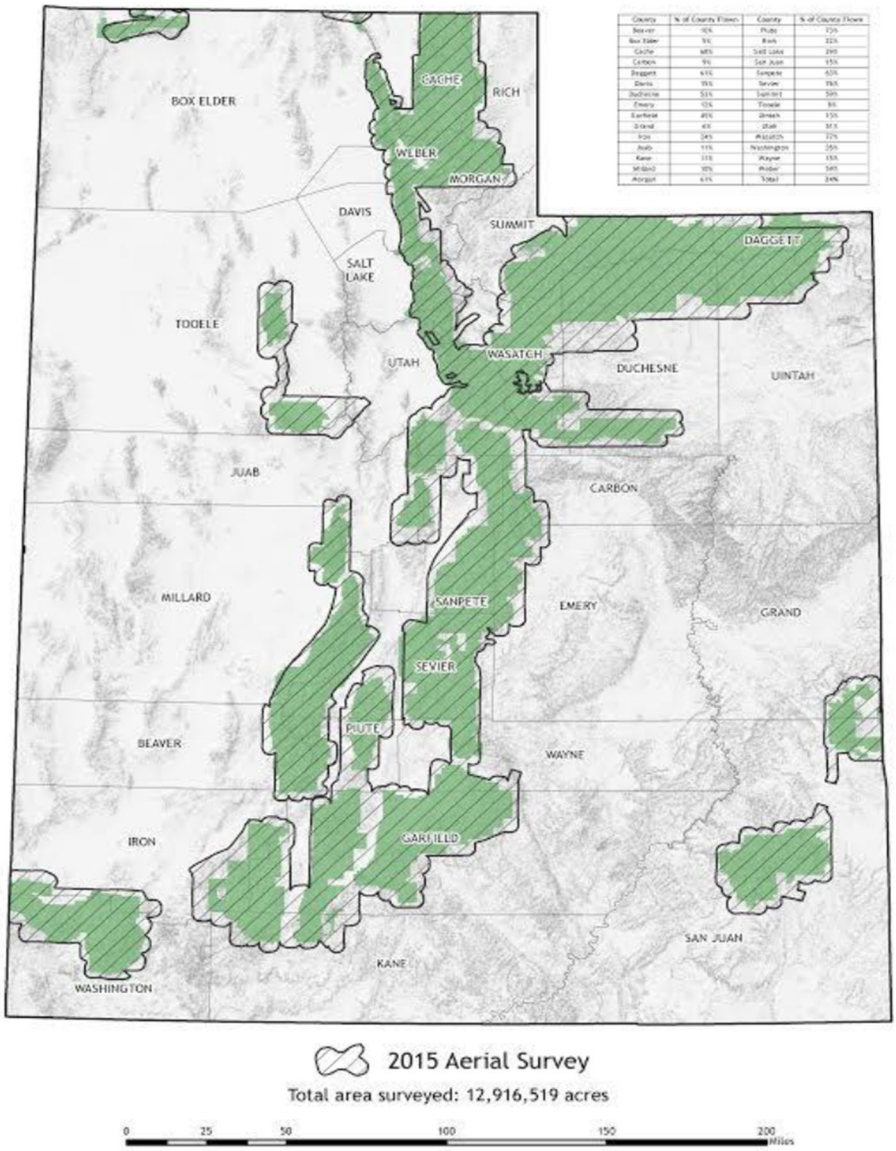
Grand County continues to experience an infestation problem of insects, disease, and noxious weeds. The unhealthy forests are conducive to insect and disease issues. Several factors contribute to the decline in forest health including: lack of active management, poor grazing patterns, fire exclusion, and invasive/noxious weeds.

**Vulnerability Assessment**

Infestation will continue to be an issue in the future because of Grand County's climate. The drought conditions, invasive weeds, insects, and species diversity are all affected by climate and will continue to be a limited problem for Grand County's forestlands and communities.

Adequate precipitation and growing space is necessary to maintain tree vigor, thereby increasing tree resistance to insects and disease. The drought conditions persistent in Grand County continues to place more stress on the forests already in poor health. The associated insect and disease issues may not be the cause of poor forest health but a result of it.

## Surveyed Areas for the 2015 Aerial Insect and Disease Detection Survey




| County | % of County Flown | County | % of County Flown |
|---|---|---|---|
| Beaver | 95% | Piute | 75% |
| Box Elder | 9% | Rich | 22% |
| Cache | 48% | Salt Lake | 29% |
| Carbon | 9% | San Juan | 15% |
| Daggett | 63% | Sanpete | 63% |
| Davis | 95% | Sevier | 78% |
| Duchesne | 51% | Summit | 59% |
| Emery | 12% | Tooele | 8% |
| Garfield | 49% | Uintah | 15% |
| Grand | 6% | Utah | 37% |
| Iron | 54% | Wasatch | 72% |
| Juab | 11% | Washington | 35% |
| Kane | 11% | Wayne | 15% |
| Millard | 30% | Weber | 54% |
| Morgan | 63% | Total | 24% |

## Natural Hazard Disaster History

Identifying past natural hazard events is key in predicting where future events are likely to occur. The following available relevant information such as date, location, area affected, and impacts are identified in the table below (Table 19). Due to the frequency and geographic extent of problem soil, and some severe weather events past events have not been recorded and are therefore not identified in the table below.

**Table 19 Natural Hazard Histories 1905-2017**

| Hazard Type | Date | Location/Area Impacted | Comment(s) |
|---|---|---|---|
| **Wild Fire** | June 28, 1905 | Bryson Wash Fire (2 Miles North Of I-70 And 3 Miles West of Utah/Colorado Border in Grand County | 855 Acres, contained on July 1, 1905 |
| **Cloudburst Storm** | August 28, 1939 | Moab City; Mill Creek | $5,000 in damage to homes, businesses and streets, serious damage to the powerhouse |
| **Flood** | August 31, 1939 | Town of Cisco; Diamond | One death |
| **Flash Flood** | July 23, 1953 | Moab City | Thousands of dollars of damage to a movie production set at Fisher |
| **Flash Flood** | August 6, 1957 | Grand County: Moab City--Mill Creek | Several thousand dollars damage to property and crops, and culinary water lines across Mill Creek |
| **Flash Flood** | August 29-30, 1957 | Moab City and Thompson | Heavy rains caused flooding along street and highways, destroying several homes. |
| **Tornado** | May 4, 1961 | Grand County | F1 tornado |
| **Flash Flood** | August 25-26, 1961 | | Thousands of dollars of damage were recorded to motels and homes. Highway 160 was blocked |
| **Flood** | June 29-30, 1962 | Moab City; Walker | Moab City park flooded |
| **Flood** | August 8, 1963 | Moab City; Mill Creek and Pack Creek | Destroyed sewer mains. Streets and roads were damaged, and several hundred acres of land were covered with silt |
| **Flood** | October 15, 1965 | Moab City; Mill Creek and Pack Creek | $1,500 damage to culverts, roads, and bridges |
| **Flood** | June 5, 1967 | Moab City; Northern Moab | Worst flood in 20 years. Destroyed homes, businesses, establishments, apartments, and streets, Thousands of dollars of damage |

| Hazard Type | Date | Location/Area Impacted | Comment(s) |
|---|---|---|---|
| **Hail** | August 14, 1968 | Grand County | 1.75 inches |
| **Flood** | August 17, 1968 | Moab City | Destroyed homes, businesses, and roads; covered in mud and water. Damage totaled about $5,000 |
| **Thunderstorm/Hi** | April 6, 1969 | | |
| **Tornado** | June 10, 1970 | Grand County | F2 Tornado |
| **Avalanche** | Winter 1970 | Grand County; Miner's | 1 building destroyed |
| **Avalanche** | Winter 1970 | Grand County | 2 deaths |
| **Flooding** | July of 1971 | Grand County—Onion | |
| **Thunderstorm/Hi** | August 30, 1971 | Grand County | |
| **Earthquake** | March 14, 1974 | Grand County; Cisco | 3.2 Richter Magnitude |
| **Hail** | June 10, 1976 | Grand County | 1.75 inches |
| **Hail** | August 30, 1986 | Grand County | 1.00 inches |
| **Avalanche** | February 1, 1991 | Grand County; Talking | 4 deaths, 6 buried |
| **Funnel Cloud** | October 7, 1993 | Moab City | |
| **Lightning** | August 16, 1995 | Moab City | 1 death, 1 injury |
| **Lightning** | September 29, 1995 | Moab City | 1 injury |
| **Lightning** | August 17, 1996 | Moab City | 1 death |
| **Flash Flood** | September 6, 1997 | Moab City | $175,000 property damage |
| **Hail** | September 20, 1997 | Crescent Junction | 1.75 inches |
| **Winter Storm** | December 7, 1997 | Grand County | 1 death, 20 injuries, $200,000 property damage |
| **Heavy Rain** | September 12, 1998 | Moab City | |
| **Winter Storm** | December 19, 1998 | Grand County | 10 injuries, $100,000 property |
| **Extreme Cold** | December 21, 1998 | Grand County | $20,000 property damage |
| **High Winds** | April 9, 1999 | Grand County | 60 kts. $2,000 property damage |
| **Lightning** | May 29, 1999 | Cisco | 1 death |
| **Wildfire** | June 20-21, 1999 | Westwater | |
| **Flash Flood** | July 8, 1999 | Moab City | |
| **Lightning** | July 14, 1999 | Crescent Junction | |
| **Flash Flood** | July 14, 1999 | Moab City | $60,000 property damage |
| **Heavy Rain** | July 27, 1999 | Moab City | $10,000 property damage |
| **Flash Flood** | July 30, 1999 | Thompson | $2,000 property damage |
| **Flash Flood** | August 11, 1999 | Moab City | |
| **Thunderstorm/Hi** | August 30, 1999 | Canyonlands | 50 kts |
| **Tornado** | April 18, 2000 | Moab City | F0 tornado, $1,000 property damage. Time: 955 MST, 38 37'N, 109 33'W |
| **High Winds** | April 18, 2000 | Grand County | 60 kts $20,000 property damage |
| **Thunderstorm/Hi** | May 24, 2000 | Moab City | 50 kts |
| **Thunderstorm/Hi** | May 25, 2000 | Canyonlands | 50 kts |
| **Wildfire** | July 4, 2000 | Cisco | |
| **Flood** | July 9, 2000 | Moab City | |

| Hazard Type | Date | Location/Area Impacted | Comment(s) |
|---|---|---|---|
| **Lightning** | July 9, 2000 | Moab City | $100,000 property damage |
| **Wildfire** | July 15, 2000 | Cisco | |
| **Lightning** | July 22, 2000 | Moab City | $2,000 property damage |
| **Wildfire** | July 24, 2000 | Westwater | |
| **Wildfire** | August 15, 2000 | Westwater | |
| **Thunderstorm/Hi** | August 20, 2000 | Canyonlands | 50 kts |
| **Tornado** | September 8, 2000 | Grand County; 18 Miles NW Of Moab. | F0 Tornado 1625 MST, 38 48'N, 109 43'W. |
| **Hail** | September 21, 2000 | Cisco | 1.00 inches $10,000 property |
| **Heavy Snow** | December 24, 2000 | Grand County | |
| **High Winds** | April 20, 2001 | Grand County | 50 kts $10,000 property damage |
| **Flood** | July 8, 2001 | Moab City | |
| **Flood** | July 9, 2001 | Moab, Canyonlands | |
| **Flash Flood** | July 10, 2001 | Moab City | |
| **Flood** | August 13, 2001 | Moab City | |
| **Winter Storm** | January 28, 2002 | Grand County | |
| **Drought** | May 1, 2002 | Grand County | |
| **Thunderstorm/Hi** | May 15, 2002 | Cisco | |
| **Drought** | June 1, 2002 | Grand County | |
| **Wildfire** | June 20, 2002 | Thompson | |
| **Wildfire** | June 22, 2002 | Thompson | |
| **Wildfire** | June 27, 2002 | Thompson | |
| **Severe Weather---Heavy Rain** | August 13, 2003 | Grand County, Millcreek, Mount Peale and La Sal Mountains | Sheriff's report; Heavy rain developed into flash flood advisory. |
| **Flash Flood** | September 6, 2003 | SR 279 Potash Highway and Long Canyon intersection | Sheriff's report; flash flood on county road way |
| **Wild Fire** | July 17, 2004 | Hay Canyon | ~200 Acres |
| **Flash Flood** | November 13, 2004 | Moab, Long Canyon | Sheriff's report; ruined road |
| **Flash Flood** | September 10, 2005 | Price, Swasey Rapid | Sheriff's report; flash flood recovered fully loaded bike with clothing etc. |
| **Wild Fire** | June 14, 2006 | Between West-Water and Cisco | ~2,847 Acres, contained on June 17, 2006 |
| **Drought** | October 1, 2006 | La Sal & Abajo Mountains | NOAA Reports |
| **Flash Flood** | October 3, 2006 | Moab | Property Damage at $40K; NOAA Reports |
| **Flash Flood** | October 5, 2006 | Moab | NOAA Reports |
| **Flood** | October 6, 2006 | Moab | Property Damage at $500K; NOAA Reports |
| **Flash Flood** | October 9, 2006 | Moab | Property Damage at $15K; NOAA Reports |

| Hazard Type | Date | Location/Area Impacted | Comment(s) |
|---|---|---|---|
| **Flash Flood** | October 10, 2006 | Moab, Chicken Corner near San Juan County | Sheriff's report; Person lost ATV during flash flood. |
| **Flash Flood** | October 14, 2006 | Moab | Property Damage at $20K; NOAA Reports |
| **Hail** | October 16, 2006 | Thompson | One-inch size hail; NOAA Reports |
| **Winter Weather** | October 17, 2006 | Tavaputs Plateau | NOAA Reports |
| **Frost/Freeze** | October 21, 2006 | Grand Flat and Arches | NOAA Reports |
| **Hail** | October 25, 2006 | Crescent Junction | One-inch size hail; NOAA Reports |
| **Winter Storm** | November 27, 2006 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Heavy Snow** | November 28, 2006 | Grand Flat and Arches | NOAA Reports |
| **Winter Weather** | December 10, 2006 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Storm** | December 18, 2006 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | December 19, 2006 | Grand Flat and Arches | NOAA Reports |
| **Winter Weather** | January 4, 2007 | Tavaputs Plateau | NOAA Reports |
| **Winter Weather--Heavy Snow** | January 12, 2007 | Tavaputs Plateau, Grand Flat and Arches, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | January 30, 2007 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | February 10, 2007 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | February 13, 2007 | Tavaputs Plateau, La Sal & Abajo Mountains, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Storm** | February 27, 2007 | La Sal & Abajo Mountains | NOAA Reports |
| **Drought** | March-December 2007 | Tavaputs Plateau, Grand Flat and Arches La Sal & Abajo Mountains | NOAA Reports |
| **Winter Storm** | March 27, 2007 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | April 8, 2007 | La Sal & Abajo Mountains | NOAA Reports |
| **Frost/Freeze** | April 11, 2007 | Grand Flat and Arches | NOAA Reports |
| **Winter Weather** | April 23, 2007 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Storm** | May 4, 2007 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | May 5, 2007 | Tavaputs Plateau | NOAA Reports |
| **Strong Wind** | June 5, 2007 | La Sal & Abajo Mountains | Winds were reported at 49kts with property damage; NOAA Reports |
| **Heavy Rain** | July 23, 2007 | Moab | NOAA Reports |
| **Flash Flood** | July 23, 2007 | Moab | Property Damage at $1K; NOAA Reports |

| Hazard Type | Date | Location/Area Impacted | Comment(s) |
|---|---|---|---|
| **Heavy Rain** | August 5, 2007 | Moab | NOAA Reports |
| **Heavy Rain** | August 5, 2007 | Moab | NOAA Reports |
| **Flash Flood** | August 28, 2007 | Moab, Delicate Arch | Sheriff's report; Wolf Ranch area flooding and NOAA Reports property damage at $1K; |
| **Flash Flood** | September 16, 2007 | Moab, Hastings Road | Sheriff's report; flooding down Hastings leaving several cars stranded on opposite side of wash. |
| **Strong Wind** | October 20, 2007 | Grand Flat and Arches | Winds at 49kts and Property Damage $1K; NOAA Reports |
| **Frost/Freeze** | October 21, 2007 | Grand Flat and Arches | NOAA Reports |
| **Winter Weather** | November 23, 2007 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Storm** | November 30, 2007 | Tavaputs Plateau | NOAA Reports |
| **Winter Storm** | December 1, 2007 | Tavaputs Plateau | NOAA Reports |
| **Winter Storm** | December 1, 2007 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Storm** | December 6, 2007 | Tavaputs Plateau | NOAA Reports |
| **Winter Storm** | December 6, 2007 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | December 10, 2007 | Tavaputs Plateau, Grand Flat and Arches, La Sal & Abajo Mountains | NOAA Reports |
| **Drought** | January –March 2008 | Tavaputs Plateau, Grand Flat and Arches, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Storm** | January 5, 2008 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | January 8, 2008 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | January 24, 2008 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | January 27, 2008 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | January 29, 2008 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | January 31, 2008 | Tavaputs Plateau | NOAA Reports |
| **Winter Weather—Heavy Snow** | February 3, 2008 | Tavaputs Plateau, Grand Flat and Arches, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Storm** | February 13, 2008 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | February 20, 2008 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | February 22, 2008 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | February 23, 2008 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | February 24, 2008 | Tavaputs Plateau | NOAA Reports |

| Hazard Type | Date | Location/Area Impacted | Comment(s) |
|---|---|---|---|
| **Winter Weather** | March 1, 2008 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | March 15, 2008 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | April 9, 2008 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Frost/Freeze** | May 2, 2008 | Grand Flat and Arches | NOAA Reports |
| **Winter Storm** | May 21, 2008 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | June 4, 2008 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Storm** | October 4, 2008 | La Sal & Abajo Mountains | NOAA Reports |
| **Frost/Freeze** | October 13, 2008 | Grand Flat and Arches | NOAA Reports |
| **Winter Weather** | November 27, 2008 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | December 7, 2008 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather Storm** | December 13-24, 2008 | Tavaputs Plateau, La Sal & Abajo Mountains Grand Flat and Arches | NOAA Reports |
| **Winter Storm** | January 23, 2009 | Tavaputs Plateau | NOAA Reports |
| **Winter Weather** | January 24, 2009 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather Storm** | February 8, 2009 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | February 13, 2009 | Tavaputs Plateau | NOAA Reports |
| **Winter Weather** | February 16, 2009 | Tavaputs Plateau | NOAA Reports |
| **Dense Fog** | February 24, 2009 | Grand Flat and Arches | NOAA Reports |
| **Winter Weather** | March 9, 2009 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | March 22, 2009 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | March 25, 2009 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Frost/Freeze** | March 26, 2009 | Grand Flat and Arches | NOAA Reports |
| **Frost/Freeze** | March 27, 2009 | Grand Flat and Arches | NOAA Reports |
| **Winter Weather** | March 29, 2009 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | March 31, 2009 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | April 1, 2009 | Tavaputs Plateau, La Sal & Abajo Mountains, Tavaputs Plateau | NOAA Reports |
| **Winter Storm** | April 2, 2009 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | April 10, 2009 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | April 11, 2009 | Tavaputs Plateau | NOAA Reports |
| **Thunderstorm Wind** | May 11, 2009 | Canyonlands Air Field | NOAA Reports |
| **Flash Flood** | May 23, 2009 | Green River; Swasey Beach | Person stranded |

| Hazard Type | Date | Location/Area Impacted | Comment(s) |
|---|---|---|---|
| **Flash Flood** | May 23, 2009 | Elgin, Moab, Potash, | Property Damage at $3K, $40K, and $70K respectively; NOAA Reports |
| **Thunderstorm Wind** | May 24, 2009 | Canyonlands Fld | Wind at 51kts; NOAA Reports |
| **Heavy Rain** | May 25, 2009 | Moab | NOAA Reports |
| **Flash Flooding** | July 25, 2009 | Castle Valley—Lot 36 | Drainage ditches plugged and minor damage, .56 inches rain in less than one hour. |
| **Drought** | August- September 2009 | Grand Flat and Arches, La Sal & Abajo Mountains | NOAA Reports |
| **Flash Food** | September 15, 2009 | Castle Valley, Placer Creek | Sheriff's office report; major flash flood at creek area. Flood damage to Buchanan, Shafer, Miller, Pope, Holy oak, upper eighty, connector road, and water and mud damage to private property. Flood water washed out Placer Creek crossing, lower culvert on the creek and connector no longer usable. Mud deposited throughout the creek flood plain, breached fence with SITLA property. |
| **High Wind** | September 30, 2009 | Grand Flat and Arches | Winds at 50kts; NOAA Reports |
| **Flash Flood/Debris Flow** | September 2009 | Placer Creek | 6-8,000 cfs |
| **Drought** | October 1, 2009 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Storm** | October 27, 2009 | Tavaputs Plateau | NOAA Reports |
| **Winter Weather** | October 27, 2009 | Grand Flat and Arches | NOAA Reports |
| **Frost/Freeze** | October 27, 2009 | Grand Flat and Arches | NOAA Reports |
| **Winter Storm** | October 27, 2009 | La Sal & Abajo Mountains | NOAA Reports |
| **Drought** | November - December 2009 | Tavaputs Plateau, Grand Flat and Arches, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | November 13, 2009 | Tavaputs Plateau | NOAA Reports |
| **Winter Weather** | November 13, 2009 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Storm** | December 7, 2009 | Tavaputs Plateau | NOAA Reports |
| **Winter Storm and Blizzard** | December 7, 2009 | Grand Flat and Arches, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Storm** | December 12, 2009 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |

| Hazard Type | Date | Location/Area Impacted | Comment(s) |
|---|---|---|---|
| **Avalanche** | December 12, 2009 | Middle Cirque | Natural Trigger, 60 feet wide, 500 feet vertical, elevation 11800 feet due to Facets |
| **Avalanche** | December 12, 2009 | Upper Horse Creek | Natural Trigger, 150 feet wide, elevation 11600 feet |
| **Dense Fog** | December 13, 2009 | Grand Flat and Arches | NOAA Reports |
| **Dense Fog** | December 18, 2009 | Grand Flat and Arches | NOAA Reports |
| **Winter Weather** | December 22, 2009 | Tavaputs Plateau, Grand Flat and Arches, La Sal & Abajo Mountains | NOAA Reports |
| **Dense Fog** | December 23, 2009 | Grand Flat and Arches | NOAA Reports |
| **Winter Weather** | December 29, 2009 | Grand Flat and Arches, La Sal & Abajo Mountains | NOAA Reports |
| **Avalanche** | December 30, 2009 | Moab region | Natural Trigger, 2 feet depth, 1000 feet vertical at elevation 11600 feet due to Facets |
| **Drought** | January-July 2010 | Tavaputs Plateau, Grand Flat and Arches, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | January 18-19, 2010 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Storm--Blizzard** | January 21, 2010 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Storm** | January 22, 2010 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | January 26, 2010 | Grand Flat and Arches | NOAA Reports |
| **Winter Weather** | January 27, 2010 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Dense Fog** | January 28, 2010 | Grand Flat and Arches | NOAA Reports |
| **Dense Fog** | January 29, 2010 | Grand Flat and Arches | NOAA Reports |
| **Dense Fog** | February 2-4, 2010 | Grand Flat and Arches | NOAA Reports |
| **Winter Weather** | February 6, 2010 | Tavaputs Plateau, Grand Flat and Arches, La Sal & Abajo Mountains | NOAA Reports |
| **Dense Fog** | February 8, 2010 | Grand Flat and Arches | NOAA Reports |
| **Avalanche** | February 12, 2010 | Observer Low Left Noriegas | Natural Trigger, 14 feet depth, 100 feet wide, 400 feet vertical, elevation 10100 feet. |
| **Dense Fog** | February 16, 2010 | Grand Flat and Arches | NOAA Reports |
| **Winter Storm** | February 19, 2010 | Tavaputs Plateau, Grand Flat and Arches, La Sal & Abajo Mountains | NOAA Reports |
| **Avalanche** | February 21, 2010 | Arrowhead Slide path and Middle Cirque | Natural Trigger, 800 feet wide, 2000 feet vertical, elevation 11200 feet; |

| Hazard Type | Date | Location/Area Impacted | Comment(s) |
|---|---|---|---|
| | | | Natural Trigger 4 feet depth, 500 feet wide 700 feet vertical, elevation 11300 feet, respectively. New snow/old snow interface. |
| **Winter Weather** | March 4, 2010 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Storm** | March 7, 2010 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | March 9, 2010 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Storm** | March 13, 2010 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Dense Fog** | March 14, 2010 | Tavaputs Plateau | NOAA Reports |
| **Dense Fog** | March 15, 2010 | Grand Flat and Arches | NOAA Reports |
| **Winter Weather** | March 18, 2010 | Tavaputs Plateau | NOAA Reports |
| **Winter Weather** | March 19, 2010 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | March 22, 2010 | Tavaputs Plateau | NOAA Reports |
| **Winter Weather** | March 31, 2010 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | April 1, 2010 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | April 2, 2010 | Tavaputs Plateau | NOAA Reports |
| **Winter Weather** | April 21, 2010 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | April 29, 2010 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | May 1, 2010 | La Sal & Abajo Mountains | NOAA Reports |
| **Earthquake** | May 31, 2010 | 19 Miles from Thompson Springs | 2.9 MAG |
| **Severe Weather--Heavy Rain** | June 13, 2010 | Moab | NOAA Reports |
| **Severe Weather--Heavy Rain** | July 26, 2010 | Castle Valley, Placer Creek drainage area | Standing water on Pope and Miller Lanes, both Placer Creek crossings became impassable with deposits of mud on private property and roads. |
| **Severe Weather--Heavy Rain and Flash Flood** | July 27, 2010 | Moab, Big Bend area | NOAA Reports and Sheriff's office report: mud a foot deep with damage to vehicles |
| **Flash Flood** | July 31, 2010 | Thompson and Moab | Sherriff's report, road washed out in Sego Canyon trapping family at day camp. Flash Flooding through Beaver Creek area from Castle Valley to Gateway |
| **Heavy Rain** | August 4, 2010 | Potash | NOAA Reports |
| **Lightning** | August 4, 2010 | Moab | Property Damage at $2K; NOAA Reports |

| Hazard Type | Date | Location/Area Impacted | Comment(s) |
|---|---|---|---|
| **Flash Flood** | August 4, 2010 | Moab | NOAA Reports |
| **Thunderstorm Wind** | August 16, 2010 | Canyonlands Fld | Wind at 53kts; NOAA Reports |
| **Flash Flood** | August 17, 2010 | Elba Station | NOAA Reports |
| **Flooding** | August 19, 2010 | Grand County; Mineral Bottom Rd And Onion | ~$100,000 and ~$125,000, respectively. Overall project ~$3 |
| **Flash Flood** | August 19, 2010 | Potash | Property Damage at 2.5M; NOAA Reports |
| **Flash Flood** | August 19, 2010 | Castle Valley, Placer Creek drainage area | Placer Creek and Miller and Pope Lanes were flooded, excessive mud deposits with impassable crossing and significant repair. NOAA Reports; |
| **Flash Flood** | September 23, 2010 | Castle Valley, Placer Creek crossings | Crossings severe damage and passable with difficulty |
| **Flash Flood** | September 28, 2010 | Castle Valley, Keogh, Taylor, Pope, and Miller Lanes | Damage to road surfaces and drainage ditches. |
| **Drought** | October 1, 2010 | Tavaputs Plateau | NOAA Reports |
| **Flash Flood** | October 7, 2010 | Castle Valley, Placer Creek drainage area | Storm water damage to road surface and dangerous to traffic/people. |
| **Flash Flood** | October 25, 2010 | Castle Valley, Placer Creek drainage area—Pope and Miller Lanes | Crossings impassable, standing water on lanes, water and mud damage to private property |
| **Winter Weather** | November 8, 2010 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | November 9, 2010 | Tavaputs Plateau | NOAA Reports |
| **Winter Weather** | November 15, 2010 | Tavaputs Plateau | NOAA Reports |
| **Winter Storm** | November 21, 2010 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Blizzard** | November 23, 2010 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | November 28, 2010 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Storm** | December 19, 2010 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Avalanche** | December 23, 2010 | Laurel Cirque | Trigger was Natural, 600 feet wide 800 feet vertical at 11600 feet elevation, Facets. |
| **Winter Storm** | December 28, 2010 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Storm** | December 29, 2010 | Tavaputs Plateau, Grand Flat and Arches | NOAA Reports |
| **Avalanche** | December 31, 2010 | Above Tree Line face Pre-Laurel Park | Trigger was Natural, 600 feet wide, 800 feet vertical at 11400 feet elevation with New Snow |
| **Winter Weather** | January 9, 2011 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | January 31, 2011 | Tavaputs Plateau | NOAA Reports |

| Hazard Type | Date | Location/Area Impacted | Comment(s) |
|---|---|---|---|
| **Winter Weather** | February 1, 2011 | Tavaputs Plateau | NOAA Reports |
| **Extreme Cold/Wind Chill** | February 1, 2011 | Tavaputs Plateau | NOAA Reports |
| **Winter Weather** | February 7, 2011 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather—Blizzard** | February 17, 2011 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Storm** | February 19, 2011 | Tavaputs Plateau | NOAA Reports |
| **Winter Weather** | February 19, 2011 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | February 24, 2011 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | February 25, 2011 | Tavaputs Plateau | NOAA Reports |
| **Winter Weather** | March 7, 2011 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Avalanche** | March 8, 2011 | Exxon's Folly, Moab region. | Trigger was Natural, New snow and Trigger was Natural, Facets, 300 feet wide 1250 feet vertical at 11400 feet elevation |
| **Avalanche** | March 9, 2011 | Moab region | Trigger was natural, 100 feet wide at 11,000 feet elevation |
| **Winter Weather** | March 17, 2011 | Tavaputs Plateau | NOAA Reports |
| **Winter Weather** | March 21, 2011 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | April 3, 2011 | Tavaputs Plateau | NOAA Reports |
| **Winter Weather** | April 9, 2011 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | April 23, 2011 | La Sal & Abajo Mountains | NOAA Reports |
| **Frost/Freeze** | April 30, 2011 | Grand Flat and Arches | NOAA Reports |
| **Winter Weather** | May 18, 2011 | La Sal & Abajo Mountains | NOAA Reports |
| **Flooding** | July 13, 2011 | Castle Valley, Placer Creek drainage area include Keogh, Taylor, Pace Lanes, and Placer Creek crossings | Water damage to drainage systems, minor damage to Placer Creek crossings. |
| **Heavy Rain** | July 18, 2011 | Moab | NOAA Reports |
| **Flash Flood** | July 20, 2011 | Castle Valley | NOAA Reports |
| **Thunderstorm Wind** | August 3, 2011 | (CNY)Canyonlands Field | Wind at 51kts; NOAA Reports |
| **Flash Flood** | August 4, 2011 | Castle Valley | NOAA Reports |
| **Severe Weather: Flash Flooding** | September 16, 2011 | Southwestern Region of County | Slow moving thunderstorm with heavy rain exceeding an inch per hour. |

| Hazard Type | Date | Location/Area Impacted | Comment(s) |
|---|---|---|---|
| **Severe Weather: Flash Flooding** | September 17, 2011 | Grand County—Castle Valley, Arches National Park, Dead Horse Point State Park, and northern area of the Canyon Lands National park, Green River and Moab Cities. | Slow moving thunderstorm with very heavy rain exceeding an inch per hour. |
| **Winter Weather** | October 6, 2011 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | November 1, 2011 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | November 5, 2011 | Tavaputs Plateau | NOAA Reports |
| **Winter Storm** | November 5, 2011 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | November 7, 2011 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | November 30, 2011 | Tavaputs Plateau | NOAA Reports |
| **Winter Weather** | December 1, 2011 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Drought** | December 1, 2011 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | December 12, 2011 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | January 21, 2012 | Tavaputs Plateau | NOAA Reports |
| **Winter Weather** | January 21, 2012 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | January 23, 2012 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | February 2, 2012 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | February 5, 2012 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | February 12, 2012 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | February 13, 2012 | Tavaputs Plateau | NOAA Reports |
| **Winter Weather** | February 19, 2012 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | February 27, 2012 | La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | February 28, 2012 | Tavaputs Plateau | NOAA Reports |
| **Drought** | March-October 2012 | Tavaputs Plateau, Grand Flat and Arches, La Sal & Abajo Mountains | NOAA Reports |
| **Winter Weather** | March 1, 2012 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Earthquake** | March 6, 2012 | 11.41 Miles from Moab | 2.7 MAG |
| **Winter Weather** | March 18, 2012 | Tavaputs Plateau, La Sal & Abajo Mountains | NOAA Reports |
| **Flash Flood** | Oct. 13, 2012 | Flooding along Salt Wash | Tourists/Vehicles Trapped |
| **Debris Flow** | Jan. 26, 2013 | HWY. 146 | Rockslide Blocking the Road |
| **Drought** | 2012/2013 | Countywide | NOAA Reports |
| **Flash Flood** | May 8, 2013 | Winter Camp Wash | Road Closed in Arches NP |

| Hazard Type | Date | Location/Area Impacted | Comment(s) |
|---|---|---|---|
| **Flash Flood** | July 2013 | Onion Creek | Grand County Road Dept. |
| **Thunderstorms** | Aug. 23, 2013 | Countywide | Winds 50+ MPH NOAA Reports |
| **Flash Flood** | Aug. 23, 2013 | Arches NP | Roads Closed covered with water and debris |
| **Flash Flood** | Aug. 24, 2013 | Salt Wash | Numerous Tourists Stranded |
| **Flash Flood** | Aug. 25, 2013 | Winter Camp Wash | Road Closed in Arches NP |
| **Flash Flood** | Sept. 10, 2013 | Arches NP | Numerous Roads Closed |
| **Flash Flood** | Sept. 13, 2013 | Spanish Valley | Road Closed, Sandbagging took place |
| **Flash Flood** | Sept. 13, 2013 | Salt Wash and Winter Camp Wash | Roads Closed in Arches NP |
| **Flash Flood** | Sept. 14, 2013 | Spanish Valley Road South of Moab | Road covered with water and debris NOAA Reports |
| **Flash Flood** | Sept. 22, 2013 | Winter Camp Wash, Salt Wash, and Salt Valley Wash | Roads Closed in Arches NP due to the flash flooding and debris clean up. NOAA reports |
| **Earthquake** | April 10, 2014 | 24.73 miles from Thompson Springs | 2.2 MAG |
| **Flash Flood** | May 11, 2014 | Arches NP | Numerous roads closed due to flooding |
| **Flash Flood** | July 30, 2014 | Wolf Ranch Road | Road Closed due to flooding, NOAA Reports |
| **Flash Flood** | July 31, 2014 | Crescent Junction | A 50 Ft section of Rail Road Track was washed out |
| **Flash Flood** | Aug. 4, 2014 | Arches NP | Delicate Arch Road Closed |
| **Flash Flood** | Aug. 13, 2014 | Winter Camp Wash, Salt Valley Wash | Roads Closed NOAA Reports |
| **Flash Flood** | Aug.13, 2014 | HWY. 292, MM 2 | Flash Flood and Debris Flow closed the road |
| **Flash Flood** | Aug.14, 2014 | HWY 128, MM 2 | Flash Flood Debris closed the road |
| **Flash Flood** | Aug. 19, 2014 | HWY 128, MM 18 | A heavy mud and flow closed the road |
| **Flash Flood** | Sept. 10, 2014 | Wolf Range Road | Closed due to flooding NOAA Reports |
| **Flash Flood** | Sept. 28, 2014 | Bitter Creek Wash | Four Feet Wall of Water, one fatality reported |
| **Flash Flood** | Sept. 29, 2014 | HWY 191 | Closed due to sand/rocks/debris |
| **Land Slide** | Nov.18, 2014 | UMTRA Site | Cliff face collapsed on to the RR tracks, suspending operation for 30 days |
| **Drought** | March-April 2015 | Countywide | Reported by NOAA |
| **Flash Flood** | June 6, 2015 | White Wash Sand Dunes | Road Closed, 20 Campers Stranded |
| **Flash Flood** | June 6, 2015 | Salt Wash | Roads closed due to fast moving water |
| **Flash Flood** | June 11, 2015 | HWY. 128 MM 29 | Road closed due to water and debris |

| Hazard Type | Date | Location/Area Impacted | Comment(s) |
|---|---|---|---|
| **Flash Flood** | June 11, 2015 | Potash Road and HWY. 279 | Road closed due to flash Flooding |
| **Flash Flood** | Aug. 31, 2015 | Arches NP | Flash Flooding traps numerous campers |
| **Problem Soils** | Sept. 14, 2015 | City of Moab | Sinkhole developed, and 1 home condemned Reported by Grand County Building Inspector |
| **Flash Flood** | Oct. 19, 2015 | Arches NP | Delicate Arch Road closed |
| **Winter Storm** | Jan. 31, 2016 | Countywide, Lower Elevation | Disrupted Travel NOAA Reports |
| **Winter Storm** | Feb.1, 2016 | Countywide, Lower Elevation | Disrupted Travel NOAA Reports |
| **Flash Flood** | Aug.3, 2016 | Town of Castle Valley | Road damage due to Flash Flood |
| **Flash Flood** | July 2017 | Boulder/Jackson Street | Hwy 191 flooded Reported by Grand County Road dept. |
| **Flash Flood** | Aug. 4, 2017 | E645698 N4353839 | DEQ Reports 6 Gas Wells had pipelines and tanks washed away |
| **Drought** | Jan 17, 2018 | Grand County | Drought Declaration 2018-3130 |

## Grand County Mitigation Strategies, Objectives and Projects

Note: For purposes of this document, "countywide" refers to a mitigation strategy that benefits the cities, towns and communities of: Thompson Springs, Cisco, Castle Valley and Moab City.

Certified Emergency Service Personnel for Grand County and Moab City include Grand County Sheriffs, Moab City Police, EMS, Building Inspectors, and the Moab Valley Fire Department.

For mitigation and action plans, the following ordinances and plans were referenced:

- Grand County Title 13 Storm Water & Flood Control Ordinances
  13.12.010 to 13.12.060
- Grand County Ordinance 526: Flood Damage Prevention Ordinance Adopted 9/14
- The Grand County Land Use Code, specifically Articles 4, 5, & 6, as amended to date.
- City of Moab Zoning Code 17.33 Floodway Zone Updated 11/17
- City of Moab Storm Water Master Plan
- The FIRM Flood Map for Moab City Panel 2 of 2.
- Grand County Emergency Operations Plan, as amended to date

- Grand County Storm Drain Master Plan
- Moab Valley Wildfire Mitigation Plan as amended to date.
- Utah Code 65A-8-203 Cooperative Wildland Fire Fighting Agreement 2017
- International Building Codes as adopted.
- Castle Valley 2015 Pre-Disaster Mitigation Plan
- Utah Division of Natural Resources Utah Wildfire Risk Assessment Portal
- Utah Division of Emergency Management Earthquake and 100 Year Flood HAZUS Analysis
- University of Utah Seismograph Station Data
- NOAA Weather Historical Weather Data

Goal Priority for mitigation actions are: High, Medium, or Low. It is possible that economic, environmental, and even political relations may cause conditions to this type of priority system to change. As such, goal priorities are only used to understand that ensuring the project is completed is of greater urgency than others. For these purposes, Objective is a general statement of the project(s) to be completed, and the Action is the specific mitigation project. The prioritization high, medium, low for each goal and associated action project was established based on the perceived need, ability to support the action project, and cost of the action project. The Grand County Working Group, Subject Matter Experts (SMEs), and the Grand County Emergency Manager finalized the priority of each action project.

High: Priority goal and project to complete.
The project can be supported.
A portion of the funding is obtainable.
Medium: Would like to complete goal and project.
The project can be supported.
The funding is questionable.
Low: Nice to complete the goal and project.
May be able to support the project.
Funding may not be available.

## Flood

| | |
|---|---|
| Goal 1: | Priority High |

| | |
|---|---|
| Objective 1: FL1 | To mitigate the effects of hillside floods and to improve storm drainage conveyance throughout the City of Moab. |

| | | |
|---|---|---|
| Action projects: FL1. | Several projects included: Moab area canyon projects including Stewart Canyon, Johnson Canyon, Tusher Canyon, and Walker Canyon. Moab southwest hillside drainage projects. Dam and check dam projects. Storm drainage improvement projects. | |
| | Time Frame: | 2018-2023 |
| | Funding: | Federal funds from FEMA., Transportation Enhancement and others, State hazard Mitigation funds, Utah Department of Transportation and City funds |
| | Estimated Cost: | $7,000,000 |
| | Staff: | Contracted work with some in-kind help |
| | Background | Much of the City of Moab is in the 100 and 500-year floodplains due to creek and hillside flooding. Damage to Moab properties frequently occurs from hillside flooding because the flows are not adequately attenuated nor properly conveyed to a safe area of discharge. The City, County, and Federal Government have built dams in an attempt to mitigate damage. Tusher Canyon and Walker Canyon now have detention ponds. However, there are needs for more hillside flooding mitigation in other areas especially in Stewart Canyon and Johnson Canyon. Additional areas of concern exist north of Stewart Canyon along the highway. In these areas, large flows are concentrated and released mostly unimpeded into populated areas. In order to best address these flows, storm drainage conveyance is necessary to safely convey these flows to an area where they can be discharged safely. |

| | |
|---|---|
| Goal 2 | Priority: High |

| | | |
|---|---|---|
| Objective 1: FL2 | Continue to support and update the Grand County Storm Drain Master Plan. | |
| Action project: FL2 | Review and revise the Storm Drain Master Plan as development warrants. | |
| | Location: | Countywide |
| | Time Frame: | Ongoing |
| | Funding: | Local |

| | | |
|---|---|---|
| | Estimated Cost: | $120,000 |
| | Staff: | County Staff, Private Contractors |
| | Background | The Storm Drain Master Plan protects the County from flood losses. The Plan also contains identified storm water basins and other structural control projects. |

**Countywide Problem Identification:** The continued development in the county has caused a need to continually re-evaluate the system and update the Storm Water Management Plan to effectively manage storm water. Development also directly impacts the historical drainage ways with culverts, roads, and structures.

| | |
|---|---|
| Goal 3 | Priority: High |

| | | |
|---|---|---|
| Objective 1: FL3 | Encourage 100% Participation in the National Flood Insurance Program (NFIP) | |
| Action project: FL3 | Assist Unincorporated Areas of Grand County to participate in the NFIP by **c**reating outreach documents promoting flood insurance and include educational materials in local newspaper(s), on the county social media sites, libraries, and in other public buildings. | |
| | Location: | Unincorporated Portions of Grand County |
| | Time Frame: | 2018-2020 |
| | Funding: | Local |
| | Estimated Cost: | 8,000.00 |
| | Staff: | County Emergency Manager, County Engineer, State Flood Plain Manager |
| | Background | Special Flood Hazard Areas have been identified by FEMA in the Unincorporated areas of the County. |

**Countywide Problem Identification:** Participation in the Nation Flood Insurance Program is available but underutilized by eligible participants residing in the identified flood plains.

| | | |
|---|---|---|
| Objective 4: FL4 | Support updating of flood hazard data | |
| Action project: FL4 | Support and encourage Grand County to develop a Pack Creek flood map modification program. | |
| | Time Frame: | Ongoing |
| | Funding: | Federal |
| | Estimated Cost: | Unknown |
| | Staff: | County Engineer and State Floodplain Manager |
| | Background | Accurate flood maps assist the County in the administration of the pack creek flood way and better reflects flood risk within the County. County shall continue to regulate construction within the Pack Creek flood way. Ninety five percent of the population in the County is exposed to Pack Creek flood area to include Moab City. To have this project accomplished this would protect the majority of Grand County population. |

*Countywide Problem Identification:* Moab City's Water Reclamation Facility (WRF) serves all the City of Moab, Grand County in Spanish Valley, and potentially San Juan County within Spanish Valley. The plant is in the Colorado River floodplain and has several components that are below the Base Flood Elevation.

| | |
|---|---|
| Goal 2: | Priority High |

| | | |
|---|---|---|
| Objective 1: FL5 | Mitigation to protect Moab City's WRF from floodwaters of the Colorado River. | |
| Action project: FL5 | Provide berms, pumps, and/or the rising of component walls to prevent floodwaters from Colorado River from inundating Moab City's WRF. | |
| | Time Frame: | On-Going |
| | Funding: | Funding sources may include FEMA or other mitigation grants, local funding from Moab City or Grand Water and Sewer, or state department of water quality. |
| | Estimated Cost: | $14,000,000 |

| | | |
|---|---|---|
| | Staff: | Contracted work design and construction of flood control features. |
| | Background | Moab City's WRF is located within the 100-year floodplain for the Colorado River. Based on the current configuration, the elevations of several of the plant's components are below the river's base flood elevation. A berm was placed around the plant in 1996, but it is not sufficiently tall to prevent the inflow of floodwater onto the facility. The plant serves a current population of over 10,000 residents including all the City of Moab, Grand County in Spanish Valley. In addition to the residents, a couple million visitors come to the area every year. This WRF is the only public treatment plant in Grand County. A major flood event would cause contamination of the river as well as rendering the WRF temporarily inoperable and potentially causing considerable damage to the facility. |

*Countywide Problem Identification:* Grand County initiates projects through the Community Impact Fund Board (CIB) for capital improvements. The following projects are those that mitigate flooding problems in the county and unincorporated areas. These projects are from the Permanent CIB list and are for the terms 2013- 2018 and 2018-2023.

| | |
|---|---|
| Goal 3: | Priority Medium |

| | | |
|---|---|---|
| Objective 1: FL6 | To continue updating and improving drainage in the Grand County area. | |
| Action project: FL6 | Grand County Storm Drain Master Plan's A, B, C, D, E, & F Priorities. A: Lulu Lane to Arbor Drive, Storm Drain B: Arbor drive to Pack Creek, Storm Drain C: Murphy Lane Southeast of Arbor Drive, Install Culvert D: Kayenta Drive near North Kayenta Drive, Install Culvert E: Marshall Lane and Muncie Drive, Storm Drain F: Murphy Lane to Pack Creek, Storm Drain | |
| | Time Frame: | On-Going |
| | Funding: | CIB; and other sources Local, SID/SSD, other Grants, Utility Fees, and Impact Fees. |
| | Estimated Cost: | $20,000,000 (50% split between Grant and Loan) |
| | Staff: | County and Contracted |

| | | |
|---|---|---|
| | Background | The mitigation projects supporting the Grand County Storm Drain Master Plan are completed as funding becomes available. |

| | | |
|---|---|---|
| Objective 2: FL7 | To continue water system improvement with the expansion of growth in the Spanish Valley area of Grand County. | |
| Action project: FL7 | Spanish Valley Water and Sewer Main Line Upgrade. | |
| | Time Frame: | 2018-2020 |
| | Funding: | CIB; and other sources Local sources, SID/SSD, other Grants, Utility Fees, and Impact Fees. |
| | Estimated Cost: | $5,000,000 ($1 million from local and $4 million from CIB fund loan) |
| | Staff: | Contracted |
| | Background | The is project is being completed in sections |

| | | |
|---|---|---|
| Objective 3: FL8 | To develop a water source for the Thompson SSD. | |
| Action project: FL8 | Develop Culinary Water Source | |
| | Time Frame: | On-Going |
| | Funding: | CIB |
| | Estimated Cost: | $286,000 (CIB Grant) |
| | Staff: | County and Contracted |
| | Background | Grand County is exploring developing additional springs as water sources. |

| | | |
|---|---|---|
| Objective 4: FL9 | Moab City continuously improves and updates storm water drainage due to developmental changes and mitigation to flood prone areas. | |
| Action project: FL9 | Hwy 191 Gateway Plan/Storm Water Drainage Improvements | |
| | Time Frame: | On-Going |
| | Funding: | CIB grant/loan, Local, other sources |
| | Estimated Cost: | $4,000,000 (CIB Grant/ Loan 50% split of $600,000) |
| | Staff: | County and Contracted |
| | Background | This is an on-going project with UDOT as the primary and the City of Moab as a vested partner. |
| Objective 5: FL10 | The City of Moab and Grand County are working to improve the drainage from flood waters in the Jackson Street area. | |

| | | |
|---|---|---|
| Action project: FL10 | Jackson Street Storm Drainage Mitigation Project | |
| | Time Frame: | 2018-2019 |
| | Funding: | CIB grant/loan, Local, and DWQ sources |
| | Estimated Cost: | $484,000 |
| | Staff: | City, County, and Contracted |
| | Background | Storm waters have flooded residences, commercial property, and covered Highway 191 with debris flows. |

| | | |
|---|---|---|
| Objective 6: FL11 | Castle Valley to Mitigate flood damage to Castle Valley Drive | |
| Action project: FL11 | Replace the culvert where Castle Creek flows under Castle Valley Road Drive with a double box culvert. | |
| | Location | Castle Valley Drive |
| | Time Frame: | 2019-2021 |
| | Funding: | Type of Funding (Federal, State, Local, Private, Combination) |
| | Estimated Cost: | $500,000 |
| | Staff: | Castle Valley Road Department |
| | Background | Castle Valley Road, the primary egress and access for the Town of Castle Valley, is prone to flooding where Castle Creek flows under Castle Valley Road. |

## Wildland Fire

| | |
|---|---|
| Goal 1 | Priority: High |

| | | |
|---|---|---|
| Objective 1: WF1 | Mitigate the impact of wildfire damage along Pack Creek and Mill Creek. | |
| Action project: WF 1 | Remove ladder fuels and create defensible space along the creek bank. | |
| | Location: | Pack Creek in Grand County and the City of Moab |
| | Time Frame: | 2018-2023 |
| | Funding: | State of Utah Fire Grant |
| | Estimated Cost: | $22,500 per year over the 5 years |

| | | |
|---|---|---|
| | Staff: | Moab Valley Fire Dept. and the Civilian Conservation Corp |
| | Background | The buildup of ladder fuels and grasses along the creek bank have created a fire danger. One fire has occurred along Pack Creek in 2018 destroying 8 homes. |
| Objective 1: WF 2 | Mitigate the impact of wildfire damage along Mill Creek | |
| Action project: WF 2 | Remove ladder fuels, invasive species, grasses and create defensible space along the Mill Creek bank. | |
| | Location: | Mill Creek in Grand County and City of Moab |
| | Time Frame: | 2018-2023 |
| | Funding: | State of Utah Fire Grant |
| | Estimated Cost: | $22,500 |
| | Staff: | Moab Valley Fire Department and the Civilian Conservation Corp |
| | Background | The buildup of ladder fuels and invasive species along Mill Creek has created a fire danger. |
| Objective 2: WF 3 | Create defensible space along Grand County Roads | |
| Action project: WF 3 | Clear a 15-foot space along each side of the road by extending the normal mowing pattern too create a defensible space and fire break. | |
| | Location: | Grand County Roads |
| | Time Frame: | 2018-2023 On-going |
| | Funding: | Local Funding |
| | Estimated Cost: | $25,000 per year |
| | Staff: | Grand County Road Department |
| | Background | The growth of grasses along the county roads has increased the probability of a fire encroaching and going over the county roads. |
| Objective 3: WF 4 | Create defensible space along all the roads in Castle Valley. | |
| Action project: WF 4 | Clear a 15-foot space on both sides of the roads in Castle Valley by extending the normal mowing pattern to create a defensible space and fire break. | |
| | Location: | Castle Valley Roads |
| | Time Frame: | 2018-2023 On-going |
| | Funding: | Local Funding |
| | Estimated Cost: | $5,000 per year |
| | Staff: | Castle Valley Road Dept. and the Castle Valley Fire Department |

| | | |
|---|---|---|
| | Background | The growth of weeds along the roads in Castle Valley have created a fire hazard. |

| | | |
|---|---|---|
| Objective 4: WF 5 | Mitigate wildfire damage to homes built in the Urban Interface by educating home owners about defensible space | |
| Action project: WF 5 | Provide Fire Wise brochures with the building permit applications for homes in the Urban Interface, provide them at community meetings and preparedness fairs. | |
| | Location: | Countywide: Grand County, Moab, Castle Valley |
| | Time Frame: | 2018-2023 |
| | Funding: | Local, State, Federal |
| | Estimated Cost: | $5,000 Per Year |
| | Staff: | County Building Department, County Emergency management, Moab valley Fire Department, State Forestry, Fire, and State Lands, US Forest Service |
| | Background | No educational material has been made available to home owners located in the Urban Interface |

## Severe Weather

| | |
|---|---|
| Goal 1 | Priority: High |

| | | |
|---|---|---|
| Objective 1: SW 1 | Prepare the County for adverse weather | |
| Action project: SW 1 | Continue to participate in the Storm Ready Program | |
| | Location: | Countywide |
| | Time Frame: | 2018-2023 |
| | Funding: | Local, State, and Federal |
| | Estimated Cost: | <10,000.00 |
| | Staff: | County Emergency Manager |
| | Background | The County participates in the National Weather Service Storm Ready Program. |

**Countywide Problem Identification:** Snowstorms, summer thunderstorms, hail, and high winds over southeastern Utah have a dramatic effect on regional commerce, transportation, and daily activity and are a major forecast challenge for local meteorologists.

| | |
|---|---|
| Goal 2 | Priority: High |

| | | |
|---|---|---|
| Objective 1:2 SW | Reduce the number of avalanche deaths and injuries | |
| Action project: SW 2 | Provide avalanche awareness education materials and encourage avalanche preparedness for county backcountry users in the northeastern portion of the County. | |
| | Location: | Mountainous area of Grand County |
| | Time Frame: | 2018-2023 |
| | Funding: | State and Local |
| | Estimated Cost: | 10,000.00 |
| | Staff: | County Emergency Management, Utah Avalanche Forecast Center |
| | Background | There have been 2 skiers killed and several skiers and snowmobile riders injured by avalanches. |

**Countywide Problem Identification:** While the avalanche terrain is primarily on US Forest Service or BLM land the recovery of bodies or the search and rescue for the injured or lost individual are coordinated by the emergency manager with search parties comprised of county search and rescue personnel.

## Landslide

| | |
|---|---|
| Goal 1 | Priority: Medium |

| | | |
|---|---|---|
| Objective 1:LS | Reduce the potential risk for commercial and residential structures identified by SECAOG GIS as located in landslide risk areas. | |
| Action project: LS 1 | Assess the probability of landslides and identify specific structures at risk through soil surveys and engineering studies. | |
| | Location: | Countywide |

| | | |
|---|---|---|
| | Time Frame: | 2018-2023 |
| | Funding: | Local, state, federal, private |
| | Estimated Cost: | 105,000.00 |
| | Staff: | Public Works, County Engineering, Private Contractors |
| | Background | Landslides have occurred and will continue to occur. |

**Countywide Problem Identification:** The County has experienced landslides that have affected County infrastructure and structures throughout the County.

## Problem Soils

| | |
|---|---|
| Goal 1: | Priority: Low |

| | | |
|---|---|---|
| Objective 1: PS | To protect resources: existing structures and new construction. | |
| Action project: PS1 | Identify problem soil areas, monitor and use water conservation efforts to mitigate shrinking/swelling of soils around structures. | |
| | Time Frame: | Ongoing |
| | Funding: | County and City |
| | Estimated Cost: | Minimal |
| | Staff: | Building Inspectors, business owners, and residents |
| | Background | Using existing building codes, property is inspected and structures throughout new construction efforts. Current building codes are adhered to for safe construction. Business owners and residents become aware of problem soils by means of meeting building codes standards in new construction.<br>Existing structures and maintenance are acknowledged by owners when problems occur usually by excessive water around structures. |

**Countywide Problem Identification:** Continuing use of existing building codes and inspections will continue to shed light on possible soil issues that exist.

## Earthquake

| Goal 1 | Priority: Low |
|---|---|

| | | |
|---|---|---|
| Objective 1: EQ | Prepare an effective mitigation program for protecting transportation and utility services in the event of an earthquake | |
| Action project: EQ 1 | Identify critical transportation and utility services that will be impacted referring to the State of Utah HAZUS report | |
| | Location: | Countywide |
| | Time Frame: | 2018-2020 |
| | Funding: | Local |
| | Estimated Cost: | < 5,000.00 |
| | Staff: | County Emergency Manager |
| | Background | Critical transportation, utility systems, and communication systems need to be maintained in the event of an earthquake. |

**Countywide Problem Identification:** The identification of critical transportation, utility, and communication systems within the County will provide the basis to develop a mitigation program to maintain their operations during an earthquake.

## Drought

| Goal 1 | Priority: High |
|---|---|

| | | |
|---|---|---|
| Objective 1:D | Encourage conservation of culinary water. | |
| Action project: D1 | Distribute educational material to the public to practice being water wise, post on the county and city social media sites. | |
| | Location: | Countywide: Grand County, Moab, Castle Valley |
| | Time Frame: | On going |
| | Funding: | State and Local |
| | Estimated Cost: | < 5,000 per year |

| | | |
|---|---|---|
| | Staff: | County Water Department, County Public Works, County News Letter Editor |
| | Background | The County is in an arid region. A Drought Disaster has been declared for 2018. |

**Countywide Problem Identification**: Cyclical periods of drought place a strain on community culinary and irrigation water resources.

| | |
|---|---|
| Goal 2 | Priority: Medium |

| | | |
|---|---|---|
| Objective 1:2D | Meet current and future community water requirements | |
| Action project: D2 | Development of new water sources encourage the use of gray water as modern technology comes on line and develop new storage capability. | |
| | Location: | County wide |
| | Time Frame: | 2018-2023 |
| | Funding: | Local, State, Federal |
| | Estimated Cost: | 10,000,000 |
| | Staff: | Public works, County Engineer, Private Contractors, State Water Board |
| | Background | To meet the needs of the community's residential and businesses water users, vigilance in locating new water sources as well as studying new technology for water reuse to meet future requirements is a must. |

**Countywide Problem Identification:** Cyclical periods of drought place a strain on availability of community culinary water. The projected future growth of the County will further stress the ability to provide sufficient culinary water.

# Appendix 1

# Plan Maintenance, Evaluation, and Implementation

## Monitoring, Evaluating, and Updating the Plan

Periodic monitoring and updates to this Plan are required to ensure the goals and objectives for the Grand County Pre-Disaster Mitigation Plan 2018 are kept current and the mitigation strategies are being carried out. This Plan has been designed to be user-friendly in terms of maintenance and implementation. This portion of the plan outlines the procedures for completing such revisions and updates. The Plan will also be revised to reflect lessons learned or to address specific hazard incidents arising out of a disaster.

The Grand County LEPC meets quarterly to review emergency management efforts within the county. This meeting is open to the public and attended by County and City governmental officials, local businesses, EMS, hospitals, fire departments, and local citizens. To keep the Grand County Pre-Disaster Mitigation Plan 2018 up-to date the LEPC will conduct an annual review to discuss the incorporation of new hazards, mitigations, or other data into the Plan.

## Annual Review Procedures

Grand County will annually review the mitigation strategies described in this plan or as situations dictate, such as following a disaster declaration. The process will include Grand County Emergency Manager organizing a Pre-Disaster Hazard Mitigation Planning Working Group comprised of individuals from organizations responsible for implementing the described mitigation strategies. Progress towards the completion of the strategies will be assessed and revised as warranted. The Grand County Emergency Manager will regularly monitor the Plan and is responsible for making revisions and updates.

## Five Year Plan Review

The entire Plan including, background studies and analysis shall be revised and updated every five years by the participating jurisdictions to determine if there have been any significant changes in the County that would affect the Plan.

Increased development, increased exposure to certain hazards, the development of new mitigation capabilities or techniques, and changes to State or Federal legislation are examples of changes that may affect the applicability of the Plan.

The Grand County Pre-Disaster Hazard Mitigation Working Group will be reconstituted for the Five-Year Review/Update Process. Typically, the same process that was used to create the original Plan will be used to prepare the update.

If the participating jurisdictions or the Utah Division of Emergency Management determine the recommendations require modifications, an amendment may be initiated as described below.

## Plan Amendments

The State of Utah Division of Emergency Management Hazard Mitigation Officer, members of the Local Hazard Mitigation Working Group, County Emergency Manager, or County Council Members/Mayor/City Manager of an affected jurisdiction may initiate amendments and updates to the Plan.

Upon initiation of an amendment to the Plan, the Grand County Emergency Manager will forward information on the proposed amendment to all interested parties including, but not limited to, all affected county and city departments, residents and businesses. Depending on the magnitude of the amendment, the full Hazard Mitigation Planning Working Group may be reconstituted.

At a minimum the information will be made available through a public notice in a newspaper of general distribution within the county providing a comment period of no less than forty-five days.

At the end of the comment period, the proposed amendment and all review comments will be forwarded to participating jurisdictions for consideration. If no comments are received from the reviewing parties within the specified review period, such will be noted accordingly. The Utah Division of Emergency Management will review the proposed amendment along with comments received from other parties and submit a recommendation to FEMA within sixty days.

In determining to recommend approval or denial of a Plan amendment request, the following factors will be considered:

1. There are errors or omissions made in the identification of issues or needs during the preparation of the Plan
2. Contemporary issues or needs have been identified which were not adequately addressed in the Plan
3. There has been a change in information, data, or assumptions from those which the Plan was based
4. The nature or magnitude of the risks have changed
5. There are implementation problems such as technical, political, legal, or coordination with other agencies

Upon receiving the recommendation from the Utah Division of Emergency Management, a public hearing will be held by the Grand County Emergency Manager. The Division of Emergency Management will review the recommendation (including the factors listed above) any oral or written comments received at the public hearing. Following the review, the Division of Emergency Management will take one of the following actions:

1. Adopt the proposed Amendment as presented
2. Adopt the proposed Amendment with modifications
3. Defer the Amendment request for further consideration and/or hearings
4. Reject the Amendment request

## Implementation Through Existing Programs

Once the Plan has been promulgated, participating cities and the County will be able to include this Plan's information in existing programs and plans. These could include the General or Master Plan, Capital Improvements Plan, Emergency Operations Plan, State, County, and/or City Mitigation Plans. Many of the mitigation actions developed by the cities and county have mitigation elements of other programs such as the National Flood Insurance Program, the Utah Wildland-Interface Code, the Building Code Effectiveness Grading System, and the Community Rating System.

## Process

It will the responsibility of the participating jurisdiction's political body to ensure that these mitigation projects are carried out no later than the target dates unless reasonable circumstances prevent their implementation. (i.e. Lack of funding)

## Funding Sources

Although all mitigation techniques will likely save money by avoiding future losses, projects may be costly to implement. The County and participating jurisdiction will continue to seek funding sources to assist funding the completion of mitigation projects. This portion of the Plan identifies primary Federal and State Grant Programs, local and non-governmental funding sources.

## Federal Programs

The following Federal Grant Programs have been identified as funding sources which specifically target hazard mitigation projects:

The Pre-Disaster Hazard Mitigation Program administered by FEMA. The program provides funding to States, Counties, and Cities for cost effective hazard mitigation activities that complement a comprehensive mitigation program that reduces loss of life, reduces injuries, or damage to property.

The funding is based on a 75% Federal Share and a 25% Non-Federal Share. The Non-Federal Share may be in the form of cash or in-kind or a combination. The following maybe eligible mitigation activities:

1. Pre-Disaster Mitigation Planning
2. Technical Assistance (i.e. risk assessments, project development)
3. Mitigation Projects
4. Acquisition or relocation of vulnerable properties
5. Hazard Retrofits
6. Minor structural hazard control or protection projects
7. Community outreach and education

The Flood Mitigation Assistance Program is provided by FEMA and administered by the State. The program provides funds to reduce or eliminate the risks of long term flood damage to structures insurable under the National Flood Insurance Program. The funding is available for mitigation planning and the implementation of mitigation measures only. The funding levels are a 75% Federal Share and 25% Non-Federal Share.

### State Grant Programs

### Local Funding

Local government depends on property taxes as a primary source of revenue. These taxes are typically used to finance services that must be available and delivered on a routine, regular basis to the public. If local budgets permit these funds may be used as matching funds for State and Federal Grants.

### Non-Governmental Funding

Another potential source of funding for implementing mitigation projects are monetary contributions from private sector companies, faith-based organizations, charities, or other non-profit organizations.

# Grand County Pre-Disaster Hazard Mitigation Plan 2018

## Appendix 2

## Grand County PDM Planning Process

### Integrating the 2018 Grand County Pre-Disaster Natural Hazards Mitigation Plan into other County, City, and Town Plans

The most direct application for local jurisdictions is to create or update a natural hazards zone or overlay in the local General Plans, zoning, and land use ordinances. Regulating land uses in natural hazard areas can effectively reduce losses of life and property. Communities should be updating their General Plan about every five years at a minimum anyway. This regular update process is a great opportunity for communities to review their sections of the Grand County Pre-Disaster Natural Hazards Mitigation Plan 2018, identify risks documented in the plan, and to update their local General Plan, zoning, and ordinances accordingly.

The responsibility and authority to regulate development in natural hazard areas lies with the County, City, or Town. The State of Utah does not regulate most development, and while the Utah Geological Survey and others offer assistance to Counties/communities, they do not have authority to regulate. Public health, safety, and welfare can be protected most effectively as communities exercise the authority given them and use the resources available to them to plan development responsibly near hazard areas.

Local emergency management officials train for emergency response to all types of natural hazards. This plan can serve as a reference to them providing historical hazard events, points of contact, general geographic locations of hazards, and potential losses per jurisdiction per hazard. Also, continued involvement in several follow-up Pre-Disaster Mitigation planning meetings will provide useful forums for discussion and collaboration among various organizations and levels of government.

Public Works and Roads Departments can also implement the information from this plan. As communities view the natural hazards data and mapping in this plan, they can accordingly identify where infrastructure could be damaged in the event of a natural disaster or where weak sections are in the various systems. Data sets for the various hazards identified in this plan are continually being updated and refined. The Utah Geological Survey and others can provide zoning and ordinance assistance for geological hazard areas and can provide the most up-to-date data and mapping.

As far as Flood Mitigation Plans, those communities that do have a plan can update it referencing the data and statistics in this plan. Potential losses and the general number of structures in FEMA floodplains can be very beneficial in those plan updates. However, the best resource for updating floodplain planning efforts is the Utah Division of

Emergency Management. The State Floodplain Manager has the necessary training and resources to assist communities in this respect. Likewise, for wildfire protection, the Utah Division of Forestry, Fire, and State Lands can aid communities which can help them become eligible for funding. The cooperative and collaborative development of the Community Wildfire Preparedness Plans and the Pre-Disaster Natural Hazard Mitigation Plans enhances the community's preparedness for all-natural hazards. For general pre-disaster mitigation funding and project assistance, the Utah Division of Emergency Management hazard mitigation planning staff can provide the most up-to-date knowledge and experience.

Perhaps the most direct way communities in Grand County can implement this plan into current planning mechanisms is by completing the mitigation strategies for their respective community found in this plan. These strategies were written by the Grand County Working Group comprised of representatives from throughout the county to find ways to decrease potential losses to life and property. As communities strive to improve natural hazards planning within their jurisdictional boundaries, they will more effectively protect the public's health, safety, and welfare by implementing these mitigation strategies.

## Grand County 2018 Pre-Disaster Natural Hazard Mitigation Planning Process Overview

The Grand County 2018 Pre-Disaster Natural Hazard Mitigation Plan update began after a Request for Proposal and a bid award with the selection of Scott Mabe LLC, a Disabled Veteran Small Business, as the contractor to work with and assist Grand County with updating the Grand County 2013 Pre-Disaster Natural Hazard Mitigation Plan. The contractor hired Ron Mosher of Ron Mosher Consulting, a sole proprietorship, to assist the contractor with the task.

The Kick-Off Meeting was held on 6/27/2016 chaired by the Grand County Emergency Manager, Rick Bailey and the San Juan County Emergency Manager, Kelly Pehrson, attended by Tammy Gallegos, Deputy San Juan County Emergency Manager, Angelia Crowther, State of Utah Division of Emergency Management Southeastern Utah Liaison, Scott Mabe, Lead Contractor, and Ron Mosher, Contractor. The purpose of the meeting was to brainstorm the composite of the 2018 PDM Working Groups for Grand County and San Juan County. A tentative meeting schedule was discussed for each county. The roles and responsibilities of the contractor and the county were discussed and agreed upon.

As a result of this Kick-Off Meeting the Grand County 2018 Pre-Disaster Natura Hazard Mitigation Plan Working Group and Grand County Core Planning Team were identified. The invitations to participate in and attend the first Grand County 2018 Pre-Disaster

Natural Hazard Mitigation Plan Working Group were sent by the Grand County Sheriff. The diversity of local, state, bordering state, and federal jurisdictions represented within the Grand County Working Group are reflected in the invited participant list.

**Pre Disaster Mitigation Working Group**

| NAME | POSITION | DEPARTMENT OR COMPANY |
|---|---|---|
| AJ Rogers | Chairman | Thompson Valley Special Service Dist. |
| Amy Weiser | Director | Moab City Community Services |
| Andrew Martsolf | Emergency Manager | Mesa County, Colorado |
| Andy Smith | EMS Manager | Grand County |
| Angelia Crowther | Liasion | Utah Division of Emergency Management |
| Art Wollenweber | Executive Director | Grand Water and Sewer District |
| Bill Hulse | Building Inspector | Grand County Building Department |
| Bill Jackson | Road Super indent | Grand County |
| Bryan Torgerson | Area Manager | SITLA |
| Chris Baird | County Council | Grand County Council |
| Cody Greaves | Fire Warden | Grand County - State of Utah |
| Craig Shumway | Sgt. | Moab City Police Department |
| Dana Horn | Office Manager | Grand Water and Sewer District |
| Darci D. Miller | RN/ER | Moab Regional Hospital |
| Dave Dillman | Engineer | Horricks Engineers |
| Dave Sakrision | Mayor | Moab City |
| David Early | Mayor | Castle Valley Town |
| Deborah Barton | Manager | Solid Waste Special Service District |
| Deborah Hatt | Executive Director | Southern Utah AOG |
| Diana Carroll | Clerk/Auditor | Grand County Clerk/Auditor |
| Don Angell | Emergency Manager | Montrose County |
| Dr. Scott Crane | Superintendent | Grand County Schools |
| Elizabeth Tubbs | Council Person | Grand County |
| Eric Martineau | PDM Expert | Utah Division of Emergency Management |
| Frank Cavaliere | Fire Chief | Lower Valley Fire Department |
| Gateway Fire Department | | Gateway Fire Department |
| George Colson | Area Representative | Red Cross |
| James Pringle | Forecaster | National Weather Service |
| Janalee Luke | Emer. Mgt. Coord. | Emery County Sheriff's Office |
| Jason Johnson | Area Supervisor | Utah State Lands, Foresgtry and Fire |
| Jaz Duncan | | Castle Valley Town |
| Jeff Foster | Public Works | City of Moab |
| Jeff Galley | Streets | Moab City |
| Jeff Reinhart | Planner | Moab City |
| Jeff Whitney | Flood Plan Manager | Grand County |
| Jerry McNeely | Liasion | San Juan County |
| Jim Webster | Commander | Grand County Search and Rescue |
| John A. Cortes | Recorder | Grand County Recorder |
| Judd Hill | Airport Manager | Grand County |
| Kelly Pehrson | Emergency Manager | San Juan County |
| Kris Hurlburt | | Citizen at Large/CERT |
| Kyle Ekker | Emergency Manager | Emery County Sheriff's Office |
| Lee Anne "Lani" Asay | | Thompson Valley Special Service Dist. |

| | | |
|---|---|---|
| Lee Shenton | Expert/Specialist | Grand County |
| Mark Marcum | Fire Chief | Thompson Valley Fire District |
| Mary Hofhine | Planner | Grand County Planning and Zoning |
| Matt Ceniceros | IT/GIS/Wizard | Grand County IT |
| Mingo Gritts | Road Manager | Castle Valley Town |
| Molly Marcello | Reporter | Moab Times Independent |
| Mona Pompilli | Office Manager | Grand County Building Department |
| Orion Rogers | Engineer | Southeast Public Health |
| Patrick McGann | Area Supervisor | Utah Department of Transportation |
| Phil Bowman | Engineer | City of Moab |
| Phillip Mosher | Fire Chief | Moab Valley Fire Protection District |
| Rachel Stenta | Acting City Manager | Moab City |
| Rick M. Bailey | Emergency Manager | Grand County Sheriff's Office |
| Robby Donaldson | EM | Southeast Public Health |
| Ron Drake | Fire Chief | Castle Valley Fire District |
| Ron Mosher | Consultant | |
| Ruth Dillon | County Admin. | Grand County |
| Scott Mabe | Consultant | |
| Steve Ross | Acting Police Chief | Moab City Police Department |
| Steven M. White | Sheriff | Grand County Sheriff's Office |
| Tal Ehlers | Emergency Manager | Unitah County Sheriff's Office |
| Tammy Gallegos | Emergency Coordin | San Juan County |
| Tony White | Area Manager | Utah Division of State Parks |
| Ty Roberts | Lt. | Utah Highway Patrol |
| Vauna Randall | Chief Deputy Recorder | Grand County Recorder |
| Zacharia Lavine | Planner | Grand County |
| | | Canal Company -Elgin |

| Grand County 2018 PDM Core Planning Group | |
|---|---|
| Rick Bailey | Grand County Emergency Manager |
| Kris Hurlburt | Citizen at Large |
| Jazmine Duncan | Representative for Castle Valley |
| Jeff Whitney | Grand County Flood Plain Manager |
| Jeff Foster | City of Moab Public Works |
| Bill Jackson | Grand County Roads Superintendent |
| Phil Mosher | Moab Valley Fire Chief |
| Ron Mosher | Consultant |
| Scott Mabe | Lead Consultant |

The first Grand County 2018 PDM Working Group Meeting was held on 10/03/2016 facilitated by the contractor. The key stakeholders were present, and the current 2013 Grand County Natural Hazard Pre-Disaster Plan was reviewed to establish what basic information required updating. The participants were asked, based on their knowledge and experience, for input to begin the process of updating some areas of the plan. Their spontaneous responses were recorded for inclusion in the plan as they recalled various activities that had occurred over the past 5 years. Jim Pringle, the NOAA weather representative offered to research and provide a severe weather history update for Grand County. Jason Johnson, Area Supervisor, State of Utah Forestry, Fire, and State Lands agreed to obtain the 2012-2017 Grand County Fire Records from the Salt Lake City Office and provide them to the contractor. Mayor Dave Erley, The Town of Castle Valley, informed the Working Group that Castle Valley had recently completed their own Pre-Disaster Natural Hazard Mitigation Plan and it had been approved by FEMA Region 8. He requested the Town of Castle Valley's 2015 Pre-Disaster Natural Hazard Mitigation Plan be an Appendix to the Grand County Plan and suggested Jazmine Duncan would be a valuable asset to the Working Group as she was involved in the Castle Valley planning process. The contractor began working with the Grand County Emergency Manager to develop a current list of Grand County critical facilities and identify which of the natural hazards impacted each facility. The contractor was tasked with researching and updating the basic county descriptive and demographic information. The contractors began contacting members of the Grand County 2018 PDM Working Group to assemble information from their respective jurisdictions and departments to complete the plan. The process of sharing information with the Grand County Emergency Manager was agreed upon to keep the county involved in every step of developing the plan.

The second Grand County Working Group Meeting was held on May 31, 2017 and was facilitated by the contractor. The basic Plan information that had been gathered by the contractors was reviewed and comments made by the participants were incorporated into the document. The status of current mitigation projects and potential future mitigation projects with points of contact were discussed. The contractor was assigned to follow up through the Grand County Emergency Manager to document future mitigation action projects proposed by the subject matter experts and insert them into the plan. A review of existing plans and ordinances was conducted to determine if there have been any changes with particular attention to flooding and flood plain issues. The flood plain manager indicated the following ordinances were up to date and being enforced. The Grand County Storm Water& Flood Control Ordinances 13.12.010 thru 13.12.060, the 2014 Grand County Flood Damage Prevention Ordinance and the City of Moab Updated Code 17.33 Floodway Zone Ordinance. The updated severe weather information gathered by Jim Pringle, NOAA, was shared with the contractors and incorporated into the plan. The issue of how to cooperate and collaborate with the development of the Community Wildfire Preparedness Plan (CWPP) was discussed. The

consensus was to include the CWPP an appendix in the Grand County Pre-Disaster Natural Hazard Mitigation Plan when the CWPP was completed. The identification and prioritization of the natural hazards affecting Grand County, municipal jurisdictions, and the critical facilities were discussed and agreed upon by the Working Group.

During the interim between the second and third Grand County Working Group Meetings information flowed between the contractors, the Grand County Emergency Manager and the members of the core planning group as the impacts of the natural hazards on the respective jurisdictions were identified and hazard mitigation action projects were developed and prioritized for presentation to the Working Group. The October 2017, Hazus Earthquake Risk Report and October 2017, Hazus 100-year Flood Risk Report for Grand County provided by the State of Utah Division of Emergency Management establish the basis for the vulnerability assessments for the flood natural hazard profile and the earthquake natural hazard profile. The Grand County Storm Drain Master Plan provided the mitigation action projects for the Grand County Roads based on the priorities established in the plan. The Grand County General Plan provided guidance for prioritizing mitigation projects related to wildfire along Mill Creek and Pack Creek. The General Plan specifically indicates the number one priority is maintaining the riparian areas along the creek beds which influenced the development of the mitigation action plans to reduce ladder fuels and build defensible space along the creek beds.

The third Grand County Working Group Meeting was held on March 6, 2018 and the contractors presented a Draft 2018 Grand County Pre-Disaster Natural Hazard Mitigation Plan for review and comment by the Working Group. The contractor facilitated a point by point review of the document seeking additional input from the Working Group. The Working Group suggested some modifications which were incorporated into the plan. The Working Group endorsed moving onto the next step of the process, the public hearing.
The Grand County 2018 Pre-Disaster Natural Hazard Mitigation Plan was posted on the Grand County website on November 21, 2017 by Matt Ceniceros, Grand County IT, and each version update added to the site for citizen review and comment. There were no comments from the community. The Public Hearing Notice was posted in five public locations, following Grand County policy, on July 19, 2018 and the Public Hearing was held on July 30, 2018. There were no citizens in attendance and no comments were received in person or electronically.

# Grand County Pre-Disaster Hazard Mitigation Plan 2018

## PUBLIC NOTICE

The Grand County Office of Emergency Management (OEM) will hold a public hearing on Monday, July 30, 2018 at the hour of 5:00 PM in the lobby between the County Clerk and County Assessor's Office located at 125 E. Center Street to receive public comment on the Draft Pre-Disaster Mitigation Plan (PDM). A copy of the draft plan can be reviewed by visiting the Grand County Utah website (grandcountyutah.net) under the County Sheriff's tab or in the Emergency Management tab.

For any additional information regarding the plan or the process, please contact the Director of Emergency Management, Rick M. Bailey at (435) 259-1310 or by email at rebailey@grandcountysheriff.org.

This public notice was placed on the Grand County Utah Emergency Management website, the Grand County Utah website, and the Grand County Utah Emergency Management Facebook site on July 19, 2018. In addition, five copies of this notice where publicly posted in the following locations:

Grand County
Courthouse Grand
County Sheriff's
Office
Grand County Office of Emergency
Management City of Moab
Administrative Office
Moab Valley Fire Protection District Office

I certified that the posting of the public notice to receive comments on the draft Grand County Pre- Disaster Mitigation Plan were posted at the locations and sites listed above.

Rick M. Bailey

Rick M. Bailey 07/19/2018

# Grand County Pre-Disaster Hazard Mitigation Plan 2018

The Letter of Invitation, meeting agendas, sign-in forms, and notes for the Grand County Working Group Meetings follow:

Grand County 2018 Pre-Disaster Natural Hazard Mitigation Plan Kick-Off Meeting

This meeting was to establish the meeting dates for the 2018 PDM working groups and compositions of the groups for both San Juan County and Grand County

Pre-Disaster Mitigation Meeting 6/27/2016

10:00 a.m. 117 S Main Monticello Utah kick off meeting

| Print Name | Signature |
|---|---|
| Tammy Gallegos | Tammy Gallegos |
| Ron Mosher | Ron Mosher |
| Scott Mabe | |
| Kelly Pehrso | Kelly Peh |
| Rick Ballard | |
| Agelia | |
| Angelia Crowther | By Phone |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

**Grand County Pre-Disaster Mitigation Working Group**

| NAME | POSITION | DEPARTMENT OR COMPANY |
|---|---|---|
| Rick M. Bailey | Emergency Manager | Grand County Sheriff's Office |
| Steven M. White | Sheriff | Grand County Sheriff's Office |
| Zacharia Lavine | Planner | Grand County |
| Jeff Whitney | Flood Plan Manager | Grand County |
| Ruth Dillon | County Admin. | Grand County |
| Bill Jackson | Road Super indent | Grand County |
| Rebecca Davidson | City Manager | City of Moab |
| Phil | | City of Moab |
| | Planner | City of Moab |
| | Public Works | City of Moab |
| David Early | Mayor | Castle Valley Town |
| Ron Drake | Fire Chief | Castle Valley Fire District |
| Mark Marcum | Fire Chief | Thompson Springs Fire District |
| | | Thompson Springs Special Service Dist. |
| | Executive Director | Grand Water and Sewer District |
| Jerry McNeely | Liasion | San Juan County |
| Cody Greaves | Fire Warden | Grand County - State of Utah |
| Phillip Mosher | Fire Chief | Moab Valley Fire Protection District |
| | | Grand County Schools |
| James Pringle | Forecaster | National Weather Service |
| Kelly Pehrson | Emergency Manager | San Juan County |
| Tammy Gallegos | Emergency Coordin | San Juan County |
| Andy Smith | EMS Manager | Grand County |
| Judd Hill | Airport Manager | Grand County |
| Kyle Ekker | Emergency Manager | Emery County |
| | Emergency Manager | Mesa County, Colorado |
| | Emergency Manager | Montrose County |
| Deborah Barton | Manager | Solid Waste Special Service District |
| | | Grand School District |

| | | |
|---|---|---|
| | | Utah Department of Transportation |
| Kris Hurlburt | | Citizen at Large/CERT |
| Angelia Crowther | Liason | Utah State DEM |
| | Council Person | Grand County |
| | | Red Cross |

**Sheriff**
**Steven White**

**Chief Deputy**
**Darrel Mecham**

**Jail Commander**
**Veronica Bullock**

**Emergency Manager**
**Rick M. Bailey**

**OFFICE OF THE GRAND COUNTY SHERIFF**
**EMERGENCY MANAGEMENT**

September 26, 2016

Utah Region 7 Pre-Disaster Mitigation Plan (Grand County Portion)

The Utah Region 7 Emergency Management Team has been awarded the FEMA grant for a Pre-Disaster Mitigation plan. We are committed to develop a local plan that will provide a basis for Hazard mitigation within our communities. We would now like to begin the process of developing a planning team. To support this activity we are organizing a meeting to discuss plan development in the area, to which you are cordially invited.

When: October 3, 2016 1:00-2:30 PM

Where: Moab Fire Training Room
45 South 100 East
Moab, Utah

In the course of the meeting we aim to bring together key strategic partners in order to establish the need for a local plan, and how we will identify the priorities and actions needed to complete the Pre-Disaster Mitigation plan.

Your input to this process is of key importance and we hope that you will be able to attend.

Yours sincerely

Rick M. Bailey
Grand Emergency Manager

Sheriff's Office Address 25 S 100 E Moab, UT 84532 Phone (435) 259-8115 Fax (435) 259-8651
Jail Address: 125 East Center St. Moab, UT 84532 Phone (435)259-4321 Fax (435)259-1364 updated 05/07/2014 eb

## MEETING SIGN-IN SHEET

| | | | |
|---|---|---|---|
| **Project:** | Pre-Disaster Mitigation Meeting – Grand County | **Meeting Date:** | 10/3/2016 |
| | | **Place/Room:** | Moab Fire Training Room |

| Name | Title | Company | Phone | Fax | E-Mail |
|---|---|---|---|---|---|
| Ty Roberts | Lt. | UHP | (435) 503-5929 | | Ty Roberts@Utah.gov |
| George Colson | DPLL | Red Cross | (435)879-9033 | | |
| Jazmine Duncan | Council member | Town of C.V | 435-259-1061 | | jazdunca@yahoo.com |
| DAVE ERLEY | Mayor | Town of CV | 435-259-4859 | | |
| Bill Jackson | County Road Supervisor | Grand Co. | 435-259-5308 | | bjackson@grandcounty utah.net |
| Mark Marcum | Dp. Supervisor GCEMS Thompson Springs FD | GCEMS Thompson Springs FD | 435-260-6159 | | mmarcum@grandcounty utah.net |
| Art Wollenweber | Manager | GWSSA | 210-1439 | | art@grandwater.org |
| Jason Johnson | Area Manager | FFSL | 210-4578 | | jasonajohnson@utah.gov |
| Phillip Mosher | Chief | MVFD | 259-5557 | | mfd1@frontiernet.net |
| Susan Thompson | Admin | Solid Waste | 259-3667 | | gcswmss@gmail.com |
| GLEN ARTHUR | ASSIT. SUPER | GCRD | 260-9831 | | GARTHOR@grandcounty utah.gov |
| Lee Shenton | UMTRA LIAISON | Grand G. | 259-1795 | | lshenton@ " |
| Mike Randall | UDOT | UDOT | 220-1897 | | MRandall@utah.gov |
| RON DRAKE | CASTLE VALLEY FIRE DEPT | CHIEF | 259-3655 | | PATROL@FRONTIERNET.NET |

Page 1 of 5

| Name | Title | Company | Phone | Fax | E-Mail |
|---|---|---|---|---|---|
| Orion Rogers | RE US | SEUHD | 8015576978 | | orogers@utah.gov |
| Cody Greaves | Fire Warden | FFSL | 22[illegible]-0179 | | cgreaves@utah.gov |
| Jim Pringle | Warning Coordination Meteorologist | NWS | 970-243-7007 x726 | 970-257-0452 | james.pringle@noaa.gov |
| Andy Smith | GCEMS Director | GCEMS | 8018912459 | | GSmith@grandcountyutah.net |
| Matt Ceniceros | IT Dir. Gr. Co. | Grand County | 4352591395 | | mceniceros@grandcountyutah.net |
| Tawny Boyd | Admin. Asst | Grand Co. Road Dept | 4352595308 | 259-3056 | tboyd@grandcountyutah.net |
| Rick M Bailey | EM | Grand County | 435459-0748 | | — |
| Angelia Crowther | DEM Liaison | DEM | 801-664-5861 | | acrowther@utah.gov |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Page 2 of 5

# Grand County Pre-Disaster Hazard Mitigation Plan 2018

## Grand County Office of Emergency Management

## Pre-Disaster Mitigation Stakeholders Meeting

October 3, 2016
1:00 PM
Moab Valley Fire Training Room
45 South 100 East
Moab, Utah

Call to order

Introductions of Stakeholders

Overview of Grant and Planning Process

Ron Mosher and Scott Mabe, Consultants for the Project

Next Meeting

Adjournment

## Agenda

## Grand County 2018 PDM

## Working Group Meeting

## May 31, 2017
## 3:00 PM – 5:00 PM

1. Review the Grand County updated basic demographic information
2. Review the Grand County Critical Infrastructure information
3. Review the Grand County Natural Hazards prioritization
4. Examine the status of the current Grand County Natural Hazard Mitigation Projects
5. Discuss the ideas, concepts, implementation, and cost estimates for the Grand County 2018 Pre-Disaster Hazard Mitigation Plan Projects

6. Establish Points of Contact for follow up on each of the proposed projects in Grand County

Presentation by the representatives of the Department of Natural Resources, Division of Forestry, Fire, and State Lands on the concurrent development of the Community Wildfire Preparedness Plan within Grand County

## Agenda
## Grand County 2018 PDM
## Working Group Meeting
## March 6, 2018
## 11:00 AM-2:00 PM

Introductions
Consultant Ron Mosher to facilitate the meeting

1. Status of Plan: Review the Draft 2018 Grand County Pre-Disaster Natural Hazard Mitigation Plan
2. Discuss proposed changes, additions, deletions, additional information required
3. Review of the way forward

*Grand County PDM Working Group*

*Tuesday, March 6, 2018 11:00 AM*

| Name | Company/Agency | Signature |
|---|---|---|
| Rick Bailey | Grand Co. SO/DEM | Rick M. Bailey |
| Angelia Crowther | DPS/DEM | Angelia Crowther |
| Eric Martineau | DEM | Eric Martineau |
| Reno Hurlburt | OEM Grand | [illegible] |
| Craig Sanchez | OEM Grand | Craig Sanchez |
| Bill Jackson | Grand Co. Roads. | Bill Jackson |
| Kyle Curtis | UHP | Kyle Curtis |
| T. Roberts | UHP | [illegible] |
| Mark Marcum | FFSL | [illegible] |
| Jason Johnson | FFSL | [illegible] |
| Pat Dean | Moab City. | P. Dean |
| Phillip Mosher | Moab Fire | Phillip C. Mosher |
| Greg Halliday | Grand County Council | [illegible] |
| Orion Rogers | Southeast UT Health | [illegible] |
| Jonathan Dutram | Southeast UT Health | [illegible] |
| Ron Mosher | Contractor | Mosher |

*Grand County PDM Working Group*

*Tuesday, March 6, 2018 11:00 AM*

| Name | Company/Agency | Signature |
|---|---|---|
| Tawny Boyd | Grand County Road | Tawny Boyd |
| Glen Arthur | " " " | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

**Grand County Pre-Disaster Hazard Mitigation Plan 2018**

Below is a quick reference of Grand County's past, present and future Mitigation projects

| Date Started | Project Name and Brief Description | Project Status |
|---|---|---|
| ~~Fall~~ 2017 | Willow Basin Fuel Break (Lower C. Fryar property) | Complete (FFSL) |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

GRAND COUNTY 2018 PDM 3

# Grand County Pre-Disaster Hazard Mitigation Plan 2018

**Grand County Council Resolution of Adoption of the 2018 Grand County Pre-Disaster Natural Hazards Mitigation Plan**

(Place Holder)

**City of Moab Council Resolution of Adoption of 2018 Grand County Pre-Disaster Natural Hazards Mitigation Plan**

(Place Holder)

**Town of Castle Valley Council Resolution of Adoption of the 2018 Grand County Pre-Disaster Natural Hazards Mitigation Plan**

(Place Holder)

# APPENDIX 3

## Grand County Hazus Analysis

HAZUS MH
EARTHQUAKE • WIND • FLOOD

# Hazus-MH: Flood Global Risk Report

**Region Name:** Grand_County_FL

**Flood Scenario:** Grand_County_100_Year_FL

**Print Date:** Monday, October 23, 2017

***Disclaimer:***
*This version of Hazus utilizes 2010 Census Data.*
*Totals only reflect data for those census tracts/blocks included in the user's study region.*

*The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.*

FEMA

RiskMAP
Increasing Resilience Together

HAZUS MH
EARTHQUAKE • WIND • FLOOD

## Table of Contents


| Section | Page # |
|---|---|
| General Description of the Region | 3 |
| Building Inventory | |
| General Building Stock | 4 |
| Essential Facility Inventory | 5 |
| Flood Scenario Parameters | 6 |
| Building Damage | |
| General Building Stock | 7 |
| Essential Facilities Damage | 9 |
| Induced Flood Damage | 10 |
| Debris Generation | |
| Social Impact | 10 |
| Shelter Requirements | |
| Economic Loss | 12 |
| Building-Related Losses | |
| Appendix A: County Listing for the Region | 15 |
| Appendix B: Regional Population and Building Value Data | 16 |

HAZUS MH
EARTHQUAKE • WIND • FLOOD

## General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Utah

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 3,684 square miles and contains 1,640 census blocks. The region contains over 4 thousand households and has a total population of 9,225 people (2010 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 4,827 buildings in the region with a total building replacement value (excluding contents) of 1,046 million dollars (2010 dollars). Approximately 90.55% of the buildings (and 76.13% of the building value) are associated with residential housing.

HAZUS MH
EARTHQUAKE • WIND • FLOOD

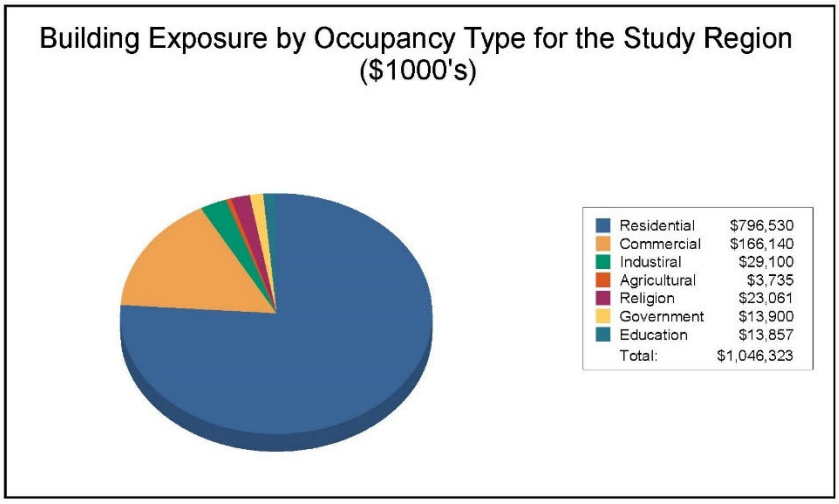
## Building Inventory

### General Building Stock

Hazus estimates that there are 4,827 buildings in the region which have an aggregate total replacement value of 1,046 million (2014 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

**Table 1**
**Building Exposure by Occupancy Type for the Study Region**

| Occupancy | Exposure ($1000) | Percent of Total |
|---|---|---|
| Residential | 796,530 | 76.1% |
| Commercial | 166,140 | 15.9% |
| Industrial | 29,100 | 2.8% |
| Agricultural | 3,735 | 0.4% |
| Religion | 23,061 | 2.2% |
| Government | 13,900 | 1.3% |
| Education | 13,857 | 1.3% |
| **Total** | **1,046,323** | **100.0%** |



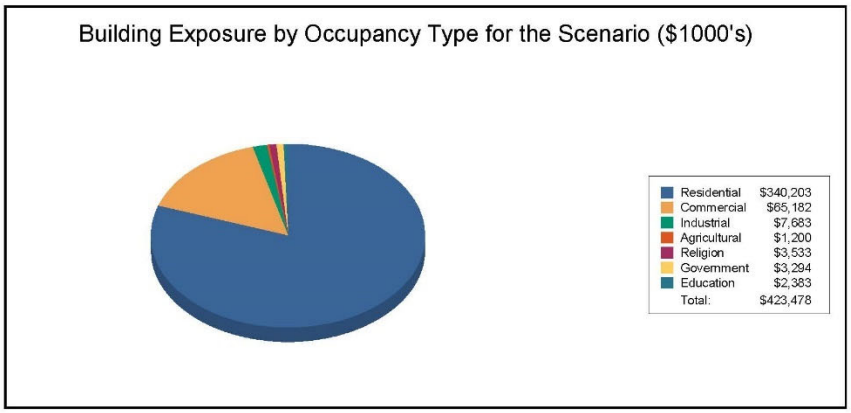

FEMA

RiskMAP
Increasing Resilience Together

HAZUS MH
EARTHQUAKE • WIND • FLOOD

**Table 2**
**Building Exposure by Occupancy Type for the Scenario**

| Occupancy | Exposure ($1000) | Percent of Total |
|---|---|---|
| Residential | 340,203 | 80.3% |
| Commercial | 65,182 | 15.4% |
| Industrial | 7,683 | 1.8% |
| Agricultural | 1,200 | 0.3% |
| Religion | 3,533 | 0.8% |
| Government | 3,294 | 0.8% |
| Education | 2,383 | 0.6% |
| **Total** | **423,478** | **100.0%** |




**Essential Facility Inventory**

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 17 beds.
There are 8 schools, 7 fire stations, 4 police stations and 1 emergency operation center.

HAZUS MH
EARTHQUAKE • WIND • FLOOD

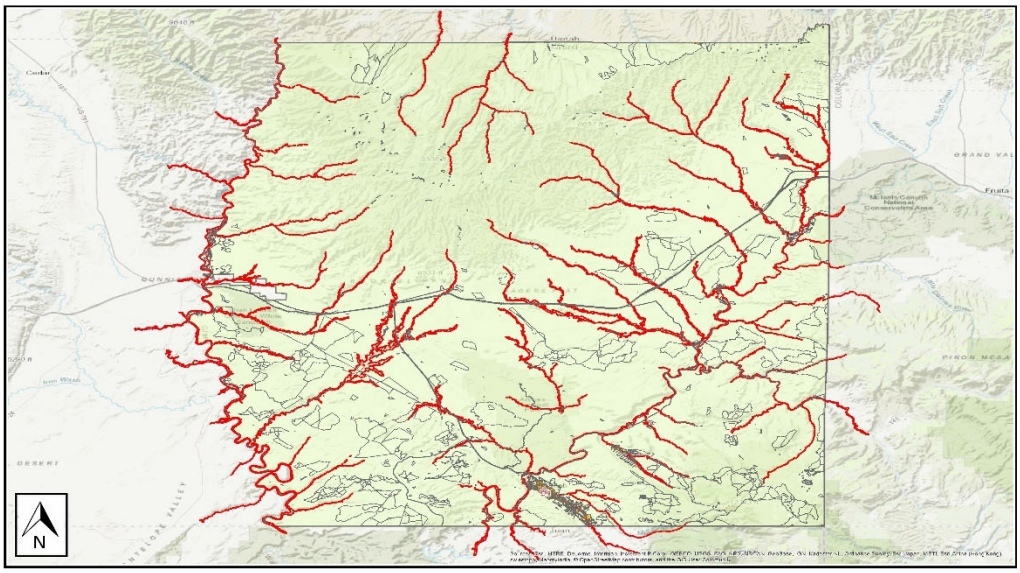
## Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

| | |
|---|---|
| **Study Region Name:** | Grand_County_FL |
| **Scenario Name:** | Grand_County_100_Year_FL |
| **Return Period Analyzed:** | 100 |
| **Analysis Options Analyzed:** | No What-Ifs |

**Study Region Overview Map**

**Illustrating scenario flood extent, as well as exposed essential facilities and total exposure**




FEMA

RiskMAP
Increasing Resilience Together

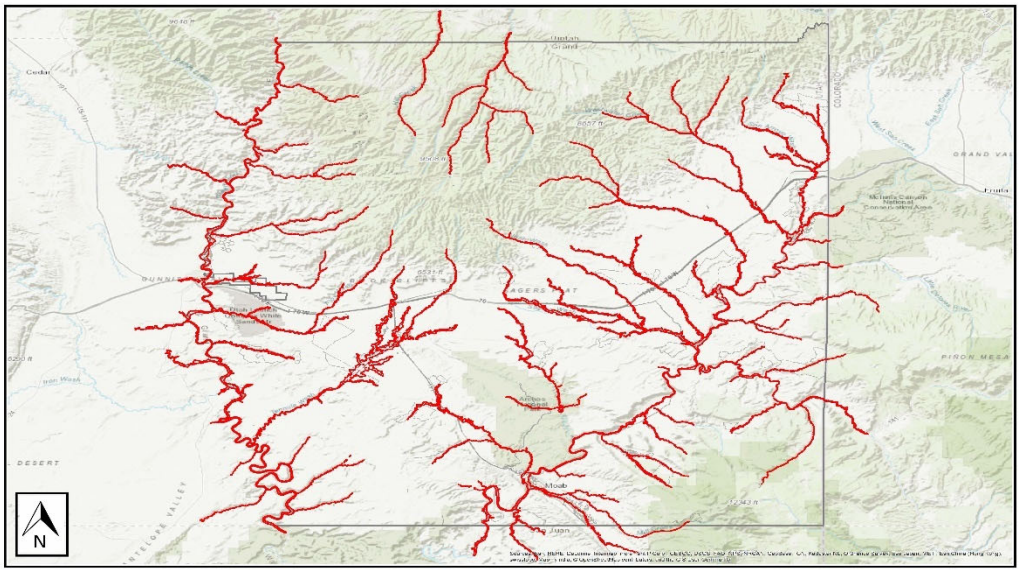
HAZUS MH
EARTHQUAKE • WIND • FLOOD

## Building Damage

### General Building Stock Damage

Hazus estimates that about 56 buildings will be at least moderately damaged. This is over 59% of the total number of buildings in the scenario. There are an estimated 9 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

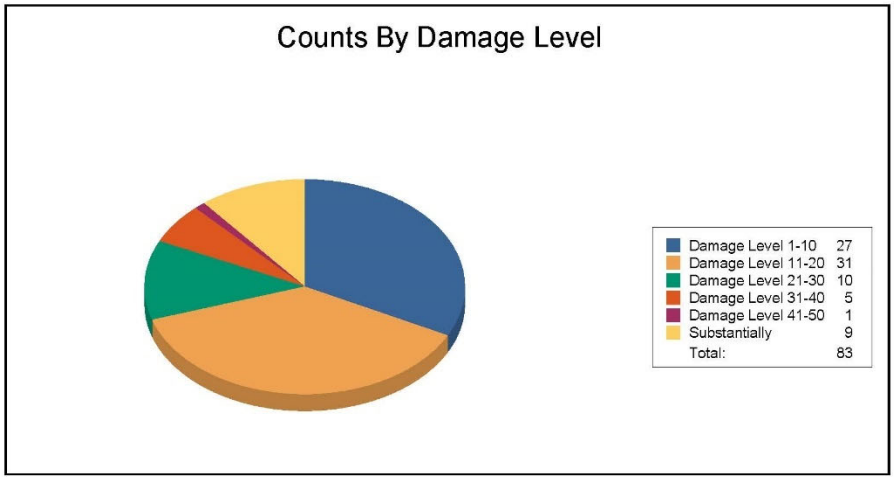
**Total Economic Loss (1 dot = $300K) Overview Map**



HAZUS MH
EARTHQUAKE • WIND • FLOOD

**Table 3: Expected Building Damage by Occupancy**

| | 1-10 | | 11-20 | | 21-30 | | 31-40 | | 41-50 | | Substantially | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Occupancy** | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** |
| Agriculture | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Commercial | 1 | 100.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Education | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Government | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Industrial | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Religion | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Residential | 26 | 31.71 | 31 | 37.80 | 10 | 12.20 | 5 | 6.10 | 1 | 1.22 | 9 | 10.98 |
| **Total** | **27** | | **31** | | **10** | | **5** | | **1** | | **9** | |




FEMA

RiskMAP
Increasing Resilience Together

HAZUS MH
EARTHQUAKE • WIND • FLOOD

**Table 4: Expected Building Damage by Building Type**

| Building Type | 1-10 | | 11-20 | | 21-30 | | 31-40 | | 41-50 | | Substantially | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Count | (%) | Count | (%) | Count | (%) | Count | (%) | Count | (%) | Count | (%) |
| Concrete | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ManufHousing | 3 | 23 | 2 | 15 | 1 | 8 | 0 | 0 | 0 | 0 | 7 | 54 |
| Masonry | 4 | 50 | 4 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Steel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wood | 20 | 32 | 25 | 40 | 9 | 15 | 5 | 8 | 1 | 2 | 2 | 3 |

FEMA

RiskMAP
Increasing Resilience Together

HAZUS MH
EARTHQUAKE • WIND • FLOOD

## Essential Facility Damage

Before the flood analyzed in this scenario, the region had 17 hospital beds available for use. On the day of the scenario flood event, the model estimates that 17 hospital beds are available in the region.

**Table 5: Expected Damage to Essential Facilities**

| | | # Facilities | | |
|---|---|---|---|---|
| **Classification** | Total | At Least Moderate | At Least Substantial | Loss of Use |
| Fire Stations | 7 | 0 | 0 | 0 |
| Hospitals | 1 | 0 | 0 | 0 |
| Police Stations | 4 | 0 | 0 | 0 |
| Schools | 8 | 2 | 0 | 2 |

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

FEMA

RiskMAP
Increasing Resilience Together

HAZUS MH
EARTHQUAKE • WIND • FLOOD

## Induced Flood Damage

### Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

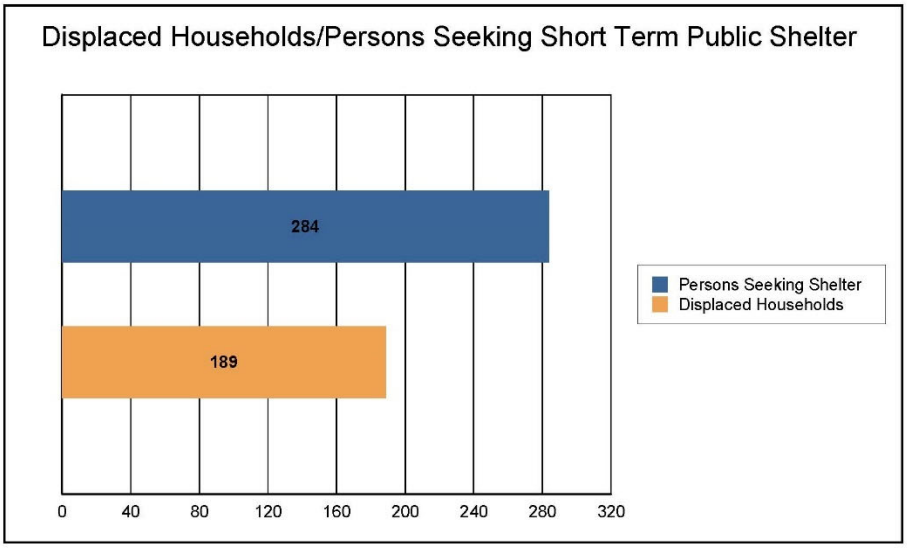
**Analysis has not been performed for this Scenario.**

HAZUS MH
EARTHQUAKE • WIND • FLOOD

## Social Impact

**Shelter Requirements**

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 189 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 284 people (out of a total population of 9,225) will seek temporary shelter in public shelters.




FEMA

RiskMAP
Increasing Resilience Together

HAZUS MH
EARTHQUAKE • WIND • FLOOD

## Economic Loss

The total economic loss estimated for the flood is 23.33 million dollars, which represents 5.51 % of the total replacement value of the scenario buildings.

### Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

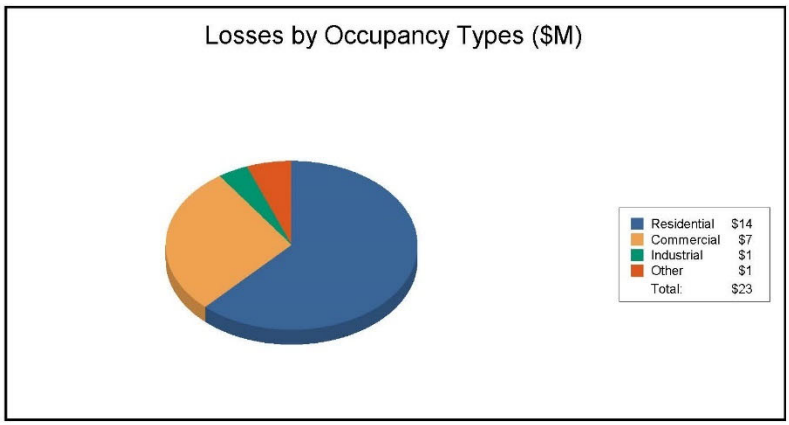
The total building-related losses were 23.02 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 61.91% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

HAZUS MH
EARTHQUAKE • WIND • FLOOD

**Table 6: Building-Related Economic Loss Estimates**

(Millions of dollars)

| Category | Area | Residential | Commercial | Industrial | Others | Total |
|---|---|---|---|---|---|---|
| Building Loss | | | | | | |
| | Building | 8.96 | 1.45 | 0.26 | 0.20 | 10.87 |
| | Content | 5.39 | 4.98 | 0.57 | 1.03 | 11.97 |
| | Inventory | 0.00 | 0.09 | 0.08 | 0.01 | 0.19 |
| | **Subtotal** | **14.35** | **6.53** | **0.91** | **1.24** | **23.02** |
| Business Interruption | | | | | | |
| | Income | 0.02 | 0.04 | 0.00 | 0.00 | 0.06 |
| | Relocation | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 |
| | Rental Income | 0.03 | 0.00 | 0.00 | 0.00 | 0.03 |
| | Wage | 0.04 | 0.04 | 0.00 | 0.13 | 0.21 |
| | **Subtotal** | **0.10** | **0.08** | **0.00** | **0.13** | **0.31** |
| ALL | **Total** | **14.44** | **6.61** | **0.91** | **1.37** | **23.33** |




FEMA

RiskMAP
Increasing Resilience Together

HAZUS MH
EARTHQUAKE • WIND • FLOOD

**Appendix A: County Listing for the Region**

Utah
- Grand

HAZUS MH
EARTHQUAKE • WIND • FLOOD

**Appendix B: Regional Population and Building Value Data**

| | | Building Value (thousands of dollars) | | |
|---|---|---|---|---|
| | Population | Residential | Non-Residential | Total |
| **Utah** | | | | |
| Grand | 9,225 | 796,530 | 249,793 | 1,046,323 |
| **Total** | **9,225** | **796,530** | **249,793** | **1,046,323** |
| **Total Study Region** | **9,225** | **796,530** | **249,793** | **1,046,323** |

FEMA

RiskMAP
Increasing Resilience Together

# Hazus-MH: Earthquake Global Risk Report

**Region Name:** Grand_County_EQ

**Earthquake Scenario:** Grand_County_2500_Year_EQ

**Print Date:** October 24, 2017

***Disclaimer:***
*This version of Hazus utilizes 2010 Census Data.*
*Totals only reflect data for those census tracts/blocks included in the user's study region.*

*The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.*

HAZUS MH EARTHQUAKE • WIND • FLOOD

FEMA

## Table of Contents


| Section | Page # |
|---|---|
| General Description of the Region | 3 |
| Building and Lifeline Inventory | 4 |
| Building Inventory | |
| Critical Facility Inventory | |
| Transportation and Utility Lifeline Inventory | |
| Earthquake Scenario Parameters | 6 |
| Direct Earthquake Damage | 7 |
| Buildings Damage | |
| Critical Facilities Damage | |
| Transportation and Utility Lifeline Damage | |
| Induced Earthquake Damage | 11 |
| Debris Generation | |
| Social Impact | 12 |
| Shelter Requirements | |
| Casualties | |
| Economic Loss | 13 |
| Building Losses | |
| Transportation and Utility Lifeline Losses | |
| Appendix A: County Listing for the Region | |
| Appendix B: Regional Population and Building Value Data | |

HAZUS MH EARTHQUAKE • WIND • FLOOD

FEMA

## General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Utah

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 3,682.75 square miles and contains 2 census tracts. There are over 3 thousand households in the region which has a total population of 9,225 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 4 thousand buildings in the region with a total building replacement value (excluding contents) of 1,046 (millions of dollars). Approximately 91.00 % of the buildings (and 76.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 1,755 and 65 (millions of dollars) , respectively.

HAZUS MH EARTHQUAKE • WIND • FLOOD

FEMA

## Building and Lifeline Inventory

### Building Inventory

Hazus estimates that there are 4 thousand buildings in the region which have an aggregate total replacement value of 1,046 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 58% of the building inventory. The remaining percentage is distributed between the other general building types.

### Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 17 beds. There are 8 schools, 7 fire stations, 4 police stations and 1 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 0 dams identified within the inventory. Of these, 0 of the dams are classified as 'high hazard'. The inventory also includes 0 hazardous material sites, 0 military installations and 0 nuclear power plants.

### Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 1,820.00 (millions of dollars). This inventory includes over 190 kilometers of highways, 120 bridges, 711 kilometers of pipes.

HAZUS MH EARTHQUAKE • WIND • FLOOD

FEMA

Table 1: Transportation System Lifeline Inventory

| System | Component | # Locations/ # Segments | Replacement value (millions of dollars) |
|---|---|---|---|
| Highway | Bridges | 120 | 457.80 |
| | Segments | 18 | 1,066.90 |
| | Tunnels | 0 | 0.00 |
| | | Subtotal | **1,524.70** |
| Railways | Bridges | 0 | 0.00 |
| | Facilities | 0 | 0.00 |
| | Segments | 71 | 182.20 |
| | Tunnels | 0 | 0.00 |
| | | Subtotal | **182.20** |
| Light Rail | Bridges | 0 | 0.00 |
| | Facilities | 0 | 0.00 |
| | Segments | 0 | 0.00 |
| | Tunnels | 0 | 0.00 |
| | | Subtotal | **0.00** |
| Bus | Facilities | 0 | 0.00 |
| | | Subtotal | **0.00** |
| Ferry | Facilities | 0 | 0.00 |
| | | Subtotal | **0.00** |
| Port | Facilities | 0 | 0.00 |
| | | Subtotal | **0.00** |
| Airport | Facilities | 1 | 10.70 |
| | Runways | 1 | 38.00 |
| | | Subtotal | **48.60** |
| | | Total | **1,755.50** |

Table 2: Utility System Lifeline Inventory

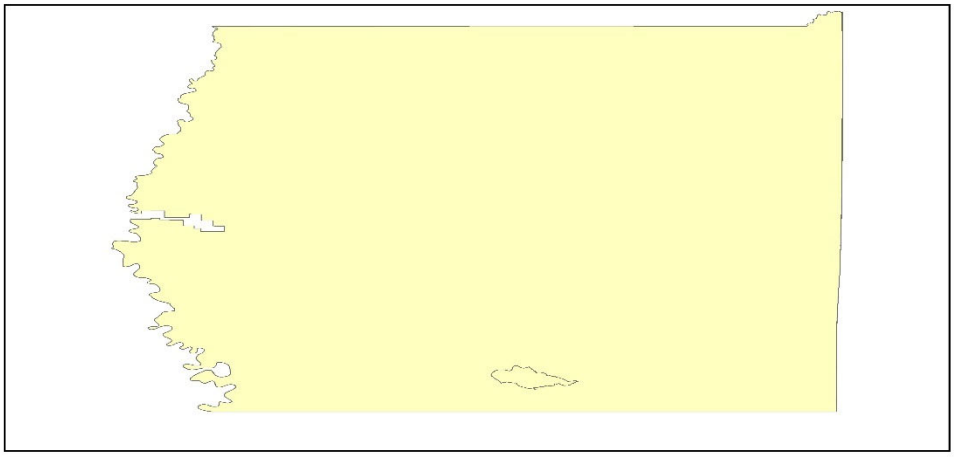
| System | Component | # Locations / Segments | Replacement value (millions of dollars) |
|---|---|---|---|
| Potable Water | Distribution Lines | NA | 7.10 |
| | Facilities | 0 | 0.00 |
| | Pipelines | 0 | 0.00 |
| | | Subtotal | **7.10** |
| Waste Water | Distribution Lines | NA | 4.30 |
| | Facilities | 1 | 65.30 |
| | Pipelines | 0 | 0.00 |
| | | Subtotal | **69.50** |
| Natural Gas | Distribution Lines | NA | 2.80 |
| | Facilities | 0 | 0.00 |
| | Pipelines | 0 | 0.00 |
| | | Subtotal | **2.80** |
| Oil Systems | Facilities | 1 | 0.10 |
| | Pipelines | 0 | 0.00 |
| | | Subtotal | **0.10** |
| Electrical Power | Facilities | 0 | 0.00 |
| | | Subtotal | **0.00** |
| Communication | Facilities | 0 | 0.00 |
| | | Subtotal | **0.00** |
| | | Total | **79.60** |

HAZUS MH EARTHQUAKE • WIND • FLOOD

FEMA

## Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.



| | |
|---|---|
| **Scenario Name** | Grand_County_2500_Year_EQ |
| **Type of Earthquake** | Probabilistic |
| **Fault Name** | NA |
| **Historical Epicenter ID #** | NA |
| **Probabilistic Return Period** | 2,500.00 |
| **Longitude of Epicenter** | NA |
| **Latitude of Epicenter** | NA |
| **Earthquake Magnitude** | 6.50 |
| **Depth (km)** | NA |
| **Rupture Length (Km)** | NA |
| **Rupture Orientation (degrees)** | NA |
| **Attenuation Function** | NA |

## Building Damage

### Building Damage

Hazus estimates that about 480 buildings will be at least moderately damaged. This is over 10.00 % of the buildings in the region. There are an estimated 4 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

**Damage categories by General Occupancy Type**

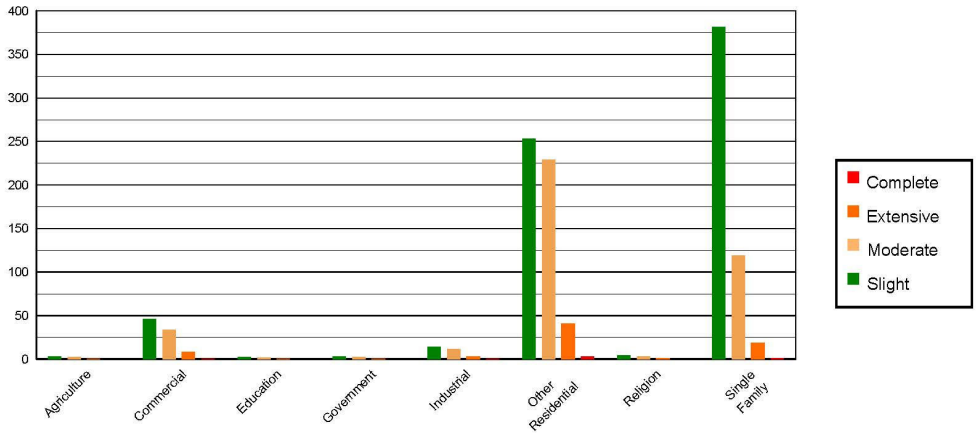



Table 3: Expected Building Damage by Occupancy

| | None | | Slight | | Moderate | | Extensive | | Complete | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Count | (%) | Count | (%) | Count | (%) | Count | (%) | Count | (%) |
| Agriculture | 14 | 0.39 | 3 | 0.42 | 2 | 0.54 | 1 | 0.83 | 0 | 0.98 |
| Commercial | 197 | 5.40 | 46 | 6.50 | 33 | 8.31 | 8 | 11.22 | 1 | 13.23 |
| Education | 12 | 0.33 | 2 | 0.31 | 2 | 0.39 | 0 | 0.46 | 0 | 0.51 |
| Government | 13 | 0.37 | 3 | 0.41 | 2 | 0.53 | 0 | 0.62 | 0 | 0.72 |
| Industrial | 55 | 1.52 | 14 | 2.03 | 12 | 2.91 | 3 | 4.43 | 0 | 4.69 |
| Other Residential | 752 | 20.67 | 254 | 35.79 | 229 | 56.91 | 41 | 55.44 | 3 | 59.16 |
| Religion | 22 | 0.61 | 5 | 0.65 | 3 | 0.81 | 1 | 1.00 | 0 | 1.17 |
| Single Family | 2,572 | 70.70 | 382 | 53.89 | 119 | 29.60 | 19 | 26.00 | 1 | 19.52 |
| Total | **3,638** | | **708** | | **403** | | **73** | | **5** | |

Table 4: Expected Building Damage by Building Type (All Design Levels)

| | None | | Slight | | Moderate | | Extensive | | Complete | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Count | (%) | Count | (%) | Count | (%) | Count | (%) | Count | (%) |
| **Wood** | 2,356 | 64.75 | 357 | 50.35 | 73 | 18.16 | 5 | 6.91 | 0 | 3.70 |
| **Steel** | 68 | 1.86 | 18 | 2.56 | 18 | 4.45 | 4 | 5.99 | 0 | 10.07 |
| **Concrete** | 66 | 1.81 | 17 | 2.35 | 12 | 2.92 | 2 | 3.07 | 0 | 2.46 |
| **Precast** | 50 | 1.37 | 11 | 1.52 | 12 | 3.01 | 5 | 6.18 | 0 | 3.87 |
| **RM** | 466 | 12.81 | 61 | 8.68 | 56 | 13.89 | 14 | 19.61 | 0 | 4.26 |
| **URM** | 63 | 1.74 | 20 | 2.87 | 15 | 3.63 | 5 | 6.24 | 1 | 19.94 |
| **MH** | 570 | 15.66 | 224 | 31.67 | 217 | 53.94 | 38 | 52.00 | 3 | 55.70 |
| **Total** | **3,638** | | **708** | | **403** | | **73** | | **5** | |

*Note:
RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

HAZUS MH EARTHQUAKE • WIND • FLOOD

FEMA

## Essential Facility Damage

Before the earthquake, the region had 17 hospital beds available for use. On the day of the earthquake, the model estimates that only 14 hospital beds (85.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 98.00% of the beds will be back in service. By 30 days, 100.00% will be operational.

**Table 5: Expected Damage to Essential Facilities**

| Classification | Total | # Facilities | | |
|---|---|---|---|---|
| | | At Least Moderate Damage > 50% | Complete Damage > 50% | With Functionality > 50% on day 1 |
| Hospitals | 1 | 0 | 0 | 1 |
| Schools | 8 | 0 | 0 | 8 |
| EOCs | 1 | 0 | 0 | 1 |
| PoliceStations | 4 | 0 | 0 | 4 |
| FireStations | 7 | 0 | 0 | 7 |

**Transportation Lifeline Damage**

HAZUS MH EARTHQUAKE • WIND • FLOOD

FEMA

**Table 6: Expected Damage to the Transportation Systems**

| System | Component | Number of Locations_ | | | | |
|---|---|---|---|---|---|---|
| | | Locations/ Segments | With at Least Mod. Damage | With Complete Damage | With Functionality > 50 % | |
| | | | | | After Day 1 | After Day 7 |
| Highway | Segments | 18 | 0 | 0 | 18 | 18 |
| | Bridges | 120 | 0 | 0 | 120 | 120 |
| | Tunnels | 0 | 0 | 0 | 0 | 0 |
| Railways | Segments | 71 | 0 | 0 | 71 | 71 |
| | Bridges | 0 | 0 | 0 | 0 | 0 |
| | Tunnels | 0 | 0 | 0 | 0 | 0 |
| | Facilities | 0 | 0 | 0 | 0 | 0 |
| Light Rail | Segments | 0 | 0 | 0 | 0 | 0 |
| | Bridges | 0 | 0 | 0 | 0 | 0 |
| | Tunnels | 0 | 0 | 0 | 0 | 0 |
| | Facilities | 0 | 0 | 0 | 0 | 0 |
| Bus | Facilities | 0 | 0 | 0 | 0 | 0 |
| Ferry | Facilities | 0 | 0 | 0 | 0 | 0 |
| Port | Facilities | 0 | 0 | 0 | 0 | 0 |
| Airport | Facilities | 1 | 0 | 0 | 1 | 1 |
| | Runways | 1 | 0 | 0 | 1 | 1 |

Table 6 provides damage estimates for the transportation system.

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

| System | # of Locations | | | | |
|---|---|---|---|---|---|
| | Total # | With at Least Moderate Damage | With Complete Damage | with Functionality > 50 % | |
| | | | | After Day 1 | After Day 7 |
| Potable Water | 0 | 0 | 0 | 0 | 0 |
| Waste Water | 1 | 0 | 0 | 1 | 1 |
| Natural Gas | 0 | 0 | 0 | 0 | 0 |
| Oil Systems | 1 | 0 | 0 | 1 | 1 |
| Electrical Power | 0 | 0 | 0 | 0 | 0 |
| Communication | 0 | 0 | 0 | 0 | 0 |

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

| System | Total Pipelines Length (kms) | Number of Leaks | Number of Breaks |
|---|---|---|---|
| Potable Water | 356 | 6 | 2 |
| Waste Water | 214 | 4 | 1 |
| Natural Gas | 142 | 1 | 0 |
| Oil | 0 | 0 | 0 |

Table 9: Expected Potable Water and Electric Power System Performance

| | Total # of Households | Number of Households without Service | | | | |
|---|---|---|---|---|---|---|
| | | At Day 1 | At Day 3 | At Day 7 | At Day 30 | At Day 90 |
| Potable Water | 3,889 | 0 | 0 | 0 | 0 | 0 |
| Electric Power | | 0 | 0 | 0 | 0 | 0 |

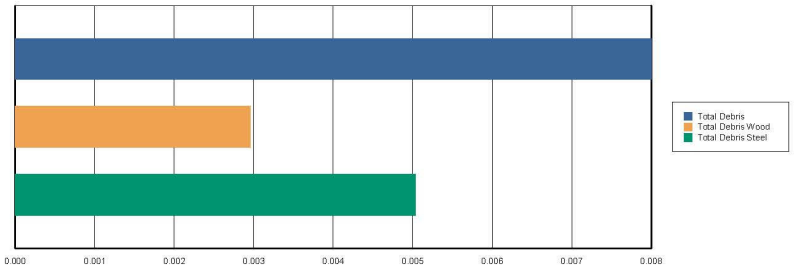
## Induced Earthquake Damage

### Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.01 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 37.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 320 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

**Earthquake Debris (millions of tons)**



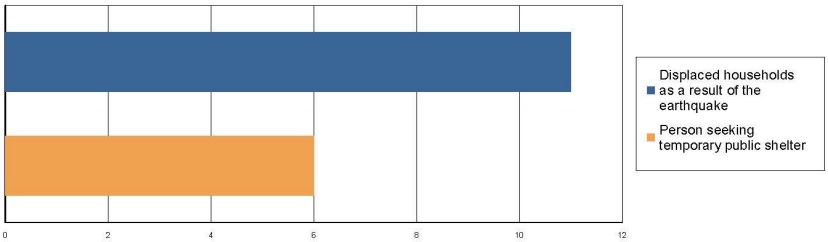

| Brick/ Wood | Reinforced Concrete/Steel | Total Debris | Truck Load |
|---|---|---|---|
| 0.00 | 0.01 | 0.01 | 320 (@25 tons/truck) |

## Social Impact

### Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 11 households to be displaced due to the earthquake. Of these, 6 people (out of a total population of 9,225) will seek temporary shelter in public shelters.

**Displaced Households/ Persons Seeking Short Term Public Shelter**




| Displaced households as a result of the earthquake | Persons seeking temporary public shelter |
|---|---|
| 11 | 6 |

### Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

HAZUS MH EARTHQUAKE • WIND • FLOOD

FEMA

Table 10: Casualty Estimates

| | | Level 1 | Level 2 | Level 3 | Level 4 |
|---|---|---|---|---|---|
| 2 AM | Commercial | 0 | 0 | 0 | 0 |
| | Commuting | 0 | 0 | 0 | 0 |
| | Educational | 0 | 0 | 0 | 0 |
| | Hotels | 0 | 0 | 0 | 0 |
| | Industrial | 0 | 0 | 0 | 0 |
| | Other-Residential | 2 | 0 | 0 | 0 |
| | Single Family | 2 | 0 | 0 | 0 |
| | **Total** | **4** | **0** | **0** | **0** |
| 2 PM | Commercial | 3 | 0 | 0 | 0 |
| | Commuting | 0 | 0 | 0 | 0 |
| | Educational | 1 | 0 | 0 | 0 |
| | Hotels | 0 | 0 | 0 | 0 |
| | Industrial | 1 | 0 | 0 | 0 |
| | Other-Residential | 0 | 0 | 0 | 0 |
| | Single Family | 0 | 0 | 0 | 0 |
| | **Total** | **5** | **1** | **0** | **0** |
| 5 PM | Commercial | 2 | 0 | 0 | 0 |
| | Commuting | 0 | 0 | 0 | 0 |
| | Educational | 0 | 0 | 0 | 0 |
| | Hotels | 0 | 0 | 0 | 0 |
| | Industrial | 0 | 0 | 0 | 0 |
| | Other-Residential | 1 | 0 | 0 | 0 |
| | Single Family | 1 | 0 | 0 | 0 |
| | **Total** | **4** | **1** | **0** | **0** |

HAZUS MH EARTHQUAKE • WIND • FLOOD

FEMA

## Economic Loss

The total economic loss estimated for the earthquake is 40.06 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

HAZUS MH EARTHQUAKE • WIND • FLOOD

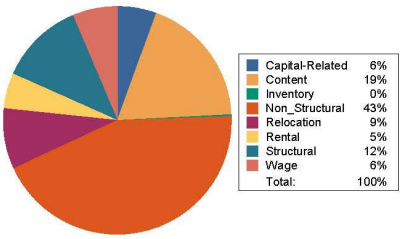
FEMA

**Building-Related Losses**

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 30.79 (millions of dollars); 26 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 58 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)




Earthquake Losses by Occupancy Type ($ millions)

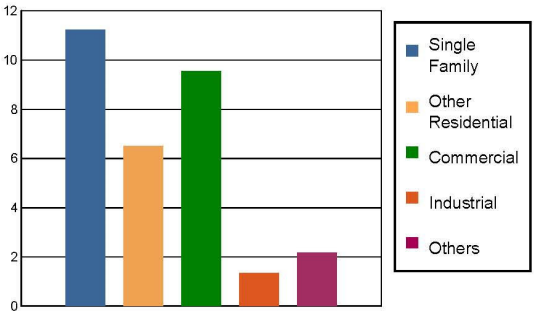



**Table 11: Building-Related Economic Loss Estimates**

(Millions of dollars)

| Category | Area | Single Family | Other Residential | Commercial | Industrial | Others | Total |
|---|---|---|---|---|---|---|---|
| **Income Losses** | | | | | | | |
| | Wage | 0.00 | 0.44 | 1.40 | 0.02 | 0.10 | 1.96 |
| | Capital-Related | 0.00 | 0.19 | 1.49 | 0.02 | 0.02 | 1.71 |
| | Rental | 0.26 | 0.66 | 0.54 | 0.01 | 0.06 | 1.53 |
| | Relocation | 0.92 | 0.54 | 0.79 | 0.09 | 0.35 | 2.69 |
| | **Subtotal** | **1.19** | **1.82** | **4.22** | **0.14** | **0.53** | **7.90** |
| **Capital Stock Losses** | | | | | | | |
| | Structural | 1.37 | 0.84 | 0.94 | 0.19 | 0.31 | 3.66 |
| | Non_Structural | 6.11 | 3.09 | 2.77 | 0.58 | 0.84 | 13.39 |
| | Content | 2.56 | 0.75 | 1.57 | 0.38 | 0.49 | 5.74 |
| | Inventory | 0.00 | 0.00 | 0.04 | 0.06 | 0.01 | 0.10 |
| | **Subtotal** | **10.04** | **4.68** | **5.32** | **1.21** | **1.64** | **22.89** |
| | **Total** | **11.22** | **6.50** | **9.53** | **1.36** | **2.17** | **30.79** |

HAZUS MH EARTHQUAKE • WIND • FLOOD

FEMA

## Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

**Table 12: Transportation System Economic Losses**
(Millions of dollars)

| System | Component | Inventory Value | Economic Loss | Loss Ratio (%) |
|---|---|---|---|---|
| Highway | Segments | 1,066.89 | $0.00 | 0.00 |
| | Bridges | 457.80 | $4.40 | 0.96 |
| | Tunnels | 0.00 | $0.00 | 0.00 |
| | Subtotal | **1,525** | **4.40** | |
| Railways | Segments | 182.17 | $0.00 | 0.00 |
| | Bridges | 0.00 | $0.00 | 0.00 |
| | Tunnels | 0.00 | $0.00 | 0.00 |
| | Facilities | 0.00 | $0.00 | 0.00 |
| | Subtotal | **182** | **0.00** | |
| Light Rail | Segments | 0.00 | $0.00 | 0.00 |
| | Bridges | 0.00 | $0.00 | 0.00 |
| | Tunnels | 0.00 | $0.00 | 0.00 |
| | Facilities | 0.00 | $0.00 | 0.00 |
| | Subtotal | **0** | **0.00** | |
| Bus | Facilities | 0.00 | $0.00 | 0.00 |
| | Subtotal | **0** | **0.00** | |
| Ferry | Facilities | 0.00 | $0.00 | 0.00 |
| | Subtotal | **0** | **0.00** | |
| Port | Facilities | 0.00 | $0.00 | 0.00 |
| | Subtotal | **0** | **0.00** | |
| Airport | Facilities | 10.65 | $1.40 | 13.11 |
| | Runways | 37.96 | $0.00 | 0.00 |
| | Subtotal | **49** | **1.40** | |
| | **Total** | **1,755.50** | **5.80** | |

HAZUS MH EARTHQUAKE • WIND • FLOOD

FEMA

**Table 13: Utility System Economic Losses**

(Millions of dollars)

| System | Component | Inventory Value | Economic Loss | Loss Ratio (%) |
|---|---|---|---|---|
| Potable Water | Pipelines | 0.00 | $0.00 | 0.00 |
| | Facilities | 0.00 | $0.00 | 0.00 |
| | Distribution Lines | 7.10 | $0.03 | 0.39 |
| | **Subtotal** | **7.12** | **$0.03** | |
| Waste Water | Pipelines | 0.00 | $0.00 | 0.00 |
| | Facilities | 65.30 | $3.41 | 5.23 |
| | Distribution Lines | 4.30 | $0.02 | 0.46 |
| | **Subtotal** | **69.54** | **$3.43** | |
| Natural Gas | Pipelines | 0.00 | $0.00 | 0.00 |
| | Facilities | 0.00 | $0.00 | 0.00 |
| | Distribution Lines | 2.80 | $0.01 | 0.20 |
| | **Subtotal** | **2.85** | **$0.01** | |
| Oil Systems | Pipelines | 0.00 | $0.00 | 0.00 |
| | Facilities | 0.10 | $0.01 | 8.37 |
| | **Subtotal** | **0.10** | **$0.01** | |
| Electrical Power | Facilities | 0.00 | $0.00 | 0.00 |
| | **Subtotal** | **0.00** | **$0.00** | |
| Communication | Facilities | 0.00 | $0.00 | 0.00 |
| | **Subtotal** | **0.00** | **$0.00** | |
| | **Total** | **79.60** | **$3.47** | |

HAZUS MH EARTHQUAKE • WIND • FLOOD

FEMA

**Appendix A: County Listing for the Region**

Grand,UT

HAZUS MH EARTHQUAKE • WIND • FLOOD

FEMA

**Appendix B: Regional Population and Building Value Data**

| State | County Name | Population | Building Value (millions of dollars) | | |
|---|---|---|---|---|---|
| | | | Residential | Non-Residential | Total |
| **Utah** | | | | | |
| | Grand | 9,225 | 796 | 249 | 1,046 |
| **Total State** | | **9,225** | **796** | **249** | **1,046** |
| **Total Region** | | **9,225** | **796** | **249** | **1,046** |

# Grand County Pre-Disaster Hazard Mitigation Plan 2018

## APPENDIX 4

## Environmental Considerations

Natural disasters are any major, adverse event which occurs from the natural meteorological, hydrologic, or geologic processes of the Earth. These events can include floods, severe weather, volcanic eruptions, and earthquakes. Any natural disaster can result in loss of life or property damage, often with concomitant economic damage. The affected population's resilience or ability to recover will impact the severity of any economic damage.

Natural disasters are an integral part of the environment's capacity to maintain balance. Over millions of years, the processes of wind, water, and geology have shaped Utah as we know it, and they will continue to do so—affecting humans and their structures. This meeting of natural events and human communities is what constitutes a natural disaster, and while modern engineering has made it possible to mitigate some of the effects of natural disasters, the potential for economic and environmental costs can be high. Human tampering with natural systems can also create an imbalance in the environment which might create problems in the future which cannot yet be seen. As such, it seems living with a small amount of risk (respecting the natural processes as much as possible), rather than constructing mitigation for every eventuality, might be best in the long run.

In order to work harmoniously with the environment, nature's own mitigation measures need to be identified, protected and/or strengthened. In addition, all applicable city codes, county codes, and state and federal laws pertaining to the environment must be followed, doing the utmost to ensure that our environment is not harmed through mitigation measures. In the main, mitigation programs proposed in this plan will be funded through federal, state, or local programs/funding. During the planning process, the following acts were evaluated, and their consideration and incorporation was deemed necessary while organizing and implementing the PDM plan.

<u>The Clean Air Act (CAA) 1970:</u> The Clean Air Act is the comprehensive Federal Law that covers the entire country under the Environmental Policy Act (EPA) regulating air emissions from area, stationary, and mobile sources. This law sets limits or National Ambient Air Quality Standards (NAAQS) on how much of a pollutant can be in the air anywhere in the United States, this controls the emissions of air pollutants. These limits ensure that all Americans have the same basic health and environmental protections. Maximum pollutant standards were set, and states may have stronger pollution controls on an individual basis, but not weaker pollution controls than those set for the whole country.

Each state explains how it will do its job under the Clean Air Act by developing a

mandated "state implementation plan" (SIP) that must be approved by EPA. The 1977 amendment was to set new dates for areas of the country that failed to meet the initial deadlines for achieving NAAQS. The 1990 amendments addressed problems such as acid rain, ground-level ozone, stratospheric ozone depletion, and air toxics. This act required that facilities with copious amounts of certain hazardous chemicals to have special emergency planning requirement; based on a facilities potential threat or risk from chemical spills, fires, explosions, etc. A Risk Management Plan (RMP) is prepared that includes hazard identification, assessments, design, and maintenance of a safe facility; necessary steps to prevent releases and ways to minimize the consequences from an accidental release (Clean Air).

The Clean Water Act (CWA): The Federal Water Pollution Control Act Amendments of 1972 came about because of the growing awareness for controlling water pollution. As amended in 1977, this law became known as the Clean Water Act whose mission is to establish the basic structure for regulating discharges of pollutants into the waters of the United States, and to reduce and maintain the chemical, biological, and physical veracity. The act gave the Environmental Protection Agency (EPA) the authority to set wastewater standards for industry.

The act also required that each state adopt water quality standards, act to protect wetlands, and limit industrial and municipal discharges into navigable waters unless permitted. It funded the construction of wastewater treatment plants for nearly every city in the United States, under construction grant programs from the EPA and recognized the need for planning for future problems that posed a threat from nonpoint source pollution (Clean Water).

Endangered Species Act of 1973: This act provides a plan for the protection of threatened and endangered plants and animals and the habitats in which they are found. Congress finds and declares that various species of fish, wildlife, and plants in the United States have been caused to become extinct, or are so depleted in numbers they are in danger of becoming extinct, because of economic development and expansion without adequate concern for conservation. Aesthetic, ecological, educational, historical, recreational, and scientific importance come from these species and are a value to our nation and its people.

The U.S. will conserve, to a practicable extent, the species that face extinction and will encourage the States through federal assistance to develop and maintain conservation programs. The reason for the Act is to provide a means in which ecosystems with endangered and threatened species will be conserved. It is also declared that all state and local agencies resolve water resource issues in connections with conservation of endangered species (Endangered).

Floodplain Management Policy: The main points of the policy are to reduce the loss of life and property and the disruption of societal and economic pursuits caused by

flooding or facility operations as well as to restore, sustain, and enhance the natural resources, ecosystems, and other functions of the floodplains. Activities will search for a balance between the, sometimes competing, uses of floodplains in a way that makes the most benefit to society. To pursue and encourage appropriate use of floodplains and to avoid long and short term negative impacts associated with the inhabitants and modification of floodplains and to avoid direct and indirect support of floodplain development, whenever there is a practicable alternative.

"Functions (Natural) of floodplains include natural moderation of floods; fish, wildlife, and plant resources and habitat; groundwater recharge; and water quality maintenance. Uses of floodplains include the following: storm water management, erosion control, open space, natural beauty, opportunity for scientific study, outdoor education, recreation, and cultural preservation, and compatible economic utilization of floodplain resources by human society" (Floodplain, Reclamation).

National Historic Preservation Act of 1966: This act was found and declared by Congress because "the spirit and direction of the Nation are founded upon and reflected in its historic heritage…the historical and cultural foundations of the Nation should be preserved as a living part of our community life and development to give a sense of orientation to the American people." Some of the other main points of the act include the awareness of historic properties that are being lost or substantially altered. The preservation will continue a legacy of cultural, educational, aesthetic, inspirational, economic, and energy benefits for future generations.

The knowledge of historic resources and the encouragement of their preservations will improve the planning and execution of federal and federally assisted projects and will assist economic growth and development. The act would like to use measures that will foster conditions in which historic resources can exist in productive harmony with present and future generations (National). Section 106 of NHPA "requires all Federal agencies to take into account the effects of their actions on historic properties, and that provide the Advisory Council on Historic Preservation (ACHP) with a reasonable opportunity to comment on those actions and the manner in which Federal agencies are taking historic properties into account in their decisions" beginning at the early stages of planning to mitigate any adverse effects on historic properties (Section 106).

Utah's Noxious Weed Control Act, July 2008: was established to provide a means to control destructive noxious weeds. The act goes hand in hand with helping to prevent wildfires as well as control insects that are both destructive to our economic and environmental landscapes. The invasive noxious weeds can spread rapidly causing enormous economic losses. It is reported that millions of acres in North America have been invaded or are at risk of being invaded by weeds which include destruction of cropland, pastures, rangelands, forests, wilderness areas, national parks, recreation sites, wildlife management areas, transportation corridors, waterways, wetlands, parks, golf courses, even yards and gardens. The Utah Weed

Control Association reports that the spread of noxious weeds is spreading at a rate of more than 4,600 acres per day on federal lands in the United States.

Noxious weeds can cause damage to watersheds and increase soil erosion leaving the land permanently damaged. The economic losses from weeds exceed $20 billion annually in the United States, and the cost continues to grow. The mitigation efforts in each county help protect and preserve our lands.

**Utah's Noxious Weed List:** Weeds are prioritized into four levels. effective December 2017 under the Rule R68-9. Authority R689-9-1, Designation and Publication of State Noxious Weeds
*Source: Utah Office of Administrative Rules, https://rules.utah.gov/publicat/code/r068/r068-009.htm.*

Class 1A: Early Detection Rapid Response (EDRR) Watch List Declared noxious and invasive weeds not native to the state of Utah and not known to exist in the State that pose a serious threat to the state and should be considered as a very high priority.

| | |
|---|---|
| Common crupina | Crupina vulgaris |
| African rue | Peganum harmala |
| Small bugloss | Anchusa arvensis |
| Mediterranean sage | Salvia aethiopis |
| Spring millet | Milium vernale |
| Ventenata (North Africa grass) | Zygophyllum fabago |
| Plumeless thistle | Ventenata dubia |
| Malta starthistle | Carduus acanthoides |
| Syrian beancaper | Centaurea melitensis |

Class 1B: (Control) Declared noxious weeds not native to the state of Utah, which pose a threat to the state and should be considered a high priority for control.

| | |
|---|---|
| Camelthorn | Alhagi maurorum |
| Garlic | Alliaria petiolata |
| Purple starthistle | Centaurea calcitrapa |
| Goatsrue | Galega officinalis |
| African mustard | Brassica tournefortii |
| Giant reed | Arundo donax |
| Japanese knotweed | Polygonum cuspidatum |
| Blueweed (Vipers bugloss) | Echium vulgare |
| Elongated mustard | Brassica elongata |
| Common St. Johnswort | Hypericum perforatum |
| Oxeye daisy | Leucanthemum vulgare |
| Cutleaf vipergrass | Scorzonera laciniata |

Class 2: (Control) Declared noxious and invasive weeds not native to the state of Utah, that pose a threat to the state and should be considered a high priority for control. Weeds listed in the control list are known to exist in varying populations throughout the state. The concentration of these weeds is at a level where control or eradication may be possible.

| | |
|---|---|
| Leafy spurge | Euphorbia esula |
| Medusahead | Taeniatherum caput-medusae |
| Rush skeletonweed | Chondrilla juncea |
| Spotted knapweed | Centaurea stoebe |
| Purple loosestrife | Lythrum salicaria |
| Squarrose knapweed | Centaurea virgata |
| Dyers | Isatis tinctoria |
| Yellow starthistle | Centaurea solstitialis |
| Yellow toadflax | Linaria vulgaris |
| Diffuse knapweed | Centaurea diffusa |
| Black henbane | Hyoscyamus niger |
| Dalmation toadflax | Linaria dalmatica |

Class 3: (Containment) Declared noxious and invasive weeds not native to the State of Utah that are widely spread. Weeds listed in the containment noxious weeds list are known to exist in various populations throughout the state. Weed control efforts may be directed at reducing or eliminating new or expanding weed populations. Known and established weed populations, as determined by the weed control authority, may be managed by any approved weed control methodology, as determined by the weed control authority. These weeds pose a threat to the agricultural industry and agricultural products.

| | |
|---|---|
| Russian knapweed | Acroptilon repens |
| Houndstounge | Cynoglossum officianale |
| Perennial pepperweed | Lepidium latifolium |
| (Tall whitetop) | |
| Phragmites (Common reed) | Phragmites australis ssp. |
| Tamarisk(Saltcedar) | Tamarix ramosissima |
| Hoary cress | Cardaria spp. |
| Canada thistle | Cirsium arvense |
| Poison hemlock | Conium maculatum |
| Musk thistle | Carduus nutans |
| Quackgrass | Elymus repens |
| Jointed goatgrass | Aegilops cylindrica |
| Bermudagrass* | Cynodon dactylon |
| Perennial Sorghum spp | including but not limited to Johnson Grass (Sorghum halepense and almum) |

| | |
|---|---|
| Scotch thistle (Cotton thistle) | Onopordum acanthium |
| Field bindweed | Convolvulus spp. |
| (Wild Morning-glory) | |

* Bermudagrass *Cynodon dactylon :* shall not be a noxious weed in Washington County and shall not be subject to provisions of the Utah Noxious Weed Law within the boundaries of that county. It shall be a noxious weed throughout all other areas of the State of Utah and shall be subject to the laws therein.

Class 4: (Prohibited) Declared noxious and invasive weeds, not native to the state of Utah, that pose a threat to the state through the retail sale or propagation in the nursery and greenhouse industry. Prohibited noxious weeds are annual, biennial, or perennial plants that the commissioner designates as having the potential or are known to be detrimental to human or animal health, the environment, public roads, crops, or other property.

| | |
|---|---|
| Cogongrass (Japanese blood grass) | Imperata cylindrica |
| Myrtle spurge | Euphorbia myrsinites |
| Dames Rocket | Hesperis matronalis |
| Scotch broom | Cytisus scoparius |

Each county in Utah may have different priorities regarding specific State Designated Noxious Weeds and is therefore able to reprioritize these weeds for their own needs.

# Grand County Pre-Disaster Hazard Mitigation Plan 2018

## APPENDIX 5

## General Mitigation Strategies

**Section 1. Mitigation Categories**

For the purpose of this mitigation plan, the mitigation strategies were divided into one of six categories according to how they accomplish mitigation. Below are the categories with examples; following, in **Section 2,** the regional natural hazard mitigation strategies are addressed using this categorization.

A. *Emergency Services*

B. *Natural Resource Protection*

C. *Prevention*

D. *Property Protection*

E. *Public Information and Involvement*

F. *Structural Protection*

*A.* Emergency Service: Emergency Services protect people during and after a disaster.

Examples include:

- Mutual aid agreements
- Protection of critical facilities
- Health and safety maintenances
- Inventory of assets
- EMS/Police/Fire response and skill

*B.* Natural Resource Protection: Natural Resource Protection includes strategies that preserve or restore natural areas or the natural function that an area provides.

Examples include:

- Wetlands protection
- Pollution reduction

- Erosion and sediment control
- Fuels reduction
- Watershed maintenance

*C.* Prevention: Prevention measures are intended to prevent the problem from occurring and/or keep it from getting worse.

Examples include:

- Planning, zoning, and ordinance regulations
- Open space preservation
- Floodplain and wetland development regulations
- Storm water management
- Minimum set back requirements
- Evacuation plans

*D.* Property Protection: Property Protection measures are used to modify buildings within high-risk areas in an attempt to reduce damage. For the most part property protection measures do not affect a buildings appearance of use making them less expensive and particularly suitable for historical sites and landmarks.

Examples include:

- Utility relocation
- Burying or flood proofing
- Non-structural earthquake mitigation
- Backup protections
- Insurance and other monetary loss minimization actions
- Technical evaluations and mapping

*E. Public Information and Involvement: Public Information and Involvement activities are intended to advise property owners, potential property owners, and visitors about the particular hazards associated with a property and ways to protect people and property from these hazards.*

Examples include:

- Education
- NFIP
- URWIN areas
- Hazard Identification
- Maps with high hazard locations identified
- Informational mailings
- Workshops
- Real Estate disclosures for natural hazards
- Real Estate insurance

*F.* Structural Protection/Projects: are man-made structures, which prevent damage from impacting property.

Examples include:

- Detention/Retention basins
- Larger culverts
- Elevated seismic design
- Floodwalls
- Debris basins
- Landslide stabilization and levees

**Section 2. General Mitigation Strategies**

**Flood/ Riverine Mitigation**

Generic Mitigation: The following are generic mitigation strategies appropriate for addressing the hazard of flooding. Many of these strategies are expanded upon in the text that follows.

- Avoidance, land-use planning and zoning ordinances
- Better flood routing through communities

- Annual warning of risk information on how to protect property and lives
- Flood insurance awareness, emphasis, and marketing
- Projects such as levees/dams
- Funding by a storm water tax in cooperation with Federal and State programs
- Additional SNOwpack TELemetry (SNOTEL) sites and enhanced instrumentation
- Protection of roads and bridges
- Greater reservoir capacities
- Curtail development in flood-prone areas
- General infrastructure protection
- Develop river corridor parkways
- Protection of wastewater treatment facilities from excessive inflows
- Protection of drinking water supply systems
- Gather hazard and risk data/information
- Development of improved mitigation techniques
- Education of local officials, developers, and citizens
- Protecting natural floodplain resources
- Good watershed management

*A. Emergency Services*

Flood Warning: Warning systems designed to alert residence of rising floodwaters. Warning systems can disseminate the information through many means such as sirens, radio, television, mobile public-address system, reverse 911, or door-to-door contact. Multiple or redundant warning systems are most effective, giving people more than one opportunity to be warned.

Flood Response: Flood response refers to the actions that are taken to prevent or reduce damage once a flood starts, and example of flood response is the turning of State Street into a river during the 1983 flood event. Many of the below actions should be part of an emergency response plan EOP developed in coordination with the agencies that share responsibilities. The EOP once developed should be exercised and continually evaluated so when the plan is needed key players know what to do. Flood response actions might include:

- Activation of the emergency operations center
- Sandbagging designated areas
- Closing streets and bridges
- Shutting off power to threatened areas
- Releasing children from school
- Ordering an evacuation
- Opening evacuation shelters

Critical Facilities Protection: Protecting critical facilities is vital, yet this protection draws workers and resources away from protecting other parts of a town or county. For this reason, listed below are vital facilities and facilities with the potential of causing a

secondary disaster if destroyed. It is important to keep these locations in mind with considering potential mitigation projects.
Facilities or locations vital to flood response efforts:

- Emergency operations centers
- Police and fire stations
- Hospitals
- Highway garages
- Selected roads and bridges
- Evacuation routes

Facilities and locations, which if flooded would create a secondary disaster, applicable to all disasters:

- Facilities housing hazardous materials
- Wastewater treatment plants
- Schools
- Nursing homes

Health and Safety Maintenance: Response to floods or other natural disasters should include measures to prevent damage to health and safety such as:

- Patrolling evacuated areas to prevent looting
- Providing safe drinking water
- Vaccination of residents for tetanus
- Clearing streets
- Cleaning up debris

Many of these recommendations should be integrated into a public information program to educate citizens on the benefits of health and safety precautions.

*B. Natural Resource Protection*

Wetlands Protection: Wetlands are capable of storing copious amounts of floodwater, slowing and reducing downstream flows, and filtering the water. Any development that is proposed in a wetland is regulated by either federal and/or state agencies. Mitigation techniques are often employed, which might consist of creating a wetland on another site to replace what would be lost through the development. This is not an ideal practice, however, since it takes many years for a new wetland to achieve the same level of quality as an existing one.

Erosion and Sedimentation Control: Controlling erosion and sediment runoff during construction and on farmland is important, since eroding soil will typically end up in downstream waterways. Sediment tends to settle where the water flow is slower, it will gradually fill in channels and lakes, reducing their ability to carry or store floodwaters. Sediment and erosion control have two principal components: minimize erosion with vegetation and capture sediment before it leaves the site. Slowing runoff increases infiltration into the soil, thereby controlling the loss of topsoil from erosion and the

resulting sedimentation. Runoff and erosion control can be done through vegetation, terraces, contour strip farming, no-till farm practices, and impoundments.

*C. Prevention*

Planning and Zoning: Land use plans are put in place to guide future development, they recommend where development should and should not take place. Sensitive and vulnerable lands can be designated for uses that would not be incompatible with occasional flood events. The zoning ordinances can regulate development in these sensitive areas by limiting or preventing some or all development.

Open Space Preservation: Preserving open space is the best way to prevent flooding and flood damage. Open space preservation should not be limited to the flood plain. Other areas within the watershed may contribute to controlling the runoff that exacerbates flooding.

Floodplain Development Regulations: Floodplain development regulations typically do not prohibit development in the special flood hazard areas, but they do impose construction standards on what is built there. The intent is to protect roads and structures from flood damage and to prevent the development from aggravating the flood potential. Floodplain development regulations are generally incorporated into subdivision regulations, building codes, and/or floodplain ordinances.

Subdivision regulations: These regulations govern how land will be divided into separate lots or sites. In some Utah cities these are known as Site Based Ordinances.

Building Codes: Standards can be incorporated into building codes that address flood proofing from all new and improved or repaired buildings.

Floodplain Ordinances: Communities that participate in the National Flood Insurance Program NFIP are required to adopt the minimum floodplain management regulations, as developed by FEMA. The regulations set minimum standards for subdivision regulations and building codes. Communities may adopt more stringent standards than those set forth by FEMA.

Storm Water Management: Development outside of a floodplain can contribute significantly to flooding by covering impervious surfaces, which increase storm water runoff. Storm water management is usually addressed in subdivision regulations. Developers are typically required to build retention or detention basins to minimize any increase in runoff caused by new or expanded impervious surfaces, or new drainage systems. Larger cities and counties within Utah enforce an ordinance prohibiting storm water from leaving a site at a rate higher than it did before the development.

Drainage System Maintenance: Ongoing maintenance of channel and detention basins is necessary if these facilities are to function effectively and efficiently over time. A maintenance program should include regulations that prevent dumping in or altering watercourses or storage basins; regarding and filling should also be regulated.

*D. Property Protection*

Relocation: Moving structures out of the floodplain are the surest and safest way to protect against damage. Relocation is expensive, so this approach will probably not be used except in extreme circumstances.

Acquisition: Acquisition by governmental entity of land in a floodplain serves two main purposes: it ensures that the problem structure is addressed; and it has the potential to convert problem areas into community assets

Building Elevation: Elevating a building above the base flood elevation is the best on-site protection strategy. The building could be raised to allow water to run underneath it, or fill could by brought in to elevate the site on which the building sits.

Insurance: Above and beyond standard homeowner's insurance, there is other coverage a homeowner can purchase to protect against flood hazard. Although this doesn't mitigate the problem it does allow the homeowner to shift the monetary loss/risk onto another party. Two of the most common insurances offered against flood loss are:

- National Flood Insurance: when a community participates in the NFIP, any local insurance agent can sell separate flood insurance policies under rules and rates set by FEMA. Rates do not change after claims are paid because they are set on a national basis.
- Basement Backup Insurance: National Flood Insurance offers an additional deductible for seepage and sewer backup, provided there is a general condition of flooding in the area that was the proximate cause of the basement getting wet.

*E. Public Information and Involvement*

Outreach Programs: Outreach projects are proactive; giving the public information even if they have not asked for it. Outreach projects should be designed to encourage people to seek out more information and take steps to protect themselves and their properties. Examples include:

- Mass mailing or newsletters to all residents
- Notices directed to high risk area residents
- Displays in public buildings
- Newspaper articles and special sections
- Radio and TV news releases and interviews
- A detailed property owner's handbook tailored for local conditions
- Presentations at meetings and neighborhood groups

Real Estate Disclosure: Disclosure of information regarding flood or hazard prone properties is important if potential buyers are to be able to mitigate damage. Federally regulated lending institutions are required to advise applicant that a property is in the floodplain. However, this requirement needs to be met only five days prior to closing, and by that time, the applicant is typically committed to the purchase. This only includes flood prone areas, at the exclusion of other hazards.

Map Information: Flood plain maps developed by FEMA outline the boundaries or the flood hazard areas. These maps can be used by anyone interested in a property to determine if it is in the floodplain. These maps are available from FEMA, the Utah Division of Emergency Management, and at many city and county planning offices. In addition, the Utah Geologic Survey creates and maintains maps illustrating geologic hazards. These maps are available for sell at the Division of Natural Resources books store.

*F. Structural Projects*

The intent behind structural projects for flood mitigation is to prevent floodwaters from reaching properties. The shortcomings of almost all structural mitigation projects are that:

- They can be very expensive
- They disturb the land, disrupt natural water flows, and destroy natural habitats.
- They are built to an anticipated flood event, and maybe exceeded by a greater-than-expected flood.
- They can create a false sense of security

Reservoirs: Reservoirs control flooding by holding water behind dams or in storage basins. After a flood peaks, water is released or pumped out slowly at a rate the river downstream can handle. Reservoirs are expensive to build, occupy large tracts of land, require maintenance, and if they fail often result in greater downstream flooding than would occur during a natural flooding event.

Levees/Floodwalls: One of the best-known structural flood control measure levees and floodwalls are steel or concrete structures placed between the watercourse and the land.

Diversions: A diversion is simply a new channel that sends floodwaters to a different location, thereby reducing flooding along an existing watercourse. Diversions structures can consist of surface channels, overflow weirs, or tunnels. During normal flows, the water stays in the old channel but during flooding events floodwaters spill over into the diversion channel.

Channel Modifications: Channel modifications include making a channel wider, deeper, smoother, or straighter. Common channel modifications include:

- Dredging: Dredging is often cost-prohibitive because the dredged material must be disposed of somewhere else, and dredged streams usually fill back in with sediment.
- Drainage Modifications: These include man-made ditches and storm sewers that help drain areas where the surface drainage system is inadequate or where underground drainage ways may be safer or more attractive.

Storm Water Management: Mitigation techniques for managing storm water include installing storm water systems, enlarging pipes, and street improvements in existing storm water systems.

**Earthquakes**

Generic Mitigation is a list of generic earthquake mitigation strategies pertaining to secondary threats often associated with earthquakes.

Generic Ground Shaking Mitigation

- Understand peak horizontal acceleration and recurrence interval
- Design appropriately
- Zoning ordinances and building codes

Generic Liquefaction Mitigation

- Move soil out
- Density soils in place
- Remove ground water
- Structural design

Generic Surface Fault Rupture Mitigation

- Avoidance
- Zoning ordinances
- Earthquake resistant building design codes
- Retrofitting of critical facilities and supporting equipment
- Retrofitting under-designed buildings
- Annual warning of risk/info on how to protect property and lives
- Projects to seismically upgrade critical public facilities/utilities and shelters
- Gather hazard and risk data/information
- Protection of roads and bridges
- General infrastructure protection
- Development of improved mitigation techniques
- Education of local officials, developers, and citizens

*A. Emergency Services*

Emergency Operations Planning: Maintain an earthquake response plan to account for secondary problems, such as fire and hazardous material spills.

Critical Facilities Protection: Protecting critical facilities are vital as the facilities play a significant role in coordinating response and recovery following an earthquake. For this reason, listed below are vital facilities and facilities with the potential of causing a secondary disaster if destroyed.

- Facilities or locations vital to earthquake response efforts
- Emergency operations centers
- Police and fire stations
- Hospitals
- Highway garages
- Selected roads and bridges
- Evacuation routes

Facilities and locations, which if destroyed would create a secondary disaster:

- Facilities housing hazardous materials
- Wastewater treatment plants
- Schools
- Nursing homes

*B. Natural Resource Protection*

- Design of pipelines
- Land-use planning
- Community master plans and zoning ordinances

*C. Prevention*

While earthquakes are not preventable proper planning, zoning, and building codes can prevent much of the damage common with earthquakes. Planning, zoning, and building codes should address minimums setbacks, critical facility locations, steep slopes, areas with liquefiable soils, and insure high factor of safety ratings for critical facilities. Community master plans and zoning ordinances define hazard areas and require developers to show that any existing hazards have been investigated and new construction will not be exposed to unacceptable risk.

*D. Property Protection*

Nonstructural Mitigation: Nonstructural mitigation consist of mitigation measures that do not affect the overall look or purpose of the building yet prevent damage to non-structural aspects and lessen the loss of life. In addition, buildings with non-structural mitigation are frequently usable after an event.

- Tie downs
- Flexible utility connections
- Mylar film on windows to prevent the glass from shattering
- Added bracing.

Retrofitting: consists of upgrading the seismic safety of a building through structural and nonstructural mitigation techniques.

Insurance: Above and beyond standard homeowner's insurance, there is other coverage a homeowner can purchase to protect against earthquake hazard, something not covered under most homeowner's insurance plans. Although this doesn't mitigate the problem it does allow the homeowner to shift the monetary loss/risk onto another party.

*E. Public Information and Involvement*

Public information and involvement for earthquakes is like the mitigation strategies outlined in the flood and riverine section mentioned above.

Real Estate Disclosure: Disclosure of information regarding earthquakes and hazard prone properties are important if potential buyers can mitigate damage. Unlike floodplains there are no federal laws, which require disclosure of earthquakes.

*F. Structural Protection*

Mitigation measures can be any type of activity that reduces the likelihood or modifies what is at risk from the hazard. Earthquake mitigation can be accomplished through building codes that ensure safe and adequate construction including earthquake resistant designs and construction. Older building should be retrofitted to comply with the codes.

**Dam Failure**

Generic Mitigation

- Proper floodplain maps, including dam breach flood potential
- Public knowledge of floodplains for the public and emergency managers
- Updated Emergency Operation Plans (EOP) integration with GIS Systems
- Maintain proper floodplain/ wetland geometry and vegetation for flood routing
- Floodplain usage compatible with floodplain needs
- More debris dams; they help to maintain flooding, debris, and mud
- Flood control pool in existing dams
- Protection of roads and bridges
- General infrastructure protection

- More authority to order releases and better forecasting would help in snowmelt floods and runoff
- Gather hazard and risk data/information
- Development of improved mitigation techniques
- Education of local officials, developers, and citizens

*A. Emergency Service*

- Good emergency management and emergency action plans
- Dam conditioning monitoring
- Warning system and monitoring
- Understand standard operating procedures

*C. Natural Resource Protection*

- Zoning of downstream usage
- Risk assessment
- Good watershed management

*C. Prevention*

- Dam failure inundation maps
- Planning/zoning/open space preservation to keep downs stream areas clear
- Building codes with flood elevations based on dam failure
- Dam safety inspections
- Draining the reservoir when conditions appear unsafe

*D. Property Protection*

- Acquisition of building in the path of a dam breach flood
- Flood insurance

*E. Public Information and Involvement*

- Communication and education of dam owners
- Communication and education with the public
- Evacuation procedures

*F. Structural Protection*

- Dam improvements
- Spillway enlargements
- Remove unsafe dams
- Design and construction review

- Direction for consulting engineers
- Instrumentations and monitoring of dams
- Remedial repair procedures
- Incremental damage assessment

**Wildfire**

Generic Wildfire Mitigation

- Avoidance
- Define, create, and maintain a defensible space
- Plant drought and fire-resistant vegetation
- Ordinances
- Modification of fuel loading in high hazard interface areas
- Wildland fire training and experience for fire department personnel
- Public education effort for people living in the interface
- Additional suppression equipment needs of fire departments and the Utah Division of Forestry, Fire, and State Lands
- Fuel modification in moderate hazard interface areas
- Protection of roads and bridges
- Annual warning of risk/info on how to protect life and property
- Gather hazard and risk data/information
- General infrastructure protection
- Development of improved mitigation techniques
- Education of local officials, developers, and citizens
- Protection of drinking water supply systems

*A. Emergency Service*

- Fire fighting

*B. Natural Resource Protection*

- Prohibit development in high-risk areas.
- Vegetation control

*C. Prevention*

- Zoning ordinances to reflect fire risk zones
- Planning and zoning to restrict development in areas near fire protection and water resources
- Requiring new subdivisions to space buildings provide firebreaks, on-site water storage, wide roads and multiple accesses.
- Building code standards for roof materials spark arrestors.

- Maintenance programs to clear dead and dry bush trees
- Regulations on open fires.

*D. Property Protection*

- Retrofitting of roofs and adding spark arrestors
- Landscaping to keep bushes and trees away from structures
- Insurance rates based on distance from fire protection
- Planning how to deal with URWIN fires before they occur
- Good visibility

*E. Public Information and Involvement*

- Educating homeowners and future homeowners about risk
- Planning how to deal with URWIN fires before they occur
- Emergency warning system, action plan
- Communication tree between fire departments and homeowners
- Community actions
- Adequate water supply and systems

*F. Structural Protection*

- Building and property assessments
- Use appropriate construction materials
- Adequate access to buildings

**Landslides**

Generic Mitigation

- Avoidance
- Recognize landslide area
- Zoning ordinances
- Remove landslide materials
- Drain subsurface materials
- Install surface drains
- Remove materials for the head of the landslide
- Re-grade
- Build buttress or retaining wall at the toe of the slope
- Install soil nails and rock anchors
- Maintain natural vegetation
- Improved geologic mapping to identify potential landslide problems
- Zoning ordinances prohibiting construction in or adjacent to areas with high landslide potential
- Soil moisture sensors at SNOTEL sites

- Gather hazard and risk data/information
- Protection of roads and bridges
- Development of improved mitigation techniques
- Education of local officials, developers, and citizens
- Protection of drinking water supply systems
- Generic Rock Fall Mitigation
- Avoidance
- Stabilize rocks
- Prerelease
- Build berms or benches
- Build structures to stop rocks

*A. Emergency Services*

- Warning systems
- Hazard identification and areas at risk

*B. Natural Resource Protection*

*C. Prevention*

- Land use planning ordinances
- Identify old landslides
  - Old landslides usually show irregular or subdued hill-like topography
  - Younger or more recently occurring landslides show signs of hummocky terrain, scarps, inclined trees, ground cracks, sharp vegetation differences, and numerous depressions or ponds.
- Identify unstable slopes
- Identify areas that could be affected by slope failures
  - Potential rock falls can be found in steep cliff areas or where bedrock crops out onto mountain slopes.

*D. Property Protection*

- Good land-use practices
- Avoid slope-irrigation, undercutting, and over-steepening

*E. Public Information and Involvement*

- Communications systems
- Proper property assessments of slope conditions

*F. Structural Protection*

- Proper assessments of slope conditions
- Grading or removing the material from the top and placing it at the toe of a slope can lessen the slope gradient
- Subsurface drainage control used to dewater and stabilize slopes
- Retaining structures: Concrete block walls or large masses of compacted earth
- Constructing debris basins
- Building deflection walls upslope of structures
- Avoiding ground level windows that face upslope
- Catchment fences
- Tieback walls
- Rock bolts
- Cut benches and berms

**Severe Weather**

*A. Emergency Services*

- Early warning systems
- Communication systems

*B. Natural Resource Protection*

*C. Prevention*

- Building code standards for light frame construction
- Ordinances that include weather resistant designs

*D. Property Protection*

*E. Public Information and Involvement*

- Listen to a weather radio

- Watch and listen to weather forecasts and warnings
- Develop a plan so you know where to take your family for shelter
- Understand risk and identify ways of reducing the impacts

*F. Structural Protection*

- Strengthen un-reinforced masonry

**Problem Soils**

Generic Mitigation

- Avoidance
- Presoak and Compact
- Remove problem soil
- Landscape so that runoff moves away from foundations

*A. Emergency Service*

*B. Natural Resource Protection*

*a. Soil awareness*

*C. Prevention*

- Landscaping with vegetation that does not concentrate or draw substantial amounts of water from the soil near foundations
- Insulating floors or walls near heating or cooling units to prevent evaporation that could cause local changes in soil moisture
- Avoid areas underlain by limestone and dolomite to prevent ground water contamination and foundation problems in karst terrain
- Use soil tests to find gypsum; do not plant high level of water plants near the house
- Reduce piping damage by limiting construction that disturbs natural drainage
- Peat deposits should be removed or avoided at construction sites
- Avoid abandoned mine areas
- Sands and calcareous loamy soils are highly erodible

*D. Property Protection*

- Special foundation designs
- Installing gutters and downspouts that direct water at least 10 feet away from foundation slabs
- Landscape with vegetation that does not concentrate or draw substantial amounts of water from the soil near foundations

*E. Public Information and Involvement*

*F. Structural Protection*

- Special foundation designs
- Installing gutters and downspouts
- Proper drainage along roads and around structures

**Drought**

*A. Emergency Service*

- Provide low interest loans or private assistance for farmers and ranchers

*B. Natural Resource Protection*

- Manage wildlife during drought periods
- Incorporate wildfire hazard mitigation planning
- Integrate financial assistance for transportation or water hauling for livestock

*C. Prevention*

- Implement cloud seeding during drought years to enhance precipitation
- Protect culinary water systems and/or provide culinary water to people or systems
- Incorporate a drought management plan
- Introduce more water resources such as wells, ponds, reservoirs, and reservoir capacity

*D. Property Protection*

*E. Public Information and Involvement*

- Create or join water conservation programs that are designed to reduce water consumption
- Incorporate a drought management plan
- Drought resource coordination

*F. Structural Protection/Projects*

N/A

# APPENDIX 6
# References and Research Sources


The Clean Air Act (CAA) 1970
https://www.epa.gov/laws-regulations/summary-clean-air-act

The Clean Water Act (CWA)
https://www.epa.gov/laws-regulations/summary-clean-water-act

Endangered Species Act of 1973
https://www.fws.gov/laws/lawsdigest/ESACT.HTML

National Historic Preservation Act of 1966
https://www.nps.gov/history/local-law/nhpa1966.htm

Utah's Noxious Weed Control Act R68-9-1, R68-9-2, R68-9-3, November 2017
https://rules.utah.gov/publicat/code/r068/r068-009.htm

"Utah Department of Transportation." n.d. *2015-2040 Long Range Transportation Plan.* 2015. <http://www.udot.utah.gov>.

*Utah Avalanche Center*. n.d. 2013. <http://utahavalanchecenter.

United States Department of Agriculture (USDA). *Natural Resources Conservation Service (NRCS)*. 8 30 2011. 2012. <http://www.ut.nrcs.usda.gov/technical/nri/>.

United States Department of Commerce. *U.S. Census Bureau*. July 2016 <http://quickfacts.census.gov/qfd/index.html>.

*U.S. Census Bureau*. July 2016. <http://www.factfinder2.census.gov>.

United States Department of Interior-U.S. Geological Survey. "National water summary 1988-89: hydrologic events and floods and droughts." Vers. 2375 Water Supply Paper. 1991. *U.S. Publications Warehouse.* R.W Paulson, et al. 2003. <http://pubs.er.usgs.gov/>.

United States Department of Interior-U.S. Geological Survey. "Groundwater and surface-water resources in the Bureau of Land Management Moab Master Leasing Plan area and adjacent areas, Grand and San Juan Counties, Utah, and Mesa and Montrose Counties, Colorado" Open File Report 2014-1062. https://pubs.er.usgs.gov/publication/ofr20141062

United States Environmental Protection Agency. *Clean Air Act of 1970*. Vers. 42 USC s/s 7401 et seq. 1970. 12 March 2003. <http://www.epa.gov/region5/defs/html/caa.htm>.

*Clean Water Act*. Vers. Section 404(c) 1979 Veto Authority. 1979. January 2003. <http://www.epa.gov/OWOW/wetlands/facts/fact14.html>.

*Clean Water Act as ammended in 1977*. Vers. 33 USC s/s 124 et sequ 1977. n.d. 20 February 2003. <http://www.epa.gov/region5/water/cwa.htm>.

*Endangered Species Act*. Vers. 7 USC 136, 16 USC 460 et seq. 1973. 10 March 2003. <http://www.epa.gov/region5/defs/html/esa.htm>.

*Water and Wetlands*. Vers. 24 May 1977, 42 F.R. 26951. 1977. 17 January 2003. <http://www.epa.gov/OWOW/wetlands/regs/eo11988.html>.

*National Drought Mitigation Center*. 2017. December 2017. <http://drought.unl.edu/DroughtBasics/WhatisDrought.aspx>.

*NOAA-National Severe Storms Laboratory*. 2013. 2003, 2012,2017. <http://www.nssl.noaa.gov/>.

*Online Utah.Com*. n.d. December 2017. <http://www.onlineutah.com

*Demographic and Economic Trends and Benchmark Report*. Grand County, Utah, 2016. December 2017. <http://www.grandcountyutah.net/>.

*Department of Workforce Services*. n.d. December 2017. <http://jobs.utah.gov/jsp/wi/utalmis/gotoCounties.do>.

*Division of Natural Resources (DNR)*. n.d. 2017. <http://wildflife.utah.gov/dwr>.

**APPENDIX 7**

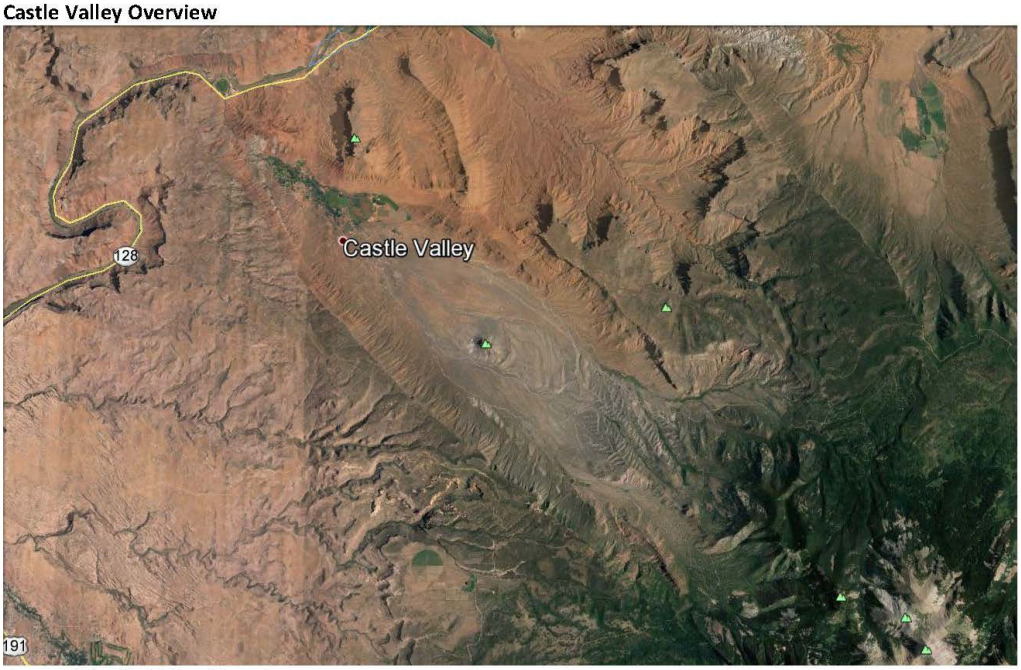
# Castle Valley, Utah

# Hazard Mitigation Plan: 2015

# TABLE OF CONTENTS


2 BACKGROUND
2 INTRODUCTION
2 PURPOSE
2 SCOPE
3 FUNDING
2 PROFILE – CASTLE VALLEY, UT
5 PLANNING PROCESS
9 RESOURCES
POTENTIAL HAZARDS WITH RISK ASSESSMENTS & MITIGATION STRATEGIES
11 FIRE
17 FLOOD
23 SEVERE WEATHER
29 COMMUNICATION/POWER OUTAGES
35 ROCK FALL
39 DROUGHT
43 WATER CONTAMINATION
48 SUSIDENCE
51 EARTHQUAKE
55 RECOMMENDED PRIORITY PROJECTS
58 PLAN MAINTENANCE

**Castle Valley Overview**




**Town of Castle Valley Overview**

# DEFINITIONS

**Catastrophic Disaster:** An event that results in large numbers of deaths and injuries; causes extensive damage or destruction of facilities that provide and sustain human needs; produces an overwhelming demand on State and local response resources and mechanisms; causes a severe long-term effect on general economic activity; and severely affects State, local, and private-sector capabilities to begin and sustain response activities. Note: the Stafford Act provides no definition for this term. (**FEMA,** *FRP Appendix B*, 1992)

**Hazard:** "A potential event or situation that presents a threat to life and property." (**FEMA**, *Hazards Analysis for Emergency Management (Interim Guidance)*, September **1983**, p. 5)

# BACKGROUND

## INTRODUCTION:

The Castle Valley Hazard Mitigation Plan is a localized plan that details the several natural and manmade hazards that are specific to Castle Valley and the Town of Castle Valley municipality, located in Grand County in the State of Utah. (See Appendix A1 –A2) This plan fulfills the requirements set forth by the Disaster Mitigation Act of 2000 (DMA 2000). The DMA 2000 requires a hazard mitigation plan in order to be eligible for mitigation grants made available by the Federal Emergency Management Agency (FEMA).

## PURPOSE:

The Castle Valley Hazard Mitigation Plan is designed to evaluate and identify local hazards that would negatively affect Castle Valley. The plan outlines mitigation strategies for each hazard with an assessment to the potential benefit, the financial viability and community acceptance /political viability. The plan will be an important step in outlining and recommending government roles, public participation, regulations and emergency systems to create a safer environment for citizens and efficient emergency response.

## SCOPE:

The Castle Valley Hazard Mitigation Plan includes all incorporated and unincorporated areas in Castle Valley. The plan addresses all natural hazards identified by the Federal Emergency Management Agency. All hazards that may affect Castle Valley and its residents are analyzed. Hazard mitigations are discussed in both long and short term goals in mind. The implementation of each mitigation strategy is discussed and possible resources and funding options are identified.

## FUNDING:

Funding for the mitigation planning process has been largely by volunteer hours. Minimal costs for office supplies, such as paper, ink, and hours worked by the town clerk will also be included.
Funding for mitigation strategies include budgeting by the Town of Castle Valley and the Grand County Service Area for Castle Valley Fire Protection District (Castle Valley Fire Protection District and possible grant and loan sources. Possible Grant and loan sources include: C.I.B., USDA, Rural Development Grants, credit unions, and other Grant Websites.
Recruiting volunteers for some of the mitigation efforts was also considered.
Volunteer hours will be counted at $22.50 per hour
Town Clerk hours are counted at $20.00 per hour

# PROFILE

**General:**
Castle Valley was initially a large ranch which was subdivided into five-acre minimum lots (now Town of Castle Valley municipal boundaries) platted, and recorded on May 11, 1973. The Town of Castle Valley was officially incorporated on July 26, 1985.

The 2010 US Census stated that the population of the Town of Castle Valley was 319 as compared to the 2000 US Census which stated a population of 349 for the Town. The 2010 US Census also showed the following demographics for Town residents:

| | | | |
|---|---|---|---|
| Male | 166 | White | 310 |
| Female | 153 | African American | 0 |
| Under 18 | 26 | American Indian or Alaska Native | 1 |
| 20-34 years old | 23 | Asian | 2 |
| 35-49 years old | 42 | Native Hawaiian and Pacific Islander | 0 |
| 50-64 years old | 159 | Other | 2 |
| 65 years old and over | 62 | Identified by two or more | 4 |

Castle Valley is surrounded by large tracts of open space and minimally developed public land that provides a natural setting, integral to the character of the Town. The sensitive nature of the land and water of Castle Valley and the effects of climate change call for creative and new ways of managing Town and surrounding lands and our local and global environments.

**Government:**
The Town of Castle Valley has a 5 member Town Council including a Mayor. The Town also has a Planning and Land Use Commission, a Road Committee and the Hazard Mitigation Committee that meet monthly in open and public meetings in accordance with Utah Code 52-4. The Town Council adopts Ordinances and Resolutions with recommendations and public hearings presented from each committee and works together to ensure the health and safety of Valley residents. 85-3 is the Town's governing Land Use Ordinance and governs and protects the resources and natural setting of Castle Valley. Ordinance 95-6 outlines processes and forms that make residents aware of natural hazards when going through the building process. Ordinance 2007-6 Prohibits Fire Hazards in periods of high fire danger. Ordinance 1996-1 protects the Town's Watershed. The Town also adopted Ordinance 2013-1 which created the Hazard Mitigation Committee. Many regional Hazard Mitigation

plans have been adopted in the past by Resolutions by the Town Council as well as a "Firewise Standard" Resolution.

**Land Use:**
Castle Valley is a rural residential and agricultural community, made up of five-acre minimum lots with single-family homes and accessory buildings in association with low-impact livestock and agricultural uses. The Town currently allows home and premises businesses, but no other commercial or industrial activity is permitted.

The Town has a modest level of public facilities and services. A community building was built on the Town lot in 2004 and serves as a gathering place for community and Town government events. The Town building is the only non-affiliated public facility in the Town and houses the Town office, meeting rooms, and a branch of the Grand County Public Library. The Town lot is home to a fire station owned and managed by the Castle Valley Fire Protection District, a shed for Roads Department equipment, a basketball court, and an outdoor picnic area. The Town has a small, part-time staff. The Town has a cemetery that it maintains with Grand County funds. There is no municipal water delivery system or wastewater treatment facility nor is there any municipal garbage removal service for residents.

**Water:**
Water is provided through individual wells and waste is managed by individual septic wastewater disposal systems. Castle Valley's aquifer is the sole source of drinking water for its residents and an irreplaceable resource.

The Castle Valley Aquifer has been declared as a Sole Source Aquifer by the Federal Environmental Protection Agency in 2001[1] and classified by the Utah Division of Water Quality as "pristine" in certain areas, however water quality varies in different parts of the Town. About 40% of the Town's lots have very hard water that must be purified in order to drink. The aquifer is extremely vulnerable to contamination. It is an unconsolidated valley-fill type and exposed at the surface with no overlying confining geologic formation. This allows contaminates to move more quickly downward to the water supply. The Town now has six monitoring wells for measuring water quality changes over time and In 2014 the Town Council set aside funds and voted to have a Water Study done for the Watershed in order to further it's protection and create a water budget.

Two streams originating from the La Sal mountains pass through the town boundaries: Castle Creek which is perennial and Placer Creek which is intermittent. There are several users with water rights for Castle Creek that use the partially spring fed creek for irrigation purposes.

**Transportation and Roads:**
Castle Valley is served by County Road 96. State Highway 128, which is about 1.7 miles outside of the Town's municipal boundary, is the principal transportation access to the Town. Castle Valley Drive serves as the main road leading in and out of the Town. Shafer Lane has been dedicated as an emergency ingress and egress road for emergency responders and for the public should Castle Valley Drive become impassable. Castle Valley Drive is the only paved (chipped sealed) Town road and is paved for the first 3.64 miles. The remaining portion of Castle Valley Drive is gravel and dirt. All other Town roads are either crowned dirt and/or gravel and are approximately 17 miles in combined length. Roads on the west side of Castle Valley Drive proceed to the base of Porcupine Rim. This results in progressively steeper grades, some exceeding 20%, making winter maintenance difficult and in some cases impossible.

[1] Environmental Protection Agency, August 6, 2001, Sole source aquifer Notice of final determination for the Castle Valley Aquifer System, Castle Valley, UT: Environmental Protection Agency, (FRL-7024-2).

The Town Roads Department is responsible for maintenance and improvements of all Town roads and for all drainages within the Town's easements. This includes flood control, dirt work, paving/chip sealing of Castle Valley Drive, signage for all Town roads, snow removal for dirt roads that receive winter maintenance, and Town vehicle and equipment maintenance and repair. Castle Valley contracts with Grand County Road Department to provide winter snow removal from Castle Valley Drive.

**Fire Protection and Emergency Preparedness:**
Castle Valley is a Wildland Urban Interface - a place where residential areas border and interact with undeveloped wildland vegetation. The Town and outlying areas are served by the Grand County Service Area for Castle Valley Fire Protection District (Castle Valley Fire Protection District), which funds and manages the Castle Valley Volunteer Fire Department. Castle Valley has received Firewise Communities/USA recognition status. On behalf of the Castle Valley community, the Castle Valley Fire District maintains this status with annual membership in Firewise Communities, a project of the National Fire Protection Association.

Until recently residents with medical emergencies experienced an approximate 30 to 45 minute response time from Grand County EMS who travel from Moab. The Grand County EMS and the Castle Valley Fire District established an Emergency Medical Response (EMR) team for more rapid, first response to medical emergencies. These trained EMR's cannot do transports, but do have a non-transport ambulance with medical supplies to treat patients until Grand County EMS arrives. The EMR team also received training involving the emergency helicopter contractor that recently established itself in the Moab area.

# PLANNING PROCESS

## Section Contents

**1. Town of Castle Valley participation and Plan adoption**
**2. Hazard Mitigation Planning Process**
**3. Public and Other Stakeholder Involvement**
**4. Integration with Existing Plans**

**1. Town of Castle Valley planning participation and Plan adoption.**
On December 18, 2013 in open session the Town of Castle Valley passed Ordinance 2013-1 creating a local Hazard Mitigation Committee. The Town of Castle Valley will formally adopt the plan upon the recommendation by the Hazard Mitigation Committee.

**2. Hazard Mitigation Planning Process**
The Castle Valley Hazard Mitigation Plan was developed through interaction between the Hazard Mitigation Planning Committee for the Town of Castle Valley, the Town of Castle Valley Municipality and Planning and Land Use Commission, Grand County Service Area for Castle Valley Fire Protection District, CERT, the Grand County Emergency Manager and the local community.

**The tasks of the Hazard Mitigation Planning Committee:**

- Attend Meetings
- Represent interests of Castle Valley and its residents
- Collect information on jurisdiction's resources
- Identify and prioritize the threat of local hazards
- Facilitate development of jurisdiction's mitigation strategy.
- Create local hazard mitigation plan according to FEMA's guidelines set forth in "State and Local Mitigation Planning How-To-Guide" dated September 2002 FEMA 386-1

The Hazard Mitigation Planning Committee met on the 2nd Wednesday of each month in open and public meetings beginning on November 13th, 2013. The Hazard Mitigation Committee will continue to meet until a draft is ready for approval. They will review and update the plan every 4 years or as new information becomes available and will hold public hearings to seek community input.

**3. Public and Other Stakeholder Involvement**

All Hazard Mitigation Committee meetings were open to the public and were posted in accordance with the Open and Public Meetings Act (Utah Code 52-4-202). The Hazard Mitigation Meeting Agendas and Minutes are posted to the Town's website as well as Utah's Public Notice Website. All Agendas, Minutes and meeting documents are kept in a book which will remain a permanent record in the Town office.

The Hazard Mitigation Committee Meetings on September 10th and October 8th, 2014 had regional Rocky Mountain Power representatives participate to discuss power outages and protocol between the Town and private power company. Members of the Castle Valley Fire Protection District, local CERT members and Planning and Land Use members were also a part of the Hazard Mitigation Committee.

The Hazard Mitigation Committee Members reached out to local groups such as the Day Star Academy, Sorrel River Ranch, Red Cliffs Lodge, Castle Valley Irrigation Company, Frontier Communications and Rocky Mountain Power to receive input and seek support in creating the Hazard Mitigation Plan for Castle Valley Utah.

Public Hearings will be held to review preliminary drafts as well as the final draft of the Castle Valley Hazard Mitigation Plan. Notice of Public Hearings for input on the drafts will be posted with a minimum of 2 weeks before the hearings will be held.

**4. Integration with Existing Plans**

Data was reviewed from the Town of Castle Valley records including: The Drainage Master Plan, Water Studies, UGS geologic studies, the Town's General Plan, Grand County's Regional Plan, and the Southeastern Utah Hazard Mitigation Plan, The Utah Division of Forestry, Fire and State Lands local Community Fire Plan, private records, newspaper articles and the Castle Valley Fire Protection Districts records were all used in the development of the Castle Valley Hazard Mitigation Plan.

## 4 Step Planning Process:

**1. Organize resources:**

Assess community support- Introduced the idea and through public meetings determined if there was enough support to begin the planning process.

Build the planning team- Public invitations went out through gatherings, word of mouth and public meetings for those interested in participating in the planning process. After a group was established an ordinance was adopted forming the Hazard Mitigation Committee.
Members include:
Jazmine Duncan- Chair, Town Council member, Fire Dept. member, CERT member
Greg Halliday- Co- chair, Fire Dept. member, former Town of Castle Valley Road Supervisor, current Road Committee member
Ron Drake- Fire Chief, Castle Valley Service District for Fire Protection, CERT member, Castle Valley Comments- Times Independent
Dave Erley- Mayor Town of Castle Valley, Road committee member
Pat Drake- Community member, CERT member
Leta Vaughn- Fire District Commissioner and Fire Dept. member, EMR member
Bob Russel- Fire District Commissioner and Fire Dept. member, EMR member, CERT member
Bob Lippman- Fire District Commission Chair and Fire Dept. member
Bill Rau- Planning and Land Use Commission- Chair
David Smith- Community member, CERT member
Rick Bailey- Grand county emergency manager
Steve White- Grand county sheriff
Ali Fuller- Town of Castle Valley Clerk, CERT member

Engage the public- Public hearings were held May 13, 2015 and Oct. 14, 2015. All meetings were open public meetings with members of the community attending and contributing on the May 13th, 2015 and Oct. 14, 2015 Public hearings held by the Hazard Mitigation Committee.
Input was also taken via letters and email throughout the entire planning process.

Identify and profile hazards- As a group we listed all hazards which affect the community, we prioritized the list in order of most probable to occur and which have the greatest impact on the community or have the greatest probability of affecting the community.

Inventory assets and estimate losses- We created a list of resources and assets. Taxable values of private property were obtained from the County Clerk which provides a base for possible losses within each hazard area. The average assessed taxable home value in Castle Valley in November 2015 is $73,659 it would however cost substantially more to replace a household in a disaster. Since property owners maintain their own wells for water, septic tanks, and propane tanks, the main infrastructure that the town maintains are roads. The maintenance, construction and rebuilding of roads and drainages is a part of the town's annual budget.

Benefit cost review- A list of priority projects was created based on actions which were seen as having the greatest impact using resources the community currently has available, or we felt could

be budgeted for. Cost analysis was done on each project using known costs for certain items and amounts given by the FEMA schedule for some unknown costs.

**2. Develop mitigation plan:**

Develop goals and objectives- As a group we decided what we wanted to achieve with our planning process. The committee used FEMA's guidelines set forth in "State and Local Mitigation Planning How-To-Guide" dated September 2002 FEMA 386-1.

Identify and prioritize mitigation actions- As a group we went through each hazard and came up with a list of possible mitigation strategies for each one, we then rated each strategy based on Potential Benefit, Financial Viability and Political Viability. Potential Benefit was given a high, medium or low rating. Financial and Political Viability were rated 1-5 with 1 being easy and 5 being very difficult.

Prepare implementation strategy- We are going to mitigate potential impacts from hazards thru executing the Action Plan Projects and thru community awareness and policy development.

Document the planning process- Each member of the committee was assigned a hazard to profile and research histories on. Each member or team working on a hazard then prepared a summary and history to add to the final plan. Agendas, Minutes and meeting documents were kept of every meeting.

**3. Implement the plan and monitor progress:**

Adopt the Hazard Mitigation Plan-

The Plan was adopted by the Town of Castle Valley on November 18th, 2015.

Implement Plan recommendations-

The group will work with the Town and stakeholders to continue to implement parts of the plan and implement priority project within the next 5 years.

Evaluate planning results-

Continual evaluation of planning progress will be ongoing and reviewed with plan every 4 years.

Review and Revise the Hazard Mitigation Plan-

The Hazard Mitigation Committee will review and revise the Hazard Mitigation Plan every 4 years.

# RESOURCES

Town of Castle Valley:

- Town hall and library
- Road shed
- Maintenance shed
- Fuel storage
- Staff
- Town Council
- Planning and Land Use Commission
- Hazard Mitigation Committee
- Road department
- Roads equipment
- 8332 Grader moldboard 14ft. $70pr/hr
- 8393 Loader wheel bucket 3 cubic yds. $40pr/hr
- 8573 Loader .....wheel 1.7 cubic yds. $38 pr/hr
- 8720TruckdumpStruckcap 8cubic yds$35 pr/hr
- Road committee
- Insurance

Castle Valley Fire District:

- Station 1
- Station 2
- 20 Volunteer personnel
- Commissioners
- Equipment
- Engine 35 brush truck
- 33 Hummer
- 34 duce 1/2
- Water tender
- 8-structure
- 37-structure
- 38 chiefs truck
- 31 brush truck
- 30- structure
- Mack
- Radios
- Satellite phone
- Cots

Church Groups:

- Day Star Academy and Farms
- LDS
- Buildings
- Tables and Chairs

Grand County UT:

- Roads Department
- Snow plow
- Emergency Medical Services
- C.V. EMRs
- Non transport ambulance
- CERT-Kris Hurlburt
- Emergency Manager - Rick Bailey
- Sheriffs' Department – mobile command post and repeater
- County Council

Interagency Fire:

- Forestry Fire and State Lands - local representatives.

State of UT:

- Planning support- Brad Bartholomew/ FEMA
- CIB – Bruce Adams
- USU- Mike Jones/Roads
- Regional engineer- Mark Stilson
- State Roads and Highway patrol
- Health department
- Agriculture extension- Mike Johnson

Federal Government:

- Rural development USDA
- FEMA
- EPA
- NRCS-Don Andrews
- Soil Conservation Agency

Private Sector:

- C.V. business owners
- Private property owners who volunteer
- Privately owned equipment: chainsaws, tractors, etc.
- Local doctors and nurses
- Water hand pumps on wells
- Frontier Communications
- Rocky Mountain Power
- Red Cliffs Lodge
- Sorrel River Ranch
- School bus
- Outbuildings and spare bedrooms

# FIRE

## BACKGROUND

Castle Valley is a Wildland Urban Interface - a place where residential areas border and interact with undeveloped wildland vegetation. This presents a number of fire-fighting challenges due to Town and residential proximity to large areas of fire-prone vegetation. Trees, shrubs, grasses, and weeds all provide significant fuel for fires; winds, topography, and difficulty of access add to fire hazards. Periods of drought, invasive vegetation, and modern fire suppression practices have helped to increase heavily overgrown areas of dry combustible vegetation. During "monsoon" season, frequent thunderstorms and cloudbursts occur, posing a threat to life and property from lightning triggered wildfires and debris flow (flood) events. These variables make Castle Valley very vulnerable to Fire however several mitigation efforts are in place and due to more development there are more firebreaks throughout the municipality.

Over the past 35 years, the Castle Valley Fire Department responded to approximately 100 fires, an average of just under three fires per year. Some years the area experiences a lot of fire activity like 1984, 2009, and 2011, which had eight and nine fires and some years like 1982, 1983 and 2010, for instance, only two fires were reported. Lightning is the leading cause of fires at nearly one third followed by human caused fires at 26 percent and controlled fires that got out of control at 22 percent. Forty-four percent of the fires occur within the Castle Valley Town area and fifteen percent each are in the Castleton area and along State Route 128 and 16 percent of the fires are on State or BLM lands. There have been fires reported in every month but nearly a quarter of the responses occur in July followed by June with 19 percent and August with 13 percent. Grass, brush and trees are the most common source of fire at 75 percent followed by structure fires at 23 percent and vehicle fires at six percent and other sources, like power poles, at four percent. Some fires will burn two or more of these categories.

## HISTORY

There were not many inhabitants in Castle Valley when the Castle Valley Fire Department was formed in 1976 but the young community had already experienced some disastrous fires and fatalities. Included in those events was a fire involving an A-frame structure near Castle Creek and Castle Valley Drive where a child perished in the building. Former Castle Valley resident and County Fire Warden Robin Donoghue said that he remembered helping Grand County Sheriff Heck Bowman sift through the rubble to find the remains of the young boy's body.
Donoghue and Dave Durrant, another early settler to the valley recognized the need for local fire protection and approached District Ranger Dick Buehler for help in organizing the fire department and acquire equipment. During the summer of 1977 the fire department acquired an excess military 2.5-ton fire truck and obtained a state lease on the property, which now houses Fire Station One on the Castleton Road. Fire department volunteers eventually built a fire house with money collected by hosting barbeques and other fund raising activities and, when there were enough residents in Castle Valley to form a tax base, formed the Castle Valley Fire Protection District.

Donoghue served as the first fire chief followed by Durrant, Frank Mendonca, John McGann, Dave Seibert, Floyd Stoughton, and Ron Drake. The fire department bought their first engine, a used, refurbished American LaFrance pumper engine in 1994 and took possession of a new International 2,000 gallon pumper/water tender in 2007, which was purchased with a CIB grant. Currently the fire department maintains nine structure and wildland fire vehicles, five of which are owned by the fire district and four are excess military vehicles on loan from the State of Utah. In 2003, the district built a second fire station, which is located behind the Castle Valley Town Hall and in December, 2010 purchased the property where Fire Station I is located, both with funds furnished by CIB grants.

**EVENTS:*** (Last ten years)

| | | | |
|---|---|---|---|
| Mar 3, 2005 | Grass | Human | Buchanan Lane |
| Jun 30, 2005 | Structure | Lightning | Castleton |
| May 22, 2006 | Brush Fire | Lightning | Buchanan Lane |
| Jun 15, 2006 | Brush | Lightning | Round Mtn Fire, 213 ac. |
| Jun 22, 2006 | Brush | Lightning | Upper Castle Valley |
| Aug 31, 2006 | Brush | Lightning | 34 Rim Shadow Lane |
| May 21, 2007 | Tree Fire | Lightning | Taylor Lane |
| Aug 5, 2007 | Structure | Lightning | Lazaris Lane |
| Sep 30, 2007 | Brush | Human | Lazaris Lane, 15 ac. |
| Oct 9, 2007 | Brush | Human | Homestead Lane |
| July 19, 2008 | Grass | Human | Loop Road |
| Aug 11, 2008 | Structure | Electrical | DayStar Academy |
| Aug 27, 2008 | Brush | Lightning | Porcupine Ranch, 4K acres |
| Apr 12, 2009 | Power Pole | Weather | Lower Pope Lane |
| May 18, 2009 | Power Pole | Failed Equip. | SR 128 |
| May 19, 2009 | Trees | Lightning | Castleton |
| July 16, 2009 | Tree | Lightning | Loop Road |
| July 19, 2009 | Power Pole | Lightning | Lazaris Lane |
| Aug 6, 2009 | Trash | Human | Red Cliff Lodge |
| Aug 13, 2009 | Tree | Lightning | Keogh Lane |
| Aug 13, 2009 | Trees | Lightning | Upper 80s section |
| Sep 30, 2009 | Tree Fire | Lightning | Keogh Lane |
| Mar 18, 2010 | Structure (pole) | Lightning | Castle Valley Drive/Keogh Lane |
| Aug 5, 2010 | Brush Fire | Lightning | Between Pope and Miller Ln. |
| Jan. 7 2011 | Structure Fire | Electrical cause | Sorrel River Ranch |
| May 18, 2011 | Tent fire | Human cause | Mile 21, SR 128 |
| Jun 8, 2011 | Trash Fire | Human cause | Sorrel River Ranch |
| Jun 18, 2011 | Arson Fire | Human cause | SR 128 |

| | | | |
|---|---|---|---|
| Jul 17, 2011 | Brush Fire | Lightning | 159 Buchanan Lane |
| Jul 19, 2011 | Brush Fire | Lightning | Porcupine Ranch |
| Jul 30, 2011 | Brush fire | Lightning | Shafer Lane |
| Dec 8, 2011 | Structure/Grass | Human, hot ashes | 447 Castle Valley Drive |
| | | | |
| Feb 10, 2012 | Straw fire | Human | SR 128 |
| Apr 19 | Dryer fire | Mechanical | Sorrel River Ranch |
| May 26, 2012 | Structure/Brush | Unknown/weather | 413 Cliffview Lane |
| July 13, 2012 | Brush Fire | Lightning | Castleton Road #1 |
| Jul 13, 2012 | Brush Fire | Lightning | Castleton Road #2 |
| Jul 20, 2012 | 4 Trees | Lightning | Porcupine Ranch Rd. |
| Jul 21, 2012 | Free Fire | Lightning | Upper 80s section |
| Aug 23, 2012 | Grass Fire | Human | Creekside Lane |
| Sep 24, 2012 | Brush Fire | Lightning | Adobe Mesa (Assist USFS) |
| Sep 1, 2013 | Cedar Trees | Lightning | Upper 80s/BLM |
| | | | |
| May 30, 2014 | Brush | Lightning | South Round Mountain |
| Jun 15, 2014 | Brush | Arson Fire | Mile 13, SR 128 |
| Jul 11, 2014 | Tree Fire | Lightning | Castleton Road |
| Jul 15, 2014 | Single Trees | Lightning | 272 Pope Lane/350 Taylor Lane |
| Aug 25, 2014 | Tree Fire | Lightning | Gravel Pit, Castleton |
| Sep 14, 2014 | Structure/Dryer | Human | Sorrel River Ranch |

*During those years when there were few fire events the Castle Valley Fire Department was still busily involved in responding to false alarms, controlled burn stand-by, medical assists, requested to assist with vehicle accidents and many other important requests.

## Fire Probability Analysis

| | | | |
|---|---|---|---|
| **Potential Magnitude** | | **Negligible** | **Less than 10%** |
| | **X** | **Limited** | **10-15%** |
| | | **Critical** | **25-50%** |
| | | **Catastrophic** | **More than 50%** |
| **Probability** | **X** | **Highly likely** | |
| | | **Likely** | |
| | | **Possible** | |
| | | **Unlikely** | |
| **Location** | **Anywhere there is fuel** | | |
| **Seasonal Pattern or Conditions** | **May- Sept. – Wildfires, Year Round – Structure fires** | | |
| **Duration** | **Hours to days.** | | |
| **Analysis Used** | **Documented events C.V.F.D., identifying resources available currently.** | | |

**Risk Assessments and Mitigation Strategies:**

While the community can do little to temper the extreme weather that causes fires, much can be done to mitigate the effects of those weather related events. Human caused fires can also be mitigated with public awareness programs and continued participation with the Firewise Program.

**(1 =Easy – 5= Difficult)**

1. Mowing Roads to expand the firebreak.
   Potential benefit= High
   Financial viability= 1 [24 hrs for all roads, 2-3x a year]
   Political viability=1

2. Policy changes to require property owners to keep fuel down.
   Potential benefit= High
   Financial viability=4
   Political viability=5

3. Increase FireWise campaign to increase public awareness
   Potential benefit=High
   Financial viability=2
   Political viability=1

4. Small controlled burning on private properties.
   Potential benefit= High
   Financial viability=4
   Political viability=4

5. Reduce fuel around power poles and ground transformers; get in touch with Rocky Mountain Power.
   Potential benefit= High
   Financial viability= 2
   Political viability= 3

7. Identify water sources with and without power sources. Determine usability and viability for fighting fires and refilling trucks.
   Potential benefit= High
   Financial viability=3
   Political viability=1
8. Create a program for the emergency siren located on C.V. Drive
   Potential benefit=High
   Financial viability= 2
   Political viability= 3

9. Create pre-planned fire breaks in the town and along its boundaries.
   Potential benefit= High
   Financial viability=4
   Political viability= 5

10. Review Town policies for the storage and disposal of fuels and hazardous materials.
    Potential benefit= High
    Financial viability= 1
    Political viability= 3

11. Use goat or sheep herds for fuel reduction.
    Potential benefit= High
    Financial viability = unknown
    Political viability= 3

12. Have certified Fire Inspector perform structure inspections on request.
    Potential benefit= High
    Financial viability= 2
    Political viability=3

13. Identify lots with overgrowth, use Forestry Fire State Lands assessments and teach property owners defensible space.
    Potential benefit= High
    Financial viability= 2
    Political viability= 3

14. Invest in specialized Town equipment to reduce fuels.
    Potential benefit= Medium
    Financial viability= 5
    Political viability= 4

15. Burning piles of weeds and spot burning fuel on private lots with proper education first.
    Potential benefit= High
    Financial viability= 0
    Political viability= 2

15. Encourage alternatives to burning such as pickups or mulching/chipping.
    Potential benefit= High
    Financial viability= 0
    Political viability= 0

# FLOOD

## BACKGROUND

The Town of Castle Valley occupies the lower (northwestern) portion of Castle Valley, extending from the gorge of Castle Creek to the southern side of Round Mountain, Porcupine Rim on the west, the Castle Valley loop road on the east, comprising 448 five acre properties. According to the Town's Drainage Master Plan done in 1988 there are 52 square miles of drainage basins. The Valley ranges in elevation from approximately 4,500 to 5,500 feet above sea level with the adjacent mountains to the southeast rising to approximately 12,000 feet. Vegetative cover on a watershed has a major effect on the amount of precipitation that runs off, an affects the storm water in several ways. Both the foliage and the litter of the plants can retain water for longer thereby lengthening the time of concentration and reduces the peak discharge rate. Castle Valley is vulnerable to flooding in severe concentrated rain events, when the water comes over a longer period of time the multitude of drainages can handle the water quite well, however more and more isolated cloudburst are effecting Castle Valley in very destructive short lived storms. The Castle Valley Road Department works to mitigate and mend the effects of storm water runoff from Placer and Castle Creeks and drainages along Porcupine Rim, Parriott Mesa, Castle Rock, Adobe Mesa, (elevations surrounding Castle Valley).

## HISTORY

Within the last 10 years there have been significant rain events that have exceeded the flow of the Colorado River during one period of time on just the Placer Creek drainage. Placer Creek drains into Castle Creek, which flows under Castle Valley Drive through a 10-foot culvert at lot 447. According to the Drainage Master Plan dated September 1988, by Armstrong Consultants, Inc., this area should have had two (2) 10-foot culverts instead of one. This culvert also was never designed to function as a check dam, however due to only one 10 foot culvert, storm water has come within a few feet of exceeding the carrying capacity of this culvert, should storm water overtop the road above this culvert, significant damage may occur to Castle Valley Drive including loss of road surface and underlying earthen fill as well as damage to downstream structures and creating a significant safety hazard.
(See Appendix A3)

Currently the Town of Castle Valley does not have a second exit that can handle the volume of traffic that Castle Valley Drive does now. This creates a situation of significant isolation and safety concerns. The Town of Castle Valley commissioned a Drainage Master Plan dated September 1988 by Armstrong Consultants, Inc. The recommendations in that Master Plan have yet to be implemented. The facilities designed for the Master Plan are based on a 10 year storm which is a reasonable level of risk for the planned facilities (culverts and channels).
Currently the Town of Castle Valley is not participating in the National Flood Insurance Program since the area is not mapped by FEMA.
(See Appendix B1-B2)

**Events:** **6 Oct. 2011 to 10 Feb. 2014**

| | | | | |
|---|---|---|---|---|
| Flash Flood | 6 Oct 2011 | Placer Creek crossings<br>Placer Ditch | Upper eighty<br>east Pope | erosion/mud |
| Flash Flood | 26 Oct 2011 | Porcupine Rim Drainage | Buchanan | erosion |
| Flash Flood | 14 Jul 2012 | Rim Drainage | Keogh/CVD | mud/erosion |
| Flash Flood | 25 Sep 2012 | Rim Drainage | Keogh/Pope<br>Holyoak/Miller | mud/erosion |
| Flash Flood | 12 Oct 2012 | Placer Drainage | Rimshadow/Pace<br>Miller/Pope/Holyoak<br>Keogh/Taylor/Connector | mud/erosion |
| Flash Flood | 23 Oct 2012 | Placer Drainage | Miller/CVD/Keogh<br>Holyoak/Buchanan/Pace | mud/erosion |
| Runoff | 17 Jul 2013 | Rim Drainage | Keogh/Taylor | mud/erosion |
| Flash Flood | 19 Jul 2013 | Placer Drainage | Keogh/Connector | erosion |
| Flash Flood | 29 Jul 2013 | Placer Drainage | Placer crossings<br>Holyoak/Miller/Keogh | mud/erosion |
| Runoff | 30 Jul 2013 | Placer Drainage | Upper 80/Holyoak | erosion |
| Runoff | 1 Aug 2013 | Placer Drainage | Rimshadow/Shafer<br>Miller/Holyoak | mud/erosion |
| Storm Runoff | 1 Sep 2013 | Placer Drainage | Connector | road washout |
| Flash Flood | 12 Sep 2013 | Placer Drainage | Crossings/Keogh<br>Miller | mud/washout |
| Flash flood | 14 Sep 2013 | Placer/Cain Hollow | Upper 80/Chamisa<br>Rimshadow/Shafer<br>Miller/Pope/Keogh | mud/washout |
| Storm Runoff | 18 Sep 2013 | Placer Drainage | Crossings/Keogh<br>Miller/Meadow | mud/washout |
| Storm Runoff | 10 Oct 2013 | Placer/Cain Hollow | Crossings/Miller | mud/rock, erosion |
| Storm Runoff | 30 Oct 2013 | Placer Drainage | Crossings/Miller | mud/rock, erosion |
| Storm Runoff | 10 Feb 2014 | Placer Drainage | Lower crossing | erosion |

## Flood Probability Analysis

| | | | |
|---|---|---|---|
| **Potential Magnitude** | | Negligible | Less than 10% |
| | | Limited | 10-15% |
| | X | Critical | 25-50% |
| | | Catastrophic | More than 50% |
| **Probability** | | Highly likely | |
| | | Likely | |
| | X | Possible | |
| | | Unlikely | |
| **Location** | All drainages and creeks. | | |
| **Seasonal Pattern or Conditions** | June- Oct. | | |
| **Duration** | Initial flow not more than a few hours, event including clean up would take days. | | |
| **Analysis Used** | Historic documentation of events, Town of C.V. road department and the Grand County regional plan. Available resources.<br>Town of Castle Valley Drainage Master Plan 1988 | | |

## FLOOD:

### Risk Assessments and Mitigation Strategies:

**(1 =Easy – 5= Difficult)**

1. Re-enforce or replace the Castle Creek culvert that flows under Castle Valley Drive, the Town's main ingress and egress.
   Potential benefit= High
   Financial viability= 4-5
   Political viability= 2

2. Build and maintain large catchment ponds in strategic places on both of the main drainages. One above the Upper 80 on the Placer Creek drainage and another on the Castle Creek drainage.
   Potential benefit= High
   Financial viability= 5
   Political viability= 3

3. For road crossings in the Upper 80 continually washed out, document and map all affected areas and tie in with Natural Resource Conservation Service study.
   Potential benefit= High
   Financial viability= 1
   Political viability= 1

4. Evaluate and consider engineering structural options for armoring major drainage crossings including concrete slips, aprons, culverts and spans.
   Potential benefit= High
   Financial viability= 5
   Political viability= 5

5. Design and build pre-fabricated bridges for crossings on upper and lower Placer Creek.
   Potential benefit= High
   Financial viability= 5
   Political viability= 5

6. Obtain needed easements in all areas where there currently isn't one granted. Enabling the Town of Castle Valley road department to legally work on flood effected areas.
   Potential benefit= High
   Financial viability= 3
   Political viability= 5

7. Put in 10 foot culverts at upper and lower Placer Creek crossings and Cain Hollow.
   Potential benefit= High
   Financial viability= 5
   Political viability= 5

8. Remove dead trees, garbage and other debris from Castle Creek above the Castle Valley Drive culvert.
   Potential benefit= High
   Financial viability= 4
   Political viability= 5

9. Maintain all road crossings and diversions by monitoring and clearing culverts of weeds and sediment and keeping clear, excavating channels, reinforcing and extending berms and maintaining road surfaces.
   Potential benefit= High
   Financial viability= 3
   Political viability= 1

10. Continue to inform residents and buyers on safe building practices for flood prone areas and ensure land use codes allow for proper flood safety building.
    Potential benefit= High
    Financial viability=3
    Political viability=3

# SEVERE WEATHER

## BACKGROUND

High winds, thunderstorms and severe winter weather are all forms of severe weather which affect our area. High winds typically accompany thunderstorms and frontal systems. They have been responsible for various damages to property. Tornadoes are not a regular occurrence but dust devils which are much lesser tornadoes are sometimes formed. Hail and lightning also accompany thunderstorms. Hail has caused damage to crops on multiple occasions. Lightning is probably the number one severe weather hazard in our area. Lightning has been responsible for numerous fires, both wild and structural. Severe winter weather can include heavy snow fall and prolonged periods of below freezing temperatures. Some homes would need to have heavy snow removed from roofs to prevent roof failure. Castle Valley does not have a municipal water system, people use individual wells for water. Many residents have been without water during prolonged periods of cold because of frozen pipes and pressure systems.

### IMPACT ON COMMUNITY

The impacts of severe weather on the community would depend on the event and duration of the event. Heavy hail can destroy crops. Daystar Farms provides produce for many of Castle Valleys' residents. Severe hail, winds or flooding affecting their farm would also hurt them financially. Many residents also rely on their own crops for food & food storage.
Any severe weather event causing residents to be displaced would impact the community, currently there are not adequate plans in place for temporary housing and backup power for municipal buildings.
High winds and thunderstorms can also cause power and communication outages which slow emergency response times and also have potential to destroy food storage for many residents. Most personal wells are also run on electricity, so outages can leave residents without water, this could impact large portions of the community in event of a fire accompanying thunderstorms.
Heavy snow fall can leave many residents unable to get out for hours while limited staff, work to open roads. This also slows emergency response times. Castle Valley has an aging population and many would need help to clear their own roofs and driveways, and there are limited resources for them to find this help. Residents who experience prolonged water outages because of frozen pipes and systems would not have anywhere in Castle Valley to fill water storage containers until their systems are thawed, they would have to rely on neighbors who may allow them to fill or take containers to Moab.
All parts of the community are vulnerable to severe weather hazards.

### GOALS TO REDUCE AND AVOID LONG TERM VULNERABILITIES

Goals for reducing long term vulnerabilities to severe weather include developing an emergency operations plan that will include the Town of Castle Valley, Castle Valley Fire District, Grand County EMS, Grand County Roads, Grand County Emergency Management, Daystar Academy and Farms, Red Cliffs Lodge, Sorrel River Ranch, members of the community and surrounding communities.

Installing back up power for all municipal buildings and equip at least one municipal building with enough supplies to temporarily house up to 20 people is another goal.

**HISTORY**

| Recorded Severe Winter Weather events | Recorded severe thunder storm events |
|---|---|
| 12/7/1997 Winter Storm | 06/2003 lightning |
| 12/19/1997 Winter Storm | 07/2003 lightning |
| 12/21/1997 Extreme Cold | 09/16/2002 wind over 50mph |
| 12/24/2000 Heavy Snow | 06/25/2005 thunderstorm |
| 01/28/2001 Winter Storm | 09/23/2005 thunderstorm |
| 11/28/2006 Heavy Snow | 04/05/2006 thunderstorm |
| 12/19/2006 Winter Weather | 06/09/2006 wind over 50mph |
| 01/12/2007 Winter Weather Heavy Snow | 06/2006 lightning |
| 12/10/2007 Winter Weather | 07/10/2006 quarter size hail/arches |
| 02/03/2008 Winter Weather Heavy Snow | 08/26/2006 wind over 50mph |
| 12/13-24/2008 Winter Weather Storm | 08/2007 lightning |
| 02/24/2009 Dense Fog | 08/2008 lightning |
| 10/27/2009 Winter Weather | 10/06/2010 wind over 50mph |
| 12/07/2009 Winter Storm and Blizzard | 08/23/2013 thunderstorm/G.C. |
| 12/13,18/2009 Dense Fog | Note: info from weather.gov |
| 12/22/2009 Winter Weather | Grand County |
| 01/26/2010 Winter Weather | Note: lightning events were recorded |
| 01/28,29/2010 Dense Fog | fire events from CV CWPP 2/14/13 |
| 02/02-04/2010 Dense Fog | |
| 02/06/2010 Winter | |

Weather
02/08,16/2010
Dense Fog
02/19/2010 Winter
Storm
03/15/2010 Dense
Fog
12/29/2010 Winter
Storm
Note: taken from regional mitigation plan
Grand
County

## Severe Weather Probability Analysis

| | | | |
|---|---|---|---|
| **Potential Magnitude** | | **Negligible** | **Less than 10%** |
| | **X** | **Limited** | **10-15%** |
| | | **Critical** | **25-50%** |
| | | **Catastrophic** | **More than 50%** |
| **Probability** | **X** | **Highly likely** | |
| | | **Likely** | |
| | | **Possible** | |
| | | **Unlikely** | |
| **Location** | **Anywhere** | | |
| **Seasonal Pattern or Conditions** | **Anytime, depending on season, winds in spring and fall, heavy snow fall in winter. Lightning with monsoons** | | |
| **Duration** | **Hours to days** | | |
| **Analysis Used** | **State of Utah hazard plan**<br>**Grand County regional plan**<br>**Weather.gov**<br>**Weather.com/encyclopedia**<br>**Resources available, response times observed** | | |

**SEVERE WEATHER:**

**Risk Assessments and Mitigation Strategies:**

**(1 =Easy – 5= Difficult)**

1. Backup power sources at municipal buildings. Including propane alternatives for generators.
   Potential benefit= high
   Financial viability=5
   Political viability=3

2. Create an Emergency Operations Plan and train staff on power outage protocol.
   Potential benefit=high
   Financial viability=3
   Political viability=3

3. Fire and Emergency Medical Responders provide presence at Town building when communications are out.
   Potential benefit= high
   Financial viability= 2
   Political viability=1

4. Public education on dealing with various severe weather issues.
   Potential benefit= high
   Financial viability= 3
   Political viability= 1

5. Develop and make use of warning systems i.e. Town Siren, social media, reverse 911, weather stations etc.
   Potential benefit= high
   Financial viability= 4
   Political viability= 2

6. Have Utility Company clear trees and snow from power lines and propane tanks.
   Potential benefit= high
   Financial viability= 3
   Political viability= 2

7. Assure availability of backup water supply and other resources such as fuel, food, firewood, cots, etc.
   Potential benefit= high
   Financial viability= 5
   Political viability= 3

8. Power infrastructure map and grid available for Fire, Town and Mitigation.
   Potential benefit= medium
   Financial viability= 2
   Political viability= 5

9. Have Town Road Department clear roads of trees.
   Potential benefit= high
   Financial viability= 2
   Political viability= 2

# COMMUNICATION/POWER OUTAGES

## BACKGROUND

### ELECTRICTY

Electricity to Castle Valley is provided by Rocky Mountain Power, a subsidiary or Pacific Corp. Electricity for Castle Valley "originates from the Rattlesnake substation southwest of [the town of ] La Sal and travels over the top of the [La Sal] mountain[s], over Porcupine Rim [above Castle Valley] to [the settlement] of Castleton then to Castle Valley. It continues on to Cisco then follows the river to Colorado – a total of 125 miles, and is the longest cul-de-sac power line of all of Rocky Mountain Power's electrical lines."[2] The length of the power transmission lines and the difficult terrain it follows adds to the potential for disruptions. Castle Valley is very vulnerable to losing power and modes of communication for at least short periods of time with longer outages occurring less frequently in comparison.

Disruptions in electricity service are periodic. Disruptions often are associated with adverse weather events, such as high winds and heavy or wet snow falls, or technical failures on the power lines or poles. It is not uncommon for electricity to go out in part or all of Castle Valley at least once a month. Outages can be momentary (although disruptive of electrical equipment), a couple hours in length, or multiple hours and into more than a full day. For example, during the weekend of November 23, 2013, electricity was out for 30 hours "as a result of the wet and heavy snow from the storm that dropped 8 to 10 inches beginning last Friday afternoon."[3] In May 2012, high winds were responsible for the electricity outage which also coincided with a structure and brush fire in Castle Valley. The lack of electricity caused "additional problems for firefighters since nearby water sources required electrical power to pump water from the ground."[4]

In most instances, short disruptions in power are an inconvenience to most residents of Castle Valley. However, longer disruptions impact different residents in different ways. Some residents rely on digital phones (rather than landlines). When the electricity goes out, their phone service is lost. This can be a serious situation if a medical or fire emergency should occur. All residents who have an internet connection (provided by Frontier Communications) receive service via DSL and an in-home modem. The modem needs electricity to operate. Without the modem, wireless internet connects are lost. For residents who work from home, that is likely to mean disruption in their work. Also, the loss of the internet reduces the communications options for learning about or reporting an emergency situation.

The following summary of outages, major causes and number of customers impacted is provided by Rocky Mountain Power.[5] A total of 79 electricity outages were noted by the company between 2008 and 2013.

2 "Castle Valley Comments," *Moab Times-Independent*, November 29, 2007.
3 "Castle Valley Comments," *Moab Times-Independent*, November 28, 2013.
4 "Castle Valley Comments," *Moab Times-Independent*, May 31, 2012.
5 Information provided in email, January 2, 2014

**Castle Valley, Utah – Rattlesnake 22 Power Line**

Top 3 outage causes: January 1, 2008 – December 16, 2013

| Cause | Number of Instances | average duration | average customers impacted |
|---|---|---|---|
| Lightning | 32 | 3.5 hours | 76 |
| Wind | 29 | 3 hours | 72 |
| Snow, Sleet and Blizzard | 17 | 3 hours | 330 |

It should be noted that these figures do not include momentary and short outages. Also, experiences of residents in Castle Valley do vary from the averages provided by the utility company.

The cost of electricity outages is difficult to determine. For people who rely upon electricity for their home occupations, any outage over one hour begins to assume some cost impact. The BandB in Town has lost customers during overnight power outages. For people dependent on electricity for home medical purposes, lengthy outages can become life-threatening. Also, loss of telephone service (through the DSL service) raised adverse issues of safety and health to residents. As noted above, the loss of power hindered the ability of the Castle Valley Fire Department to respond to a fire in the valley in 2012.

It is possible to estimate the costs of electricity outages to Castle Valley, using the data provided by Rocky Mountain Power and hypothetical dollar figures. Two categories are suggested: an inconvenience cost of $10 per hour and a major disruption cost of $50 per hour. For example, lightning caused outages for the five year period for which data is available resulted in the following costs:

32 instances x 3.5 hours per outage x $10/hour of outage x 76 customers = $85,120

Or the cost as a major disruption to customers' home electrical equipment, work, food storage, purchase of backup generators, etc can be determined as:

32 instances x 3.5 hours per outage x $50/hour of outage x 76 customers = $425,600

Total costs to Castle Valley customers of outages over the same five year period from the three causes noted by Rocky Mountain Power come to:

At $10/hour as an inconvenience cost = $ 316,060
At $50/hour as a disruption cost = $1,580,300

Rocky Mountain Power reports that technology upgrades it has made over the past year will make it easier and quicker for the company to identify the location of outages and respond with repair crews. In fact, residents have noticed some improvements, with fewer outages. The Town government has established a good working relationship with the utility company which also improves response times to deal with outages.

**Telephone**

Telephone service is provided in one of two ways in Castle Valley: to customers by Frontier Communications through landline or wireless telephone service; to customers with cell phones who are able to access service.

For the most part, telephone service to Castle Valley as provided by Frontier is fairly reliable. A wireless transmission tower from Bald Mesa in the La Sal Mountains south of Castle Valley relays transmissions into and out of the valley, using a reflector above the valley on Porcupine Rim. The reflector directs a signal to a distribution station located near the center of Castle Valley.

Outages have occurred in the service. The most significant recent outage occurred on November 30, 2013. On that date 911 service was down for 10-15 hours. During much of that time, the company, local residents, nor Grand County emergency services were aware of the outage. Frontier has since responded that similar outages were unlikely to occur in the future.

It is not possible to accurately estimate the cost of disruptions in telephone coverage to Castle Valley residents. However, using the inconvenience cost noted above for electricity outages, a ballpark estimate would be $250,000-$300,000 since 2008. Losses to residents who rely on telephone service to conduct businesses would add to that figure.

For residents with wireless telephones with Frontier service, electricity outages also mean loss of telephone coverage.

Some residents are able to access telephone service with their cell phones. Text messages seem to go through more efficiently than telephone connections. Private cell phone companies have said they are unwilling to invest in building a cell tower in or near Castle Valley.

**Internet**

Internet service also is provided by Frontier Communications. Service is DSL, coming through telephone lines. Thus, the quality of internet service is similar to that for telephones. However, a number of residents who live further away from the distribution station in the center of the valley have noted a fall-off in both reliability and speed of internet connections. Also, it is not uncommon for customers to have to reboot their modems once, twice, or several times per day, thus disrupting service.

Like wireless telephones, internet service is dependent on electricity. When electrical outages occur, there is no internet coverage.

Frontier's internet system is connected in Moab to a transmission system operated by Emery Telcom. Emery reports that is has sufficient bandwidth to handle all of the areas internet traffic. At the same time, Frontier reports that bandwidth is sufficient to handle all of Castle Valley's traffic. At some point in these statements, it appears to many residents of Castle Valley that a gap remains in reliable and efficient internet coverage.

An estimate of the cost of disruptions to the internet will parallel those of electricity outage costs, although the actual cost is likely to be somewhat lower.

**Electronic Communication Summary**

For a small, relatively remote rural community, Castle Valley has reasonable communications systems. However, as a small, rural community, Castle Valley is very vulnerable to electricity and telephone outages, especially if those outages coincide with other emergency situations. The major gaps are in always-on electricity and telephone/internet services. Providers of both electricity and telephone/internet services report improvements in their ability to reliably meet the needs of Castle Valley residents, but the vulnerability of the lengthy electrical power line to storms and technical problems continues to place the town at risk of break downs in effective communications. The Town and the Fire District have taken steps to mitigate potential utility outages.

**Mitigation Initiatives**

The town of Castle Valley, the Castle Valley Fire District, and Grand County emergency services have made several improvements to help mitigation communications issues in the valley.

Both the town and the Fire District have met with electricity and telephone providers to voice concerns and seek solutions to existing problems. On several occasions in recent years, the Town has sought to open communication with cell phone providers, but is regularly told that cell phone infrastructure investments are not in those companies' interests.

The Fire District is in constant contact with the Grand County Sherriff's Office through handheld radios. In addition, the Fire District has acquired one satellite phone for use in emergencies when the handheld radios do not function. The Sherriff's Office has been very responsive to the potential emergency needs of the town. In the past it has brought in portable communication equipment. Finally, the Fire District and town have collaborated to set up an emergency communication system available to all residents during prolonged electrical or telephone outages. Notices have been posted to inform residents how they can access that assistance.

**Mitigation Goal**

The goal is to assure that all Castle Valley residents are aware of communication options during emergency conditions.

Objectives to reach that goal include:

- Developing and distributing awareness-raising materials on emergency response options available to Town residents.
- Maintaining the Fire District assistance at the Town Center during power and/or telephone outages.
- Maintaining good working relationships with the Grand County Sheriff's Office for emergency services and with utility companies.
- Assuring that Town ordinances and regulations remain up-to-date so to provide clear guidance for emergency prevention and, when needed, mitigation.

## Communications Power Outage Probability Analysis

| | | | |
|---|---|---|---|
| **Potential Magnitude** | | **Negligible** | **Less than 10%** |
| | | **Limited** | **10-15%** |
| | **X** | **Critical** | **25-50%** |
| | | **Catastrophic** | **More than 50%** |
| **Probability** | **X** | **Highly likely** | |
| | | **Likely** | |
| | | **Possible** | |
| | | **Unlikely** | |
| **Location** | **Entire Length of Rattlesnake line** | | |
| **Seasonal Pattern or Conditions** | **Generally occurs along with severe weather events** | | |
| **Duration** | **Seconds to days** | | |
| **Analysis Used** | **History of occurrence, utility company, Times independence column, Ron Drake local reporter and Fire Chief.** | | |

## COMMUNICATION/POWER OUTAGES:

**Risk Assessments and Mitigation Strategies:**
**(1 =Easy – 5= Difficult)**

1. Develop protocol for reporting problems with communication.

   Potential benefit= High
   Financial viability= 1
   Political viability= 1

2. Assure a culinary water backup source is available for town residents for at least 72 hours.
   Potential benefit= High
   Financial viability= 5
   Political viability= 3

3. Set up a command post at the Town Hall during prolonged electricity and/or telephone outages.
   Potential benefit= High
   Financial viability= 2 [Volunteer hours]
   Political viability=1

4. Increase public awareness of the need to have available 72 hour emergency kits,
   Potential benefit= high
   Financial viability= 3
   Political viability= 1

5. Install back-up power for all municipal buildings and church. Have supplies for 20 people, including food, water, bedding etc.
   Potential benefit= High
   Financial viability= 4 - However there are potential donations from other agencies.
   Political viability= 1

6. Develop MOUs with surrounding communities and agencies for appropriate support during emergencies. Develop a continuity of government Ordinance and plan to give power to the council if the Mayor is not available during an emergency.
   Potential benefit = High
   Financial viability= 3 [Plan for paying back assistance]
   Political viability= 2

# ROCKFALL

## BACKGROUND

The study, GEOLOGIC HAZARDS OF CASTLE VALLEY, GRAND COUNTY, UTAH by William E. Mulvey of the Utah Geological Survey, states the following regarding rockfalls:

> "Rockfalls occur along cliffs in Castle Valley. As development advances higher on alluvial fans and slopes below cliffs, the risk from falling rocks will increase.
>
> Rockfalls originate when erosion and gravity dislodge rocks from cliffs or slopes. The most susceptible unit in Castle Valley is the Wingate Sandstone where outcrops are disrupted by bedding surfaces, joints, or other discontinuities that break rock into loose fragments, clasts, or slabs. Rocks in talus and cliffs may dislodge, fall onto steep slopes, and travel great distances by rolling, bouncing, and sliding.
>
> Primary causes of rock falls are weathering, freeze-thaw of water in outcrop discontinuities, and ground shaking during earthquakes. Keefer (1984) indicates that rockfalls may occur in earthquakes as small as magnitude 4.0.
>
> Rock falls present a hazard to structures and personal safety. Homes built on slopes below Porcupine Rim are particularly vulnerable."

A rockfall hazard map is available to the public at the Town Building and their website.

## IMPACT ON COMMUNITY

The impacts of Rockfall on the Community would depend on the location and severity of the event. Rockfalls can cause damage to structures, roads, and can alter drainages which could negatively impact other properties and roads. Rockfalls will mostly happen higher up on the rim side of the valley.
(See Appendix A4)

## HISTORY

Although rockfalls occur often few are documented or cause damage here is a list of witnessed rockfalls:

July 8, 1985 - 48,000 cubic yards of rock fell from Porcupine Rim barely missing a home at the top of Rim Shadow Lane. No damage was reported but an inch of dust covered the surfaces inside the house due to open windows.

July, 2003 a medium sized rockfall was sited between Rim Shadow and Lazaris lanes. No damage to properties was reported.

February, 2004 a small rockfall was sited southeast of Lazaris lane. No damage to properties was reported.

August, 2010 a medium sized rockfall was sited above Holyoak lane. No damage to properties was reported.

November 2015 a large rockfall was sited above Holyoak lane. No damage to properties was reported.

Since 1959, five rock falls on Porcupine Rim have been documented, four of these in the past six years **(W.E.** Case, Utah Geological Survey, verbal communication, November 25,1991).

**GOALS TO REDUCE VULNERABILITIES**
Typical mitigation measures to reduce the impacts from Rockfalls would be cost prohibitive for property owners and the Town. Strategies to decrease vulnerability include continuing to inform property owners of this hazard through the building permit process, and having the road department continue to clear roads after rockfalls. These strategies should be included in a future emergency operations plan.

## Rock Fall Probability Analysis

| | | | |
|---|---|---|---|
| **Potential Magnitude** | **X** | **Negligible** | **Less than 10%** |
| | | **Limited** | **10-15%** |
| | | **Critical** | **25-50%** |
| | | **Catastrophic** | **More than 50%** |
| **Probability** | **X** | **Highly likely** | |
| | | **Likely** | |
| | | **Possible** | |
| | | **Unlikely** | |
| **Location** | **Rim sides of Castle Valley, Pace Hill, Hwy. 128.** | | |
| **Seasonal Pattern or Conditions** | **Early spring and during rain events, could occur at any time.** | | |
| **Duration** | **Minutes, with cleanup lasting hours to days** | | |
| **Analysis Used** | **Observations of residents, recorded events, Grand County regional plan, geologic hazard reports, C.V hazard maps.** | | |

## ROCKFALL:

**Risk Assessments and Mitigation Strategies:**
**(1 =Easy – 5= Difficult)**

1. Develop plans for road closure if rock fall closes roads.
    Potential Benefit=High
    Financial viability= 2
    Political viability= 1

2. Continue to provide property owners and renters with hazard information.
    Potential benefit= High
    Financial viability= 2
    Political viability= 1

3. Obtain equipment for stabilization and cribbing.
    Potential benefit= Medium
    Financial viability= 4-5
    Political viability= 1

4. Build deflection berms, slope benches and rock catch fences.
    Potential benefit= Medium
    Financial viability= 5
    Political viability= 5

5. Continue to identify lots affected by rock fall hazard.
    Potential benefit= High
    Financial viability= 1
    Political viability= 1

# DROUGHT

## HISTORY

The Freemont and Ute people were in the area of Castle Valley long before white settlers arrived in the region. The Martin brothers were the first white settlers and had the first non-native child in the area in 1886. Farming and ranching was the primary focus of the area with many irrigations ditches coming off of springs along Castle Creek irrigating the lower valley and large irrigation wells in the upper valley. Much more water was used for farming than the current residential use that exists present day. According to local irrigation ditch users the flows from the springs and in the ditch have decreased in the last 30 years mostly due to less annual snowpack.

## BACKGROUND

The Town of Castle Valley states the following to be our Goal with regard to water: *To maintain or enhance water quality and quantity in the Castle Valley watershed by improving our knowledge, developing policies, and taking action as needed.*

The source of well water for Town residents, depending on location, is either the valley-fill aquifer or, for those who live closer to Porcupine Rim, the Cutler formation aquifer. The latter tends to have significantly more solids and salts in it, and it impacts the quality of valley-fill aquifer in the lower part of the Valley.

The quality of the water varies in different parts of the Town. The Utah Division of Water Quality has officially classified the water quality based on a classification system focused primarily on total dissolved solids (see Water Classification Map).

### IMPACT ON COMMUNITY

The Valley-fill aquifer is fed from a large watershed in the La Sal Mountains whose boundaries were defined by the Federal Environmental Protection Agency in 2001 (see Watershed Map) when it declared the watershed to be a sole source aquifer. This means that the aquifer system is the sole and principle source of drinking water for the residents of the Town and that contamination or depletion of this aquifer system would be detrimental to the health and safety of the town residents.

In 1996, the Town passed a Watershed Protection Ordinance. The Town is committed to working with private landowners, agencies and authorities that own property in the Town's watershed to protect water quality and quantity. The Town also tries to use the EPA sole source aquifer designation as much as possible in these interactions.

At this point, there are no good firm estimates of the Valley's overall water capacity, i.e. size of aquifer, quantity of recharge, amount of usage. The Town now has six monitoring wells for measuring water quality changes over time. A number of publications regarding what we know and don't know about our watershed and its process are gathered in the Town Building and are available to the public.

**GOALS TO REDUCE VULNERABILITIES**

In 2006, Alice Drogin formed a Watershed Protection Group, which is in a series of groups and task forces which have looked into how to best protect the quality and availability of Castle Valley's water. Work continues today for watershed protection as the Town is currently having another Water Study done to determine the Water budget for the Town and further protect the Castle Valley aquifer.

The following are the highlights from two papers, one from the Utah Climate Center, the other from the Colorado College. Using information from instrumental records dating back 60 years, Great Salt Lake shoreline data dating back a century, and tree ring data dating back 900 years, the UCC concludes that:
1) in the context of the past thousand years, 20th-century Utah - and the latter half in particular - has been exceptionally wet. The commonly assumed "30-year average" cycle is misleading, because the year-to-year deviation from the average is high. While dry periods in the late 20th century usually lasted less than a decade, drought lasted during most of the 13th and 17th centuries.

2) they found a clear 12-year pattern for northern Utah (which fades in the south) but also two more strong patterns - a 40-year cycle and a 150-200 year cycle. These appear to be linked to a climate pattern in the Pacific Ocean called the Pacific Quasi-Decadal Oscillation which affects the path of the jet stream and hence the moisture we receive.

The Colorado College study also showed a "Little Ice Age" running from about 1300 A.D. to the early 1800's, preceded by a "Medieval Warm Period" from about 800 A.D. to the mid-1200's.

Looking forward, the study projects
(1) a reduction of 6% and 20% in annual runoff between 2041-2060 for the Colorado River Basin, principally because of markedly lower snowpack.
(2) a slight increase in average annual temperatures.
(3) increased desertification resulting in an increased number and severity of wildfires: fire risk rising by 30%-60% under current greenhouse emission rates.
(4) the 21st century may "be nasty".

If the floods don't get us, the fires probably will.....

## DROUGHT:

### Risk Assessments and Mitigation Strategies:

**(1 =Easy – 5= Difficult)**

1. Monitor water depths in Castle Valley wells.
    Potential benefit= High
    Financial viability= 1
    Political viability= 1

2. Determine the point at which the Town would implement a groundwater drought management plan.
   Potential benefit= High
   Financial viability= 5
   Political viability= 3

3. Build large retention ponds above the community.
   Potential benefit= High
   Financial viability= 5
   Political viability= 5

4. Install rain water catchment systems.
   Potential benefit= Medium high
   Financial viability= 5
   Political viability= 1

## Drought Probability Analysis

| | | | |
|---|---|---|---|
| **Potential Magnitude** | | **Negligible** | **Less than 10%** |
| | | **Limited** | **10-15%** |
| | | **Critical** | **25-50%** |
| | **X** | **Catastrophic** | **More than 50%** |
| **Probability** | | **Highly likely** | |
| | **X** | **Likely** | |
| | | **Possible** | |
| | | **Unlikely** | |
| **Location** | **Everywhere** | | |
| **Seasonal Pattern or Conditions** | **Long term condition with seasonal breaks** | | |
| **Duration** | **Years to decades** | | |
| **Analysis Used** | **Utah Climate Center, Colorado College, National Weather service** | | |

# WATER CONTAMINATION

## BACKGROUND

Castle Valley's primary water resources are the aquifer that underlies the valley, Castle Creek and a small number of springs that mostly occur adjacent to Castle Creek. The aquifer is the sole source of drinking water for Castle Valley residents and Castle Creek provides surface water for irrigation, recreation and maintenance of important riparian areas. It is believed that there is significant interaction between the aquifer and surface sources such as Castle Creek, springs and intermittent sources such as Placer Creek. Because of that interaction and because the Castle Valley community has very limited sources of water, contamination of any of the sources could be disastrous. To date there have been no contamination problems, but it is vital that any potential sources of contamination be identified and action taken to prevent or mitigate contamination.
(See Appendix A5-A6)

## CONTAMINATION HAZARDS

Contamination of the Aquifer
Widespread contamination of Castle Valley's aquifer would be a major threat to the Castle Valley community and could be extremely difficult to mitigate or cure, therefore the emphasis should be on prevention. An ongoing water quality monitoring program will help identify potential contamination problems before they become widespread, but at the same time it is important to regulate activities or materials that are known to have caused water contamination issues elsewhere. Possible sources of aquifer contamination are:

1) Airborne Pollutants – There are a variety of airborne pollutants that can bond with or dissolve in surface water and then through seepage make their way into an aquifer. Aquifer contamination from airborne VOCs produced by oil drilling activity has occurred in other parts of Utah.

2) Agricultural Chemical / By-Product Seepage – Most agricultural chemicals and by-products are water soluble and if used in large amounts or high concentrations can migrate into aquifers. This is a common problem in areas with a lot of conventional agricultural activity or feedlots.

3) Septic System Seepage – By design, septic system effluent is leached into the adjacent soil and will be cleaned by microbiological action in the soil. However, if the density of septic systems in an area is too high for the cleaning capacity of the soils and / or the water table is relatively close to the surface then an aquifer can become contaminated by the effluent.

4) Industrial / Chemical Spills – There are many products available for industrial, yard or household use that contain high concentrations of chemicals and compounds that could pose a considerable threat to aquifer water. It is not expected that yard, garage or household use of such products would occur on a level that could contaminate an entire aquifer, but there are commercial or industrial activities that might use hazardous chemicals or compounds in volumes and / or concentrations that could pose such a threat.

Contamination of Individual Wells

There are any number of ways that an individual well can become contaminated and in such cases there are generally better opportunities for mitigation and repair. However, due to the movement of water within the aquifer the contamination of any individual well should be considered a serious matter because a high concentration of contaminants introduced in a specific location could become a widespread problem. Possible sources of individual well contamination are:

1) Surface Water Intrusion – Wells that are inadequately sealed (grouted) at the top can be contaminated by surface water intrusion (i.e. contaminated from the top down). Sources of such intrusion are flooding, irrigation runoff or precipitation pooling near the wellhead. More specific threats from such intrusion are covered in the following paragraphs.

2) Agricultural Chemical / By-Product Seepage – Most agricultural chemicals and by-products are water soluble and if present in large amounts or high concentrations near a well could potentially contaminate an individual well by seeping into the water that the well draws. Spills or runoff containing dissolved agricultural chemicals or feedlot by-products could also be a cause of individual well contamination, particularly if the wellhead is not adequately sealed.

3) Chemical Spills – There are many products available for yard, garage or household use that contain high concentrations of chemicals and compounds that could contaminate an individual well if spilled near the well, particularly if the wellhead is not adequately sealed.

4) Septic System Seepage – Septic system effluent could contaminate an individual well if the septic system and well are not adequately separated, particularly if the water table is close to the surface.

Contamination of Castle Creek

Being a surface water body, Castle Creek is more susceptible to contamination. Castle Creek is not a source of drinking water so its contamination may be viewed as less of a threat to the community than contamination of the aquifer, but because there is significant interaction between surface water and aquifer water and because Castle Creek water is distributed and used for flood irrigation contamination of its water could become a serious problem. Possible sources of Castle Creek contamination are:

1) Airborne Pollutants – There are a variety of airborne pollutants that can bond with or dissolve in surface water. Castle Creek could be contaminated by such pollutants if they are present in large amounts or local high concentrations. Such contamination has occurred in other areas where commercial or industrial activity occurs near surface water.

2) Agricultural Chemical / By-Product Runoff – Most agricultural chemicals and by-products are water soluble could contaminate Castle Creek if present in large amounts or high concentrations in areas where there is a large volume of irrigation or storm water runoff into the creek.

3) Industrial / Chemical Spills – There are many products available for industrial, yard or households use that contain high concentrations of chemicals and compounds that could contaminate Castle Creek if spilled or used in areas where there is a large volume of irrigation or storm water runoff into the creek.

4) Septic System Seepage – It is conceivable that septic system effluent could seep into Castle Creek, particularly in areas where there are springs and a high water table.

5) Thermal Wells – Depending on the design and material used in thermal wells they potentially cause a major threat to contamination of underground water.

6) Mining – There are several gold deposits and a long history of mining in the La Sal mountains. Placer Creek in Castle Valley was named after the Placer Gold, such an industry also poses a threat water contamination.

## Water Contamination Probability Analysis

| | | | |
|---|---|---|---|
| **Potential Magnitude** | | **Negligible** | **Less than 10%** |
| | | **Limited** | **10-15%** |
| | | **Critical** | **25-50%** |
| | **X** | **Catastrophic** | **More than 50%** |
| **Probability** | | **Highly likely** | |
| | | **Likely** | |
| | **X** | **Possible** | |
| | | **Unlikely** | |
| **Location** | **Would depend on the source of contamination.** | | |
| **Seasonal Pattern or Conditions** | **Anytime** | | |
| **Duration** | **Would depend on where and what type and quantity of contaminate.** | | |
| **Analysis Used** | **Utah Geologic Survey (UGS)** | | |

## WATER CONTAMINATION:

**Risk Assessments and Mitigation Strategies:**
**(1 =Easy – 5= Difficult)**

1. Regular water quality monitoring and sampling of selected wells and Castle Creek, to provide an early warning of future issues.
   Potential benefit= High
   Financial viability= 2
   Political viability= 1

2. Delineate and Protect the Castle Valley Watershed . The Town should take whatever legal action is available to create broad protection for the entire Castle Valley watershed.
   Potential benefit= High
   Financial viability= 3
   Political viability= 2

3. Educate Castle Valley residents, agricultural and commercial operators to help them understand how water source contamination can occur and how to prevent it.
   Potential benefit= High
   Financial viability= 2
   Political viability= 3

4. Continue to regulate septic system placement, construction and use done by the State, any indication of water contamination caused by septic systems should trigger action by the Town.
   Potential benefit= High
   Financial viability= 1 to 4 (if the Town is involved)
   Political viability= 1 to 4 (if the Town is involved)

5. Continue to regulate wellhead sealing (grouting) done by the State, any indication that a well has been contaminated by surface water intrusion should trigger action by the Town.
   Potential benefit= High
   Financial viability= 1
   Political viability= 1

6. Use appropriate regulation to limit pollutants used in commercial and industrial activity so sources of VOCs and other concentrated chemical contaminants are prohibited or severely limited.
   Potential benefit= High
   Financial viability= 2
   Political viability= 3

7. Use Appropriate Zoning to Limit Septic System Density (i.e. population density)
   Potential benefit= High
   Financial viability= 2
   Political viability= 2

8. Construct a Community Water and Sewer System.
   Potential benefit= High
   Financial viability= 5
   Political viability= 5

9. Contain and clean contaminated sources by through contractor or by obtaining the tools and training needed to flush contaminated wells or contain and clean any contamination of Castle Creek from spills, runoff, etc.
   Potential benefit= High
   Financial viability= 4
   Political viability= 2

10. Consider and research the use of composing toilets and other alternative composting systems.
   Potential benefit= High
   Financial viability= 3
   Political viability= 3

11. Maintain above ground water storage for a back-up water source.
   Potential benefit= High
   Financial viability= 4
   Political viability= 2

# SUBSIDENCE

## BACKGROUND

Subsidence is the motion of a surface (usually, the Earth's surface) as it shifts downward relative to sea-level. Subsidence is what can create sinkholes, which typically occur naturally as a result of percolating water and the gradual removal of soluble bedrock. This process creates a void that ultimately results in a collapse of the overlying cave roof. Though most often occurring in regions with heavy limestone deposits, sinkholes also appear in areas of chalk, gypsum, basalt, and where there are underlying salt beds, several of which are abundant in Grand County.

Human activities such as mining, groundwater over-extraction, extraction of natural gas, earthquake, overly dry expansive soils, drainage diversion and failing infrastructure – such as water main leaks, or the collapse of sewer systems and other buried pipes – can also create sinkholes.

## HISTORY

Castle Valley is part of a large, regional, collapsed salt anticline that includes Paradox Valley to the Southeast. It is surrounded by Permian to Tertiary sedimentary and igneous rocks. Beneath the Valley is the Pennsylvanian Paradox Formation that contains thick salt layers deposited in a shallow sea. As these salt layer were buried they became mobile and formed diapir in what now Castle Valley. The uplift of the Colorado Plateau in the late Tertiary increased erosion rates and allowed ground water to dissolve the salt layers from the core of the anticline. As a result the overlying rock collapsed and eroded, leaving Castle Valley in the core of the anticline. In 1992 Mulvey mapped a suspected Quaternary fault parallel to Porcupine Rim northwest of Round Mountain. Several sinkholes along this fault are attributed to localized dissolution or piping.

## IMPACT ON COMMUNITY

Present day subsidence and sinkholes have yet to make a big impact on the Castle Valley community however the larger concern could be directed at the reason why they appear or increase in size. Many of the activities that are responsible for creating sinkholes could be very detrimental to the holistic health of Castle Valley. Over-mining water in the valley could lead to drought and seriously impact the community. Other activities such as mining in the region could affect Castle Valley's Sole Source Aquifer if sinkholes begin to appear from mining practices.

## GOALS TO REDUCE VULNERABILITIES

The Town of Castle Valley has had many geologic and hydrologic studies done in the past which have helped the valley understand more about the local aquifer and the effects the geology plays on the valley as a whole. Continuing to monitor local subsidence and draw conclusions as to why they have formed will protect the community by forecasting possible future problems. The knowledge gained from continual water monitoring and a general understanding of Castle Valley's watershed will help the community create a water budget that will not over mine the valley's water and create sinkholes.

## SUBSIDENCE:

**Risk Assessments & Mitigation Strategies:**
**(1 =Easy – 5= Difficult)**

1. Monitor water depths in Castle Valley wells.
   Potential benefit= High
   Financial viability= 1
   Political viability= 1

2. Determine the point at which the Town would implement a groundwater drought management plan.
   Potential benefit= High
   Financial viability= 5
   Political viability= 3

3. Create log of current sinkholes and monitor their changes.
   Potential benefit= High
   Financial viability= 3
   Political viability= 2

4. Inhibit any kind of mining in the local region that may create subsidence.
   Potential benefit= High
   Financial viability= 5
   Political viability= 3

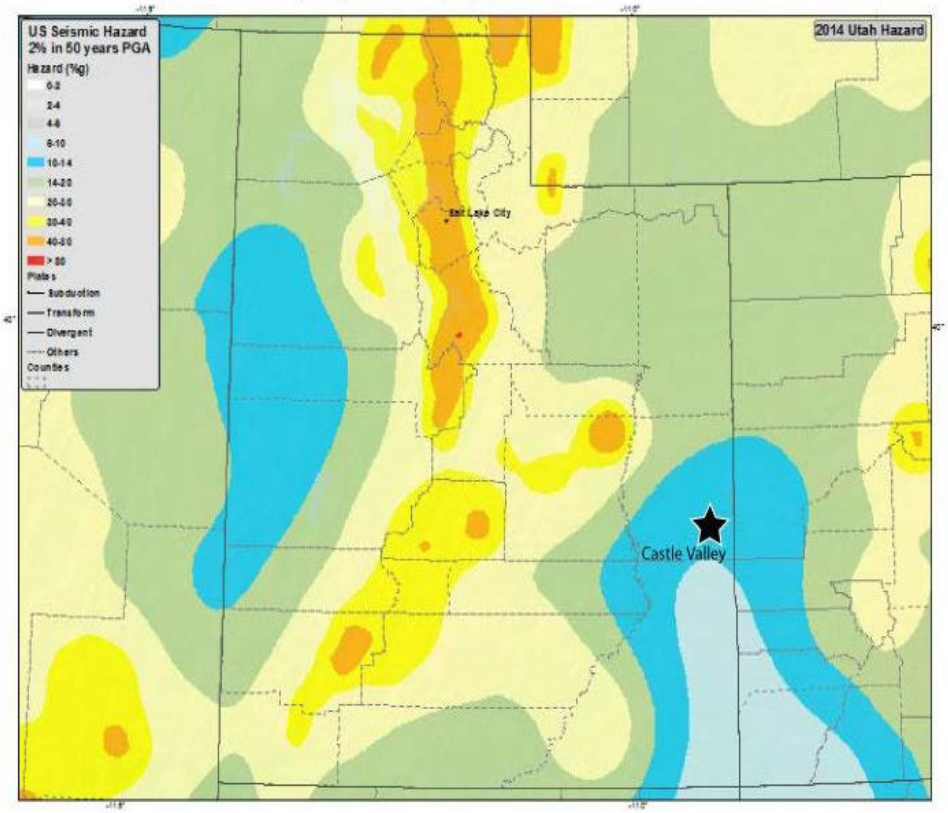
5. Bring awareness and education to subsidence to the community.
   Potential benefit= High
   Financial viability= 1
   Political viability= 1

# EARTHQUAKE

## BACKGROUND

Earthquakes are not a major threat or hazard to Castle Valley. The underlying geology is stable. However, north of Castle Valley, along the Wasatch Front (see map), a number of faults exist and have produced earthquakes within recorded history.

This is the most recent 2% in 50 year probability map from 2014 data.



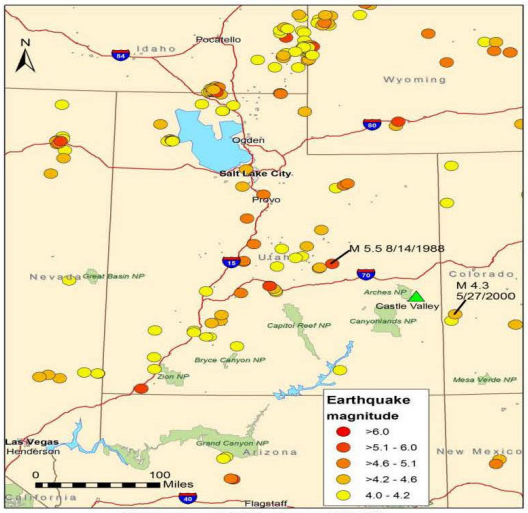

Source: http://earthquake.usgs.gov/earthquakes/states/utah/hazards.php
Available at http://earthquake.usgs.gov/earthquakes/states/utah/hazards.php

**IMPACT ON COMMUNITY**

The map illustrates that Castle Valley has a 2% probability that it will shake harder than 0.10 to 0.14g's every 50 years. It also means that there is a 98% probability that it will not shake harder than 10 -14%g every 50 years.
The probability of exceeding those acceleration values in the next ~2500 years is ~100%.

The table below will help translate the expected acceleration for Castle Valley into relative terms should an event of that size occur.

| Instrumental Intensity | Acceleration (g) | Velocity (cm/s) | Perceived Shaking | Potential Damage |
|---|---|---|---|---|
| I | **< 0.0017** | < 0.1 | Not felt | None |
| II-III | **0.0017 - 0.014** | 0.1 - 1.1 | Weak | None |
| IV | **0.014 - 0.039** | 1.1 - 3.4 | Light | None |
| V | **0.039 - 0.092** | 3.4 - 8.1 | Moderate | Very light |
| VI | **0.092 - 0.18** | **8.1 - 16** | Strong | Light |
| VII | 0.18 - 0.34 | **16 - 31** | Very strong | Moderate |
| VIII | 0.34 - 0.65 | **31 - 60** | Severe | Moderate to heavy |
| IX | 0.65 - 1.24 | **60 - 116** | Violent | Heavy |
| X+ | > 1.24 | **> 116** | Extreme | Very heavy |



All earthquakes magnitude 4 and greater, 1900 -2014.
Source: http://earthquake.usgs.gov/earthquakes/search/

**Earthquakes and Rock Falls**

The August 14, 1988 magnitude 5.3 San Rafael Swell earthquake caused numerous rockfalls on the edge of Lockhart Basin.

Source: http://www.seis.utah.edu/lqthreat/nehrp_htm/1988sanr/1988sanr.shtml

Given the rock fall hazard from Porcupine Rim, it is reasonable to say that the rock fall hazard is increased by the seismic potential beyond what would be expected in an aseismic environment. Further, rockfalls can occur by seismic occurrences outside of Castle Valley, including occurrences over 50 miles away.

It is known that landslides have been initiated by earthquakes as low as magnitude 4.
Source: Keefer, D. K, 1984, Landslides caused by earthquakes: Geological Society of America Bulletin, v. 95, p. 402-421.

**Induced Earthquakes**

The M4.3 Paradox, Colorado, earthquake in 2000 was caused by deep well brine injection and has been the source of over 4,500 small earthquakes since the well was put into operation in 1991. Only 22 earthquakes, about 0.5% of the induced events, have magnitudes greater than or equal to M2.5. It is possible that larger earthquakes could be generated from this known source but well operators have reduced the injection rate since the M4.3 event in 2004 however, a M3.9 earthquake occurred in 2004.

Only 4 induced earthquakes with magnitude greater than or equal to M 3.0 have occurred.
All but one of these occurred prior to the mid-2000 decrease in injection rate, including the largest induced event – the M4.3 event which occurred on May 27th, 2000 (after ~4 years of continuous injection).

Source: http://www.usbr.gov/uc/wcao/progact/paradox/annualRep/PVSN-2008Annual-Rep.pdf

**GOALS TO REDUCE VULNERABILITIES**

Discourage deep well brine injections that have been known to cause small earthquakes.
Create awareness for the community to a have 72- hour kit with ample food and water storage if roads and passes are shut down due to the effects of an earthquake.

## Earthquake Probability Analysis

| | | | |
|---|---|---|---|
| **Potential Magnitude** | | **Negligible** | **Less than 10%** |
| | **X** | **Limited** | **10-15%** |
| | | **Critical** | **25-50%** |
| | | **Catastrophic** | **More than 50%** |
| **Probability** | | **Highly likely** | |
| | | **Likely** | |
| | | **Possible** | |
| | **X** | **Unlikely** | |
| **Location** | **River corridor and along steep slopes and cliffs.** | | |
| **Seasonal Pattern or Conditions** | **Potential from fracking or injection wells.** | | |
| **Duration** | **Seconds to minutes with clean-up lasting hours to days.** | | |
| **Analysis Used** | **USGS and government records** | | |

**EARTHQUAKE:**

**Risk Assessments and Mitigation Strategies:**

1. Culinary water backup- cistern research
   Potential benefit = High
   Financial viability= 5
   Political viability= 3

2. Include information about earthquakes in public awareness publications.
   Potential benefit= medium
   Financial viability=2
   Political viability=2

3. Work with Grand County to keep Loop Road open year around as Hwy 128 is likely to experience excessive rockfall.
   Potential benefit=medium
   Financial viability=2
   Political viability=1

4. Develop community accountability system to ensure no one is left behind.
   Potential benefit=High
   Financial viability= 1
   Political viability=1

## RECOMMENDED PRIORITY PROJECTS

| **Goal** | **Priority -** 1 |
|---|---|
| **Objective** | Have a Emergency Operations Plan in place to be prepared for major disasters. |
| **Action Project:** | Develop Emergency Operations Plan. (FEMA FA-197 Appendix B) |
| **Time Frame:** | One year. |
| **Funding:** | Volunteers based, with support from the Town Clerk under the salary position. |
| **Estimated Cost:** | Depends on number of people and time involved, unknown. A Estimation from Rick Bailey, the Grand County Emergency Manager, would to take a trained individual 15 hours to complete the plan. |
| **Jurisdictions Involved:** | Town of C.V staff, C.V.F.D, volunteers, County emergency manager, Sheriffs' Department staff. Representatives from surrounding community, including Daystar Academy and Farms, Red Cliffs Lodge, Sorrel River Ranch, residents along river corridor and in Castleton and Willow Basin. |

| **Goal** | **Priority -** 2 |
|---|---|
| **Objective** | Identify in detail issues in the major drainages in Castle Valley to prevent or mitigate major events that may occur. |
| **Action Project:** | Annual and interim inspections of Placer and Castle Creek drainages. |
| **Time Frame:** | Annual Inspections and after events, beginning immediately. |
| **Funding:** | Town of Castle Valley Tax Base |
| **Estimated Cost:** | 8 hours each inspection at 22.50 per hour for staff labor. |
| **Jurisdictions Involved:** | Town of C.V. road department staff. |

| Goal | **Priority** – 3 |
|---|---|
| **Objective** | Bring awareness to the community about how to be prepared for and mitigate possible hazards. |
| **Action Project:** | Annual - quarterly public awareness publications. |
| **Time Frame:** | By the end of 2015 |
| **Funding:** | Town of Castle Valley Tax Base |
| **Estimated Cost:** | $200 per mailing plus Town Clerks regular salary. |
| **Jurisdictions Involved:** | Town of Castle Valley Town Clerk will be responsible for the mailing with info from the CV Fire District. and CV Hazard Mitigation Committee. |

| Goal | **Priority** - 4 |
|---|---|
| **Objective** | Maintain the ingress and egress roads open for the community in case of an emergency. |
| **Action Project:** | Maintain ingress and egress for community, Castle Creek, Shafer Lane and Upper 80 crossings. |
| **Time Frame:** | Present and Ongoing |
| **Funding:** | Town of C.V. annual roads budget. |
| **Estimated Cost:** | |
| **Jurisdictions Involved:** | Town of Castle Valley. road department and MOU with Grand County road department. |

| Goal | **Priority** - 5 |
|---|---|
| **Objective** | Have back-up generators tied into public buildings for prolonged power outages. |
| **Action Project:** | Install back-up power for municipal buildings. |
| **Time Frame:** | Two years for all buildings, Town and Fire Department. |
| **Funding:** | Possible Grants or from the Town's Tax Base for capital improvements. |
| **Estimated Cost:** | Thousands of dollars |
| **Jurisdictions Involved:** | Town of C.V and C.V.F.D |

| Goal | **Priority** - 6 |
|---|---|
| **Objective** | Create Interlocal agreements to efficiently handle mitigation and disaster recovery efforts. |
| **Action Project:** | Advise and seek agreements with other organizations in the community, interagency and government. |
| **Time Frame:** | Immediately and ongoing. |
| **Funding:** | Town of Castle Valley Tax Base. |
| **Estimated Cost:** | Will depend on time of people involved at 22.50 per hour. |
| **Jurisdictions Involved:** | Town of C.V. staff and C.V.F.D. along with utility companies , Grand County road department, Daystar Academy and Farms, C.V B and B, Redcliffs Lodge and Sorrel River Ranch, UDOT. |

# PLAN MAINTENANCE PROCESS

The Hazard Mitigation Committee will update the plan every four years or as determined by events. The plan will be updated by November of 2019.
Public hearings will be held prior to updating the plan.

Appendices will be added as information becomes available and as events occur.

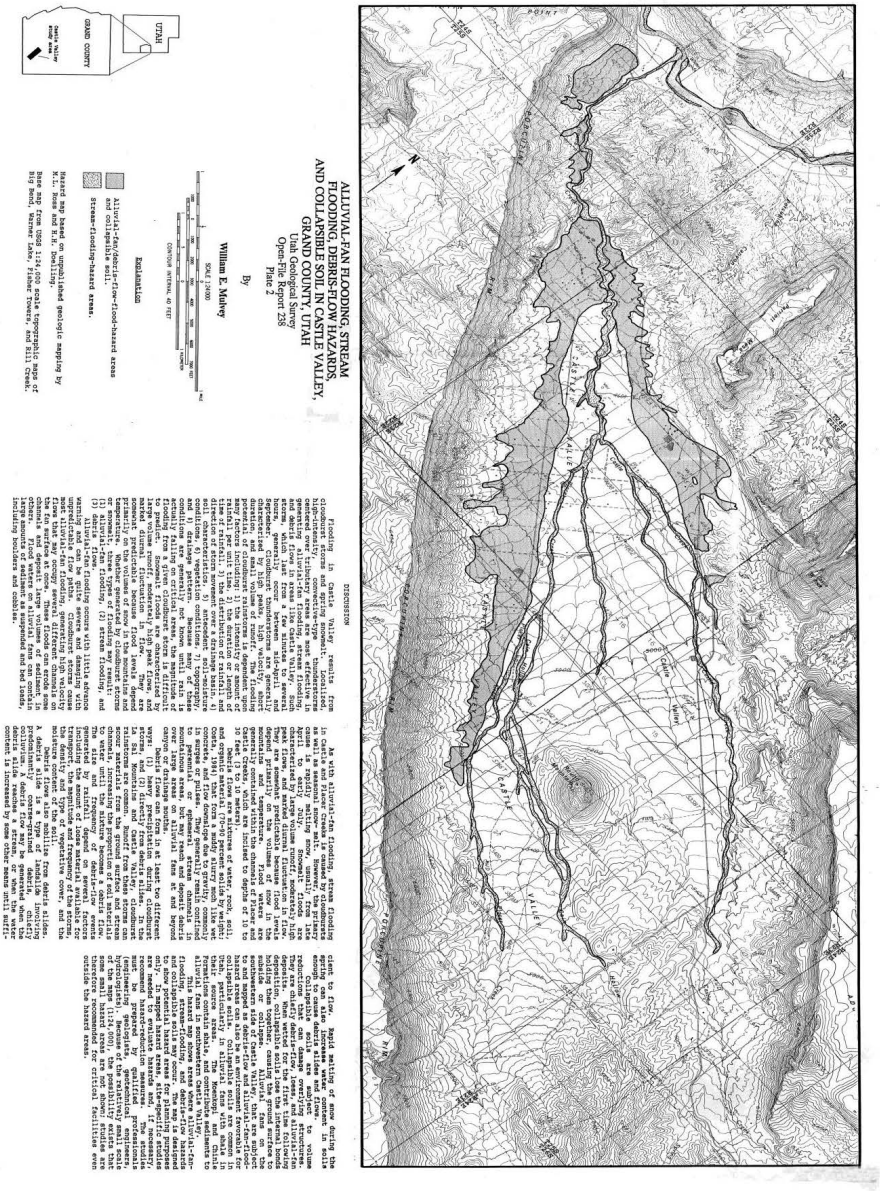
Because the majority of committee members involved in the process are, members of the Fire District or of the Town of Castle Valley Public Body, updating the plan every four years will also help maintain continuity in local government.

# Appendix A:

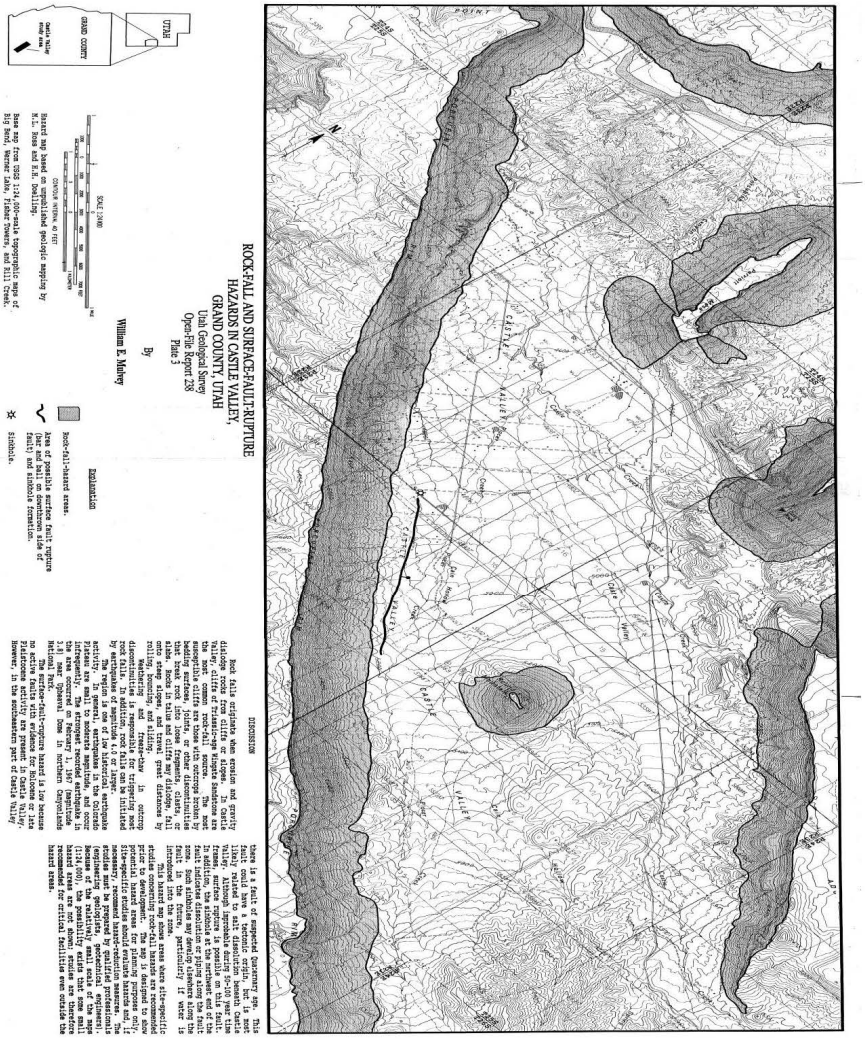
## A1 – State of Utah

## A2 - Grand County, Utah

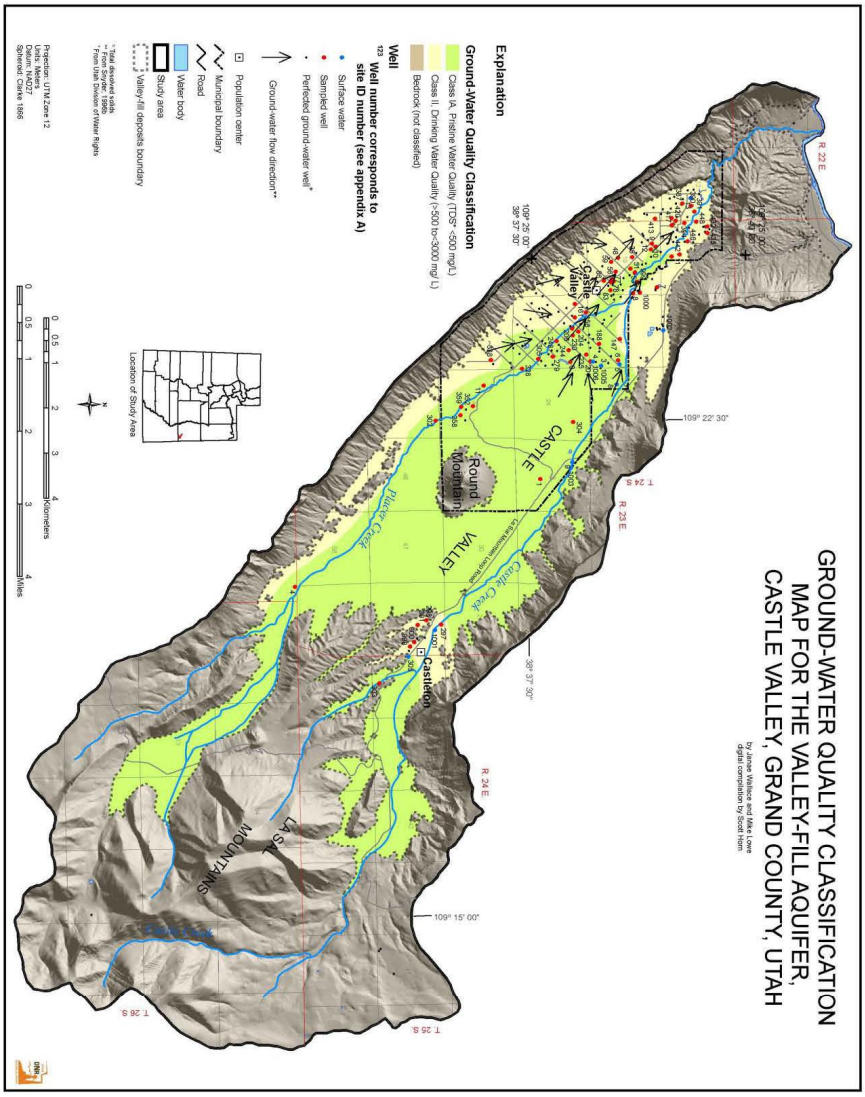
**A3**


ALLUVIAL-FAN FLOODING, STREAM FLOODING, DEBRIS-FLOW HAZARDS, AND COLLAPSIBLE SOIL IN CASTLE VALLEY, GRAND COUNTY, UTAH
Utah Geological Survey
Open-File Report 238
Plate 2
By
William E. Mulvey
SCALE 1:24000
CONTOUR INTERVAL 40 FEET
Explanation
Alluvial-fan/debris-flow-flood-hazard areas and collapsible soil.
Stream-flooding-hazard areas.
UTAH
GRAND COUNTY
Castle Valley area
N
DISCUSSION
CASTLE VALLEY
Colorado River
Green River
Moab
Big Bend
Warner Lake
Fisher Towers
Bill Creek

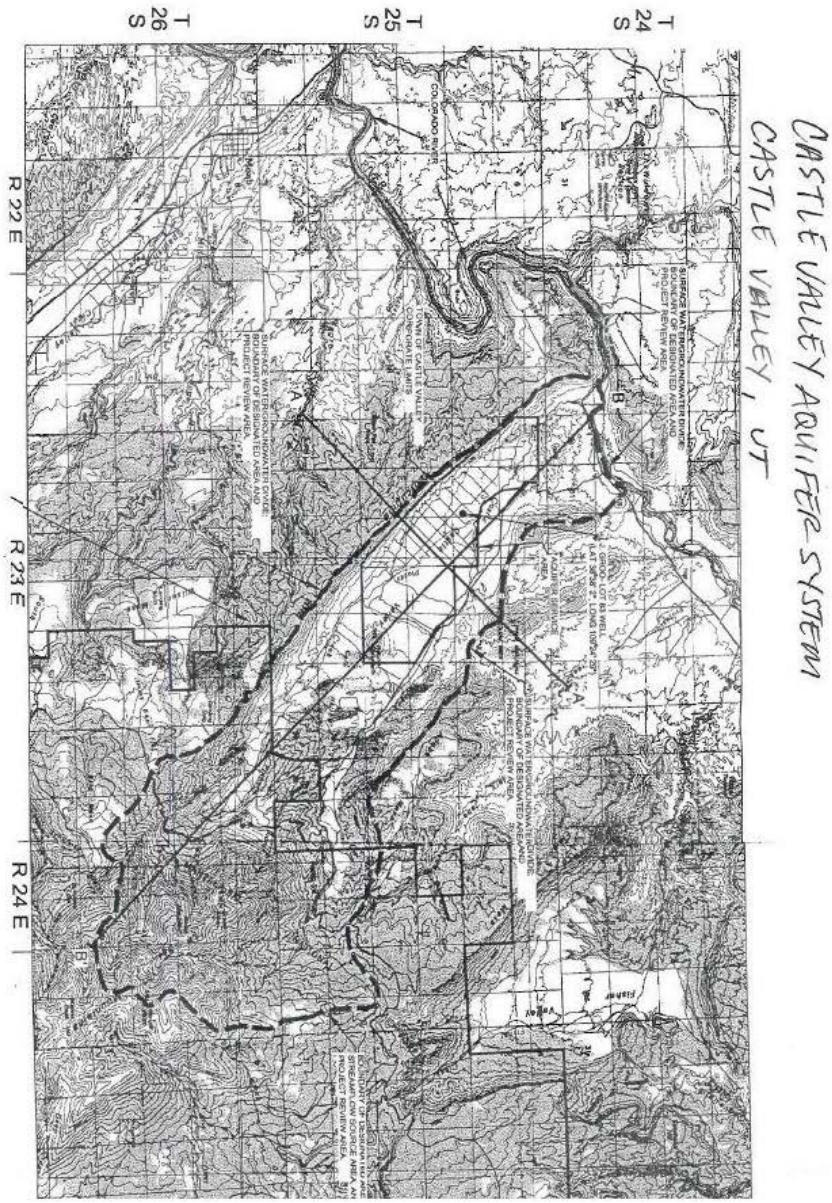
**A4**


ROCK-FALL AND SURFACE-FAULT-RUPTURE
HAZARDS IN CASTLE VALLEY,
GRAND COUNTY, UTAH
Utah Geological Survey
Open-File Report 208
Plate 3
By
William E. Mulvey
UTAH
GRAND COUNTY
Base map from USGS 1:24,000-scale topographic maps of
Big Bend, Wenner Lake, Fisher Towers, and Hill Creek.
Explanation
Rock-fall-hazard areas.
Sinkhole.
N

**A5**


GROUND-WATER QUALITY CLASSIFICATION
MAP FOR THE VALLEY-FILL AQUIFER,
CASTLE VALLEY, GRAND COUNTY, UTAH
by Janice Wilcher and Mike Lowe
digital compilation by Scott Horn
Explanation
Ground-Water Quality Classification
Class A. Pristine Water Quality (TDS* <500 mg/L)
Class II. Drinking Water Quality (~500 to~3000 mg/ L)
Bedrock (not classified)
Well
123 Well number corresponds to site ID number (see appendix A)
Surface water
Sampled well
Perfected ground-water well*
Ground-water flow direction**
Population center
Municipal boundary
Road
Water body
Study area
Valley-fill deposits boundary
Location of Study Area
Projection: UTM Zone 12
Datum: NAD27
Spheroid: Clarke 1866
Castle Valley
Round Mountain
CASTLE
VALLEY
Castleton
LA SAL
MOUNTAINS
R. 22 E
R. 23 E
R. 24 E
T. 24 S
T. 25 S
T. 26 S
109° 25' 00"
38° 37' 30"
109° 22' 30"
109° 15' 00"
Kilometers
Miles

**A6**


CASTLE VALLEY AQUIFER SYSTEM
CASTLE VALLEY, UT
T 24 S
T 25 S
T 26 S
R 22 E
R 23 E
R 24 E
COLORADO RIVER
GRAND COUNTY'S VALLEY CORPORATE LIMITS
SURFACE WATER-DIVERTED CHARGE BOUNDARY OF DESIGNATED AREA AND PROJECT REVIEW AREA
BOUNDARY OF DESIGNATED AREA AND PROJECT REVIEW AREA
A
B

# Appendix B:

## B1

Castle Valley Drive consists of 3.64 miles of pavement (chip seal x 2) and there are 14 miles of additional dirt and gravel roads. There is a single 10-foot culvert at Castle Creek and Castle Valley Drive, a 10-foot and two 6-foot culverts at Castle Creek and Willoughby Way. There are 5-foot culverts on Placer Creek and Buchanan Lane, Placer Creek and Shafer Lane and Placer Ditch and Miller Lane. There are 3-foot culverts under or parallel to Castle Valley Drive at Amber Lane, Chamisa Lane, Rimshadow, Lazaris, Bailey, Pace, Buchanan, Shafer, Miller, Pope and Holyoak Lanes. As well as 3-foot culverts under other sections of all of the above-mentioned roads to also include Rimrock, Castle Creek, Homestead, Cliffview, Keogh and Taylor Lanes. Additionally, there are numerous culverts that have silted up or are undersized and currently nonfunctional. Originally the ranch that preceded the town had four retention ponds to catch runoff, one located at the eastern end of Pope Lane, one west and north of Castle Valley Drive and Holyoak Lane, one between Buchanan and Shafer Lanes east of Castle Valley Drive on historic Placer Creek drainage and between Bailey and Lazaris Lanes west of Castle Valley drive. All check dams have either been silted in or breeched with the exception of the one between Holyoak and Pope Lanes west of Castle Valley Drive, which is still functional. Two 3 foot culverts one on Placer Creek in the upper eighty at lots 359 and 358 and one on the connector portion of Castle Valley Drive at Placer Creek were washed out or are nonfunctional due to damage by severe storm water events. These two areas are now subject to periods of road closure, until repairs can be made.

## B2

The area from east Holyoak to east Buchanan Lanes is relatively flat and is the historic flood plain for Castle and Placer Creeks. There are numerous former channels that these creeks have made in the past. Placer Creek was diverted into a manmade ditch from lot 328 alongside the Bureau of Land Management fence northeast to lot 277 then north to lot 242/233 into a 5 foot culvert under Miller Lane thence across lots 232 and 203 to a 5 foot culvert under Shafer Lane to another 5 foot culvert under Buchanan Lane to lot 369 (Town of Castle Valley, greenbelt lot) to Castle Creek. Should runoff flow exceed the capacity of this ditch, floodwaters have and may breech the berm at lot 328/308 and proceed into the historic Placer Creek channel. This channel can no longer handle the water from Placer Creek, as there is not a culvert across Holyoak and the culverts under Pope, Miller, Shafer and Buchanan Lanes are not sufficient to handle Placer Creek storm water runoff anymore.

# Appendix C:

## Castle Valley Hazard Mitigation Committee

## Approved Meeting Minutes:

November 2013 – November 2015

**Hazard Mitigation Meeting**
**Nov.13, 2013 6pm Town Hall**

**1. Team Building Exercise (Bring your chosen hazard & 3 possible mitigation tactics.)**
The hazards where passed around and other mitigation strategies were added on by everyone in the group.
There was discussion around who would need help in the event of any kind of emergency, and how to locate and get the information to help the different kinds of people in the valley.
There was discussion around rock fall and how to identify where the zone of high potential.
**2. Finalize date for first public input meeting.**
Jaz stated that next meeting will be held at fire station 1 due to the PLUC meeting being moved.
There was discussion around when to hold the public input meeting and they decided on Wed Dec. 4 at 6:00pm.

**A. Advertise/ outreach**

People were assigned duties to help advertise and spread the word about the Pub. Hearing.

**B. Possible CERT involvement, handouts for attendees**

They decided to have Firewise, emergency first aid, and 24 hour kit pamphlets available.
There discussed what questions they should ask attendees at the Public Hearing.

-Have you been effected by a hazard, how would you like to be reached, what kind of resources would be available and skills (medical), first aid kits, what special needs, how do you get your information, would you use phone trees, do you have a 72 hour kit, do you have a firewise property?

**C. Recording minutes and organizing documentation**

Ali is going to take the minutes and will organize the documents in a Hazard Mitigation book.
**3. Developing sub groups & specific assignments**
Jaz stated that each group will look at what assets the Town has in each area and what each area is missing or how it could be improved.

**A. Road Drainages**

Greg H. and Bob L. will work on roads and drainages.

**B. Communications; methods and systems**

Bob R.and Bill R. will work on communications.

**C. Public outreach and education**

David S., Pat D., and Leta V. will work on Pub. outreach and education.

**D. Fire**

Ron D. and Jake B. will work on Fire.
**4. Updates on info gathering for everyone**
Bill R. read from 85-3 regarding keeping properties hazard free, however hazard was not defined.
Jaz stated that she had talked to a Brad Barthalomew who gave the group a tool to use to insure that all aspects of the plan are in place before completing it. She stated that having a real planner in this process would give the plan more points for CRS funding.
Bob R. asked what the chain of command was and how and who to contact in an emergency or for assistance.
Ron stated that there are portable repeaters to help with communications.
Jaz stated that she had looked into national flood insurance program which the town would need to be participating in, in order to get funding. She stated that Grand County does not participate but Moab does and it would seem like the town needs to participate.

**Minutes:**
**Public Input for Hazard Mitigation Planning followed by**
**Hazard Mitigation Planning Meeting.**
**December 11, 2013 Castle Valley Town Hall 6:00 pm.**

**1. Public Input on topics related to disaster mitigation planning.**
Ron Drake stated that it seemed like the county could do a better job of plowing the road out in Castle Valley specifically Pace Hill.
There was discussion around how and when to get a plow out to clear Pace Hill.
Jazmine questioned who the community would contact to remedy the problem.
There was discussion around the town plowing and sanding Pace Hill and what would be needed to do so.
Tom Noce on Pace Lane stated that he had experienced flooding on his property and questioned what would happen if the valley received it's annual rainfall in one day, which would be 9 inches and that it is a possibility. He suggested slowing water down and creating more ponds and berms to slow and spread the water and return it back to the ground. For major floods he wasn't sure what the solution would be, he stated that the upper 80 could use a lot of work and mostly bridges to mitigate the massive flooding that is capable in that area.
MaryBeth mentioned Brad Lancaster who works with the same principals of slowing, spreading, and sinking the water as it comes down. She also stated that there are new building codes that base new developments on keeping all of the water on that lot.
Greg Halliday stated that those principals all work however often they lack the knowledge needed to handle the amount of sediment that comes down in flooding.
There was discussion around how dirt work done by property owners on their own lot would create a larger system throughout the valley
Dave Erley stated that Placer Creek is the biggest concern since the flooding damage is so severe. He stated that keeping the water in the drainage seems like the best idea.
There was discussion around how to ensure property owners are aware of the natural hazards that their lot is vulnerable to and how to mitigate those issues.
Erley stated that he had been in contact with Verizon and it was recommended to him to have as many people call Verizon and complain about their service then Verizon would raise a red flag after so many calls and their attention will be drawn to our valley and it could pave the way for better communication in the future.
David Smith stated that in order for Frontier to give better service when the internet was out the best way to have it repaired was to have as many people call in as possible.
Jazmine read comments left by Cris Coffee who stated her concern for vehicles that are not able to get around in deep snow and icy conditions. She was concerned about frozen pipes, septics backing up, and people without water or phone.
There was discussion around the older community in the valley and their ability to dig their vehicles out in the snow and the decreasing abilities of the elderly.
There was discussion around fire proofing properties both of residents that reside here as well as those that don't.
Greg Halliday stated that the tumble weeds in the spring create another big fire danger when they pile up along fence lines.

**2. Regular scheduled meeting updates.**
Bill Rau stated that his group had met with the sheriff regarding communications and he was not aware of the phone lines and 911 being down a week or so ago. The sheriff recommended calling Frontier regarding the phone issues. Sheriff White stated that he would be willing to have a conversation with commercial

companies about getting some communication infrastructure on their Willow Basin emergency communication station. He stated that we all pay for 911 to work and that that service should *always* be available.

There was discussion around testing the Town's siren and how to let residents know that the Town would be performing a test run as well as how to know if all residents could hear the siren.

Jazmine stated that the next step would be risk assessment and reviewing how many times the power had gone out and how many times the mobile unit had come out to the valley.

Erley stated that when the Forest Service comes to an emergency they bring their own cell towers and that could be a way to find the best location for a cell site.

David Smith and Leta worked on Public Outreach and he stated that it would be nice to come up with a list of people with resources like heavy equipment.

The group agreed to think of people to call that might be willing to help out with their resources in the case of an emergency.

Jazmine stated that based off the work the groups have done in each of their areas it is now time to identify and profile hazards, inventory assets, and estimate losses.

Noce stated that if the Wasatch Fault ever went it would be likely that Castle Valley would be cut off from each direction on the River Road, State Hwy 128.

Jazmine stated that for each hazard there will be risk assessment done.

There was discussion around how to assess the value of properties that would be in harms way. The group decided to get info from the county to get tax values on properties to help assess the value of what could be lost.

There was discussion around who would work on each hazard assessment.

Erley stated that it would be nice to get all the data in Excel in order to make it easy to update and revise it in the future. He stated that mitigating some hazards may make others more likely and that everything needs to be looked at as a whole. He stated that after going through this process it will make it a lot clearer where the strong and weak points lie.

Jazmine stated that having this plan completed will make CV a lot more eligible for grants & FEMA's support but the Town needs to look into National Flood Insurance in order to be eligible for support from FEMA in the case of a flood. She stated that Moab is participating in the insurance program but Grand County is not.

There was discussion around the meeting schedule, the next meeting will be held at Fire Station 1 due to the PLUC meeting being held that same night

# Hazard Mitigation Planning
# Public Input Meeting

For The Town of Castle Valley

Wednesday, Dec. 11th, 2013 at 6:00 p.m.

CASTLE VALLEY COMMUNITY CENTER

2 CASTLE VALLEY DRIVE

Please Sign In:

Mary Selk

Pamela Gibson

Ted [illegible]

Bob Russell

Bill Rau

David Smith

Jasmin Dunn

[illegible]

[illegible]

LETA VAUGHN

Thank You!

**Minutes**
**Hazard Mitigation Planning Committee Meeting**
**January 8th, 2014 at 6pm**
**Castle Valley Community Center, 2 Castle Valley Dr.**

**Present:** Jazmine Duncan, Bill Rau, Bob Russell, Pat Drake, Ron Drake, Bob Lippman, Greg Halliday, David Smith.
**Recorder:** Alison Fuller

**Call to Order**
Jazmine Duncan called the meeting to order at 6:03p.m.

**1. Appoint Chair and Co-Chairs.**
The group appointed Jazmine as the chair and discussed who should be the co-chair and appointed Greg Halliday as the co-chair in the event Jazmine couldn't attend.

**2. Public input, and comments.**
Greg Halliday stated that his wife Susan was working on the website for the Fire District and that she would create a link to the Hazard mitigation planning process as well as to the Town's website.
Duncan stated that there was concern for some road drainage damage on Pope where there had been some back hoe work done on private property that created some drainage issues. The citizen was also concerned about a poorly placed culvert. He suggested periodic letters sent to private property owners with poor drainage systems to invite an easement with the Town to do regular maintenance.
Halliday stated that there were some private property owners who have been working with the Town, but access and easements need to be permanent and not done on a one time basis.
There was discussion around the Placer creek drainage and where the drainage was originally.
Halliday stated that there is an 8-10 ft. drop from the current drainage to the original drainage and if Placer creek gets back to that drainage it will destroy homes and properties. He stated that in the flood in 2009 the creek partially returned to that route and deposited a lot of debris.
Pat Drake inquired about the best way to handle the issue.
Halliday stated that the best spot for the drainage would be to put it in the original drainage if there were not so many homes and properties that would be greatly affected by the creek returning to it's original path. He described the drainage issues on Pope lane and all the artificial diversions made on it in the past.
Duncan stated that there was another citizen who was very concerned about the flooding issues in the valley and was worried about the Town's liability.
There was discussion about the eligibility of getting involved in the National Flood Insurance Program and that the representative for the NFIP would like to come to CV to talk to the community about the program and the process.
Bob Lippman stated that it would be good to draft a careful and comprehensive letter to gain access to properties that need maintenance done on the drainages.
Duncan stated that it would be good to work that letter into the mitigation plan to mitigate the flooding

impact.

Halliday stated that currently the property owners are in charge of handling the water on their property. There was discussion around getting the Town involved in handling the drainages on private property through easements to insure proper water flow in Castle Valley.

Ron Drake shared an article about 2 fatalities from rock fall and stated that no one had been hurt yet in CV, but there is a lot of rock fall. He shared some other pictures and photos from a rock fall in CV in previous years that brought massive amounts of dirt and debris into a home.

**Develop written list of agreed upon disasters to include in plan.**

There was discussion on what disasters to include:

Rock Fall, Flooding, Prolonged Cold, Extreme Heat, High Winds, Wild Fire, Communications Failure, Road Access Issues, Potential Water Contamination, Lightning storms were all discussed.

There was discussion about working out an arrangement with the hotels on the river corridor when Pace Hill is impassable and residents are unable to get home.

There was discussion about previous floods that washed out many points all along HWY 128 and how many access points would be impassable in the event of major flooding not only in the valley but also on the roads in & out of the valley.

Duncan asked if adding water contamination to the disaster list would be appropriate. The group discussed the topic and decided to add it to the list as polluting the aquifer could be disasters for Castle Valley long term.

**4. Subcommittee work updates, where are we in risk assessment phase? Where are we going?**

**A. Identify and profile hazards**

**B. Inventory assets**

**C. Estimate losses**

Bill Rau stated that there had been 79 outages in CV in the past 5 years. They were broken down by events such as snow, wind, lightening. etc, he stated that there was not a category for technical problems on their end although those events probably have happened as well.

There was discussion around what the losses are during outages and how to quantify the loss. There were things such as food storage loss and health issues in extreme weather.

Bob Russell stated that he was working on the telephone portion of communications and the Sheriff was willing to work with the town in any way to support proper communications including bringing out the portable communications trailer when necessary. He stated that he has a meeting scheduled with Mike Guiles who represents Frontier for Utah and Nevada and was hoping that would be productive.

There was discussion about the other possibilities for communications through other different phone and cellular services.

There was discussion around the different types of communication failure and what would constitute an emergency.

Ron Drake brought up the fact that if the towers on Bald Mesa didn't have power it would prohibit any communication from CV to Moab.

There was discussion around bettering communications and the possibility of getting a satellite phone to mitigate the impact of any issues with the Bald Mesa towers.

Ron Drake reported on the fire preparedness for the valley.

There was discussion around tracking and identifying the past fires as well as the fire prone areas where brush is thicker, where fires would be harder to access, or where main utilities would be vulnerable.
David Smith stated that due to poor timing for the Daystar academy accompanied by deep snow, he had not had much success yet with creating a more fire safe community.
Duncan asked if David would also look into Drought as a hazard.
Halliday stated that flooding form Porcupine rim is usually minor and short lived although there has been some major road damage from rim flooding. He stated that there is some work that was done on SITLA land above fire station one to prevent Castle Creek from cutting into private property (Jeff Whitney's home). He stated that he had identified two choke points on Castle Creek as well as storm run-off drainages. He identified other points of concern during flooding. He stated that during the 2009 flood placer creek was wider than the river and massive boulders were moved and huge amounts of sediment were deposited. He stated that if the culverts were lost at the Castle Creek crossing new culverts alone would be $35,000 for a 5 ft. culvert. There was more discussion around remedying the Castle Creek culverts under Castle Valley Drive. Ideally a double concrete box culvert would replace the current culvert before it washes out, however the cost for that are in the $200,000 range.
Duncan reported on severe weather as a hazard and stated that a lot of different categories would fit under this category which they previously discussed.

**5. Discuss meeting with NIFP director John Crofts and SHMO Brad Bartholomew set for Feb. date not yet set. Public outreach regarding possible participation in the National Flood Insurance Program.**
Duncan stated that she hoped the meeting would happen in February with the stated representatives and the committee would need to be sure and advertise it well to insure good community attendance.

**6. Discuss next phase of planning. Plan development.**
**A. Develop goals and objectives**
**B. Identify and prioritize mitigation action.**
**C. Prepare implementation strategy**
**D. Document the planning process**
Duncan stated that the committee is still in the assessment stage of the process and gathering the data is important but developing the mitigations will be a little more interesting.
There was discussion around getting FEMA's fee schedule for costs.

**7. Additional needs.**

Duncan adjourned the meeting at 8:10pm.

**Adjournment**

**Approved:** Jazmine Duncan 3/19/14 **Attested:** Alison Fuller 3.19.14
**Jazmine Duncan, Chair** **Date:** **Alison Fuller, Town Clerk** **Date:**

3

Hazard Mitigation Planning Meeting
Town of Castle Valley
Wednesday, Jan. 8th, 2014 at 6:00 p.m.
CASTLE VALLEY COMMUNITY CENTER
2 CASTLE VALLEY DRIVE

Please Sign In:

Bill RAU

PAT DRAKE

Thank You!

**MINUTES**
**HAZARD MITIGATION COMMITTEE**
**OCTOBER 8TH, 2014 AT 6:00 P.M.**
**TOWN HALL - 2 CASTLE VALLEY DR.**

**Members Present:** Jazmine Duncan, Bob Russell, Leta Vaughn, Dave Erley, Ron Drake Bill Rau, Jason Matz, Deb Dull, Dan Vink, Greg Halliday, Jack Campbell.

**Recorder:** Alison Fuller

**CALL TO ORDER**

Jazmine Duncan called the meeting to order at 6:03 p.m.

**1. Public Comment**

Mayor Erley thanked Rocky Mountain Power (RMP) for coming to the meeting.

**2. Approval of the Minutes – September 10th, 2014.**

Halliday moved to approve the minutes as presented, Russell seconded, the Motion passed unanimously.

**3. Rocky Mountain Power representative discussion.**

The group went around and introduced themselves to each other.

Dan Vink showed the group the Rattlesnake Power Line and described how outages occur and where faults would affect the line in different locations.

Bob Russell inquired about ways to prevent line wide outages.

Vink described radio signals that help narrow down outages and circuits that blow fuses to inhibit outages down the line. He stated that lightning strike, birds, wind and age are all challenges of the Rattlesnake Line.

RMP is only aware of outages when customers call or if the outage is affecting one of their "sub stations."

Greg Halliday discussed the incident last year where the RMP tech. could not find the fuses and asked if there were maps in the work trucks.

Vink stated that each truck has maps and GPS and there should not have been that problem and if something like that were to happen again someone should call RMP and alert them of the issue.

Duncan stated that she would like to know whose responsibility it is to clear brush and debris from around the power lines.

Vink stated that on private property it is the customers' responsibility to keep the debris clear, but RMP maintains transmission lines He stated that they are willing to disconnect & re-connect the power free of charge so tree work can be done safely.

There was discussion around how RMP prunes trees and plans for future growth by working on a 3 year rotation.

RMP hires private contractors to do their tree work on the power lines they maintain.

There was discussion around trees that are growing up to the power lines and getting scorched before they reach the line and what RMP does about those trees.

There was discussion around outages being seasonal with lighting and fire season being the worst time for outages.

Vink stated that if there was a fire in the area he would expect a phone call from the fire chief alerting him of it. He stated that with any emergency in the area that would affect the power he would like to hear about it. He stated that his cell phone # is 435-210-4352.

The road department met with Vink previously and went over areas of concern and sorted out the best remedies for each area. The green power boxes are fairly indestructible and the green boxes partially surrounded by mud were not of concern at this point.

Erley stated that the Town now has legal right-of-way for a 4-season emergency access but it has a power pole in the middle of the cul-de-sac at the northeast end of Shafer Lane and in the future will need to move it.

Vink stated RMP moves power poles all the time and each pole and power box has a license # that RMP can identify the data about that piece of equipment and then forward the request onto the appropriate person. Broken insulators, broken braces, conductors on the ground, transformers leaking oil, branches on the power line, exposed wires on the green boxes, are all things RMP would like to know about. Use the yellow tag on the equipment to get the ID number which is gps'd in their database.

Duncan inquired about what is in place right now to prevent new power lines from being laid in drainages.

There was discussion around the Town's Ordinance that inhibits any new areal power lines, and that new ground lines are put in conduit to prevent damage to the lines if they do become exposed.

There was discussion around how to deal with power in the ground in conduits that become exposed over time and creating more town regulations to ensure that lines are buried properly.

Rau asked if Castle Valley would have enough power for the growth in the future.

Vink stated that RMP would meet the demand and build more infrastructures to make it possible.

Ron Drake inquired about a new power line that was on the table several years ago and inquired about any progress.

Vink stated that he had been trying to resurrect that idea but was currently looking for funding.

Deb Dull stated that RMP is planning on building their first solar farm in Utah and they are the 2nd largest wind powered company in the nation.

Campbell inquired about the 3 legs of power in the valley and if citizens could figure out which leg they are on to make sense of the outages.

Vink stated that the legs change due to power used by customers. RMP will move customers around on different legs in order to balance out the load.

There was discussion around overlaying the Town's plat map on the RMP maps and how RMP locates customers and poles.

There was discussion around methods & devices used for finding electrical faults in the system.

There was discussion around the Federal Government's control over information utility companies are allowed to give out.

Russell inquired about how Castle Valley would be triaged in massive outage.

Vink stated that Fire Departments, Schools & Hospitals are addressed first and then they try to restore power to the most people possible at once. He stated that in big disasters they have resources they can call on to address bigger issues in emergencies.

Dull described the protocol for major damage and the promptness of the response of RMP due to their relationships with other big companies for resources.

There was discussion around RMP's command centers that go into action for major disasters.

Campbell stated that when there are outages in the valley not everyone can call RMP to alert them of the outage due to the lack of cell phone service and electric free phones.

Vink stated that if the power is out the meter will not blink, and customers that do not have power should always call RMP and make them aware of the problem.

**4. Continue Step 3, develop mitigation plan.**

**A. Identify mitigation actions for earthquake, drought, & water contamination & rate on worksheets**

**B. Prepare mitigation strategy time frames?**

**C. Document the planning process – discussion on putting our plan on paper.**

Rau made a motion to adjourn, Vaughn seconded, the Motion passed unanimously.

Jazmine adjourned the meeting at 7:41p.m.

**ADJOURN**

**APPROVED:** 11/12/14

**Jazmine Duncan, Chair** **Date:**

**ATTESTED:** 11.12.2014

**Alison Fuller, Town Clerk** **Date:**

3

HAZARD MITIGATION COMMITTEE MEETING

Town of Castle Valley

Wednesday October 8th, 2014 at 6:00 p.m.

CASTLE VALLEY COMMUNITY CENTER

2 CASTLE VALLEY DR.

## Please Sign In!

Jack Campbell

Dan Erley

Al Rivard

Deb Dale

DAN VINK - RMP

Ron Drake

Jamie Dunn

PAT DRAKE

Thank You!

**MINUTES**
**HAZARD MITIGATION COMMITTEE**
**NOVEMBER 12TH, 2014 AT 6:00 P.M.**
**TOWN HALL - 2 CASTLE VALLEY DR.**

**Members Present:** Jazmine Duncan, Bob Russell, Leta Vaughn, Ron & Pat Drake, Bill Rau, Greg Halliday.
**Recorder:** Alison Fuller

**CALL TO ORDER**

Jazmine Duncan called the meeting to order at 6:03 p.m.

**1. Public Comment**

**2. Approval of the Minutes – October 8th, 2014.**
Bill Rau moved to approve the minutes as presented, Greg Halliday seconded, the Motion passed unanimously.

**3. Approval of meeting schedule 2015.**
Leta Vaughn moved to adopt the presented meeting schedule, Rau seconded, the Motion passed unanimously.

**4. Continue Step 3, develop mitigation plan.**

**A. Identify mitigation actions for earthquake, drought, & water contamination & rate on worksheets.**

There was discussion around other hazards that have been addressed that have the same effects and mitigations.
The group discussed public awareness and responsibilities of lot owners to prepare their own properties.
Halliday discussed the shallow salt anticlines that pose less of a threat locally in Castle Valley.
Pat Drake discussed residents who are home bound and checking in on them in emergencies.
Halliday brought up sink holes as possible problems an earthquake could cause.
The group discussed & rated earthquake public awareness and community accountability as mitigation efforts.
There was discussion around springs and wells that have or could run dry.
Duncan stated that the town monitoring wells in the valley had not shown any significant change in the 8 years they have been monitored.
There was discussion around how long it takes water to make it down to the aquifer and where the water originates.
The group discussed residents who water for fire breaks and how the Town would be able to limit water use when wells start running dry.
The group discussed and rated with their worksheets: limiting water use, public awareness, and a secondary water source, i.e. Colorado River, mountain springs.
The group discussed and rated with their worksheets working with the Forest service and BLM to protect the watershed as a mitigation effort for drought and water contamination.
The group discussed water contaminates storage and if residents are doing a good job of protecting the aquifer by storing hazardous materials properly.

1

The group discussed and rated with their worksheets the Conditional Use Policy regarding hazardous material storage.
The group discussed and rated with their worksheets public education and regulations for water contamination mitigation.
Ron Drake stated that septic systems, spills, and dead animals are possible water contaminates.
There was discussion around dead animals being more efficiently broken down by wildlife rather than burying them.
Rau stated that mining is a very serious concern for water contamination.
Halliday brought up pesticides as a long term problem for water contamination.
There was discussion around animal pens being too close to well sites, and the set-backs for wells & septic tanks.
There was discussion about severity of water contamination and the different levels of contamination.

**B. Prepare mitigation strategy time frames?**
**Bring hazard summary and histories.**

Duncan shared her hazard summary and history and the format she used to present them.
The group reviewed an example of a hazard mitigation plan and what their plan's table of contents should include.
Duncan reviewed the Profile for Castle Valley within the plan and suggested that the group use the Town's General Plan as a template for the Profile.

**C. Document the planning process – discussion on putting our plan on paper.**

The group discussed how they would arrange their hazards in the mitigation plan and what needs to be included in each.
They discussed photos that are available for the plan and getting their hazard sections to Duncan to start to form a rough draft.
Rau suggested working with the PLUC & other town committees to put some of the mitigation regulations in place.
Duncan stated that once the group has a rough draft they will hold a public hearing to receive input on the plan at which point they will clean up the draft and get the formatting finalized.

Vaughn moved to adjourn, Halliday seconded, the Motion passed unanimously.

Duncan adjourned the meeting at 7:17 p.m.

**ADJOURN**

**APPROVED:** Jazmine Duncan 12/10/14
**Jazmine Duncan, Chair** **Date:**

**ATTESTED:** Alison Fuller 12.10.14
**Alison Fuller, Town Clerk** **Date:**

2

HAZARD MITIGATION COMMITTEE MEETING

Town of Castle Valley

Wednesday November 12th, 2014 at 6:00 p.m.

CASTLE VALLEY COMMUNITY CENTER

2 CASTLE VALLEY DR.

# Please Sign In !

Bill Rall

Thank You!

# MINUTES
## HAZARD MITIGATION COMMITTEE
## DECEMBER 10TH, 2014 AT 6:00 P.M.
## TOWN HALL - 2 CASTLE VALLEY DR.

**Members Present:** Jazmine Duncan, Leta Vaughn, Ron & Pat Drake, Bill Rau, Greg Halliday, Dave Erley, David Smith
**Recorder:** Alison Fuller

## CALL TO ORDER

Jazmine Duncan called the meeting to order at 6:02p.m.

**1. Public Comment**

**2. Approval of the Minutes – November 12th, 2014.**
Halliday moved to approve the minutes as presented, Erley seconded, the Motion passed unanimously.

**3. Continue Step 3; Develop mitigation plan.**

**A. Prepare mitigation strategy time frames.**
**Bring hazard summary and histories.**

**B. Document the planning process – discussion on putting our plan on paper.**

Duncan stated that she had several hazard histories and reports from the group but still needed more to complete that portion of the plan. She reviewed the hazards that still needed to be turned in.
Leta Vaughn stated that she had more mitigations for Rock fall from the Town's geologic Hazard report.
Duncan reviewed 3 strategies the group had created for Rock fall.
The group discussed adding deflection berms, slope benches rock catch fences, building homes on ridges and being aware of geologic processes as possible mitigation efforts for rock fall.
Duncan reviewed who was working on the Earthquakes section & Water Contamination section of the Plan.
The group discussed getting volunteers for creating fire breaks in the valley.
Duncan and Erley discussed having Water Agent Groo do the water contamination section for the Plan.
Duncan reviewed the format of the plan and asked for ideas on how to proceed with getting the plan completed.
The group discussed what the scope would include inside of the Plan and if more groups such as the Fire District, Daystar Academy, and surrounding citizens should be included.
Duncan stated that they had not received much interest from the surrounding groups to help with the plan but it would be good to get everyone involved.
There was discussion around what parts of funding they wanted to discuss inside the plan as far as cost to create the plan and funding that has helped with mitigation efforts and what funding would be involved to put more mitigation efforts in action.
Duncan asked how often the Hazard Mitigation Plan should be updated.

The group discussed reviewing the plan every 5 years like the General Plan or every 4 years. They thought it would be a good idea to have it on a 4 year rotation so that each Mayor can go through that process and maintain some continuity in government.

Pat Drake inquired about doing the General Plan on the same schedule as the Hazard Mitigation Plan an if there were things that would cross over between the plans.

There was discussion around creating continuity in government and that the Fire District may have a more seamless transition.

The group stated that it would be good to visit the plan more often if disaster events occur and as it is needed.

Rau suggested adding the wording "new appendices will be added as events occur or as new information becomes available."

Erley stated that catchment ponds in the upper 80 or somewhere between the Quaky Shake and the & The Daystar Academy should definitely be added as mitigation efforts against large debris flows and flooding in Castle Valley.

The group rated the catchment ponds with their worksheets grading the political viability, the financial feasibility and potential benefit.

Halliday wondered what the liability would be on the catchment ponds.

The group discussed how they would phrase power outages as a hazard and what the real issues are when there is a power outage. They discussed communication failure and internet failure as a real issue with power outages. They discussed inadequate infrastructure as a way to describe the power outage hazard.

Rau made a motion to adjourn, Pat Drake seconded, the Motion passed unanimously.

Duncan adjourned the meeting at 6:39p.m.

**ADJOURN**

| **APPROVED:** | | **ATTESTED:** | |
|---|---|---|---|
| Jazmine Duncan | 1/14/15 | Alison Fuller | 1.14.15 |
| **Jazmine Duncan, Chair** | **Date:** | **Alison Fuller, Town Clerk** | **Date:** |

2

HAZARD MITIGATION COMMITTEE MEETING

Town of Castle Valley

Wednesday December 10th, 2014 at 6:00 p.m.

CASTLE VALLEY COMMUNITY CENTER

2 CASTLE VALLEY DR.

# Please Sign In !

Bill Rau

Pat Drake

Ron Drake

Thank You!

**MINUTES**
**HAZARD MITIGATION COMMITTEE**
**FEBRUARY 12, 2014 6:00P.M.**
**2 CASTLE VALLEY DR.**
**CASTLE VALLEY TOWN HALL**

**Present:** Jazmine Duncan, Bill Rau, Bob Russell, Ron Drake, Pat Drake, Greg Halliday, David Smith, David Erley, Ted Bright, Bruce Keeler, Pamela Gibson, Mark Webster, Pam Hackley John Crofts, Brad Bartholomew, Jake Burnett, Tom Noce, Jack Campbell, Laura Cameron, Jocelyn Bucks.

**Call to Order**

Jazmine Duncan called the meeting to order at 6:12p.m.

**1. John Crofts and Brad Bartholomew NFIP (National Flood Insurance Program)**

John Crofts introduced himself as the Utah State Flood Manager under the division of emergency management for Utah and he works in conjunction with FEMA to manage the NFIP.

Brad Bartholomew introduced himself as the State Hazard Mitigation Officer and Recovery Officer who works closely with John Crofts.

Mayor Erley stated that Castle Valley's chief concern is dealing with proper drainage and allowing residents the opportunity to be eligible for disaster relief.

Crofts stated that the NFIP is a voluntary program. He stated the program started 45 years ago due to many unhappy communities and insurance customers. Present day there are a over 21,000 communities participating which is 99.5% of all U.S. population can purchase flood insurance through the NFIP. Their goal is to protect life, property environment & commerce. He stated that Congress attached the NFIP to money by including the process in public loans. He stated that CV does not have a flood study done for this area. These studies classify the flood plain boundaries. He stated that there are different levels of ordinances that need to be adopted according to what type of flood plain the community may be in. Level A Ordinances are for communities that do not have flood studies. Ideally FEMA would have the country mapped and studied, but heavily populated areas are weighed more heavily. He stated that Level A's are valuable because those communities are still able to participate in the NFIP. He stated that the Level A ordinance in a small community enables regulations on building and developing in flood zones which in turn protects life, property, environment, and commerce. He stated that participating in the NFIP program automatically makes the community eligible for help from FEMA in the state of emergency. He stated the benefits outweigh the risk. He presented a resolution template and a draft ordinance with some blanks to be filed in, reviewed by a lawyer and then adopted, after which he would review, turn in to the Federal Registry and then anyone in our community could purchase NF Insurance.

Laura Cameron inquired about the Level A Ordinance.

Crofts stated that the Level A exists so any community can have access to the NFIP. He stated that the Town would commit to the ordinance and be responsible for it.

What if a flood study was done for Castle Valley?

Crofts stated that if a study was done later and development was done in a high risk flood plain, FEMA was fair by charging a lower rate for the insurance despite the high risk however FEMA still required that development to purchase insurance. He stated that if a study was done for a community that was already participating in the NFIP it could instantly change the demand for certain developments to pay for NF Insurance. If homes are owned outright and there is not a bank loan on the property there's no

1

requirement to purchase flood insurance if the community is participating. If the home is not in a flood plain they are not required to purchase flood insurance. He stated that there are 2 counties in Utah that are not participating in the NFIP, and Duschene County was planning on joining. There was discussion around why Grand County was not participating. He ultimately did not know why there were not involved.

There was a question about privatizing the NFIP.

Crofts stated that he did not foresee that happening due to the Super storms that occur. He stated that there are advantages to having the NFIP having the US Treasury back it. He stated that due to changes the rate for Flood Insurance will go up. He stated that in approximate 'A' zones where it was not clear how high a flood level would actually be those people had been getting subsidized and that was about to end and be based on actual risk instead. He stated that even though rates may go up it is worth it because it would save life, property, environment, & commerce, and is a real proponent of joining the program as a level 'A' community. When a study comes to level 'A' areas the communities fair really well because of the awareness. He urged the audience to join the NFIP.

Pat Drake asked why NFIP repeatedly pays for areas to be rebuilt when the continuously get damaged by floods.

Crofts stated that insurance in those places are going to go sky high when all the financial changes are in place. He stated that the sample ordinance that he provided was a Level A and could be changed and made more restrictive but not a lot of things could be taken out.

There was a question about cost to join the program.

He stated that after joining the program he does a bi-annual report that goes into cost, he stated that there would need to be a Flood Plain Manager hired or perhaps volunteer. He stated that they would need to be trained and FEMA would pay for their transportation, the community would incur an $88.00 fee.

There was an inquiry about the minimum ordinance that would need to be adopted to participate in the program.

Crofts stated that it is hard to enforce a Level 'A' community because there is not a flood plain study that has been done to truly enforce the ordinance. He stated that the ordinance could be more restrictive and that a Level 'A' was an easy hurdle to jump over. He stated that with the Level 'A' it was really on the shoulders of the community to help new comers understand where flood danger could be. He stated that it is not the law that real estate agents have to tell someone if they are in the flood plain or not. He stated that he had some e-mailed questions to answer regarding how much a flood study would cost…he stated that he was guessing not estimating in the couple hundred thousands.

Mayor Erley stated that CV has seen their 500 year flood recently and are aware of where the water goes. He wanted to know how serious FEMA was about coming and looking at CV's reality. He stated that he could suggest to property owners to talk to a contractor and have a berm built to protect them from floods and not have a study done with property owners locked into paying high annual insurance. He wanted to know who he would talk to from FEMA to have a study done. He stated that there is a creek on the map that had been manipulated and affected the drainage. He explained the issue CV faces with Placer Creek trying to return to its original drainage. He stated the Town has a drainage review map that was done in 1988 which instructed the town to have catchment ponds that were regularly cleaned and to get easements from property owners to do so, both of which have not been done. He stated that the way he understands it if FEMA came in and did a map, certain property owners could be forced to pay high premiums if the town participates. He stated that it seems like citizens may be better off hiring a back-hoe and building berms to protect their homes.

Duncan stated that property owners would only be forced to pay if they do not own their homes or have a mortgage through a bank. (and are in a flood zone)

2

Crofts stated that he agreed with the Mayor.

Mayor Erley stated that he built his house in the worst possible spot, and he owned it so he would not have to pay the insurance. After the last major flood debris did come to the house, & there were boulders 70ft away, he stated that he did have more earthwork done after that.

Crofts read from the sample 'A' ordinance regarding a question about the "special flood hazard zone", he stated that he did not know why that was in the ordinance because a level 'A' has no zoning map.

Can the geological hazards map be used in part or whole?

Crofts stated that the map could be used if the town considered it accurate.

What does the Flood Plain Administrator do?

Crofts stated that he trains the Flood Plain Administrator and he works with known hazards and the building permit agent, they would provide a bi-annual report (every other year) and would report to himself. He stated that they would tell people about the NFIP. He discussed the possibility of the Town being liable for flood damage because they did not make the NFIP program available.

Could CV participate without the County's participation?

Crofts stated that the County did not need to participate in order for CV to.

Does the Town need to participate in order to get help with mitigation costs?

Brad Bartholomew stated that the State does require participation to be eligible for flood mitigation grants.

Could variances may be given if they cause undue hardships.

Crofts state that variances really don't apply to Level 'A's.

There was discussion around regulations on shipping containers and trailers.

Crofts stated that they were dangerous and could cause major damage but the Town can regulate how they would like.

There was a question regarding building requirements and materials used to flood proof as well as the placement of manufactured and mobile homes.

Crofts stated that the question was very complicated for a Level A. He stated that existing structures that are out of compliance prior to the adoption of the ordinance are not exempt and would not be exempt upon a flood study either. He stated that some houses are being put on stilts.

Duncan asked what people would pay annually for NFIP.

Crofts stated that it could be as low as $150. For someone in a special flood hazard area a good price would $800ish to $2-3000 a year. He stated that the policy is based off of the base line flood elevation. He stated that the insurance covers up to $250,000 for homes and more for commercial. If you lived in Louisiana, 6 ft below sea level it would be $70,000 a year if the cost changes occur in 4 years.

Mayor Erley inquired about Moab's participation.

Crofts stated that Moab has gone above and beyond and the people in Moab can purchase a policy with a %10 discount because of it.

Bartholomew stated that FEMA does not come to Utah too much, and only 6 disasters have been declared since the tornado in Salt Lake in 1999. He talked about the concentrated major rains southern Utah had last year and that the state had seen a lot of damage however FEMA requires a state to acquire $4 million worth of damage before they come in. Counties have to meet the threshold as well with a formula close to $3.25 per person in the county, otherwise no help will come from FEMA. He said because Utah has so few numbers rural communities can receive a ton of damage but not meet the minimum. He stated that there would have to be a lot of damage to a populated area for FEMA to come to town. He stated that the Town signed the South Eastern Utah mitigation plan so they are eligible for mitigation grants and funding. He stated that the funding for these grants and projects are dwindling in Washington, last round there were $200 million worth of proposals and $25 million were

awarded. He stated that there were some grants that work backwards that only become available after a disaster. He discussed other projects that received funding in St. George when the damn broke, culverts in Washington County. He stated that most the projects tend to be along the Wasatch Front mitigating earthquake risks.

Pat Drake asked if what realistic to ever expect funding in Castle Valley?

Bartholomew said that if a disaster is declared in the State public assistance is made available state wide. He stated that Washington County applied for new culverts after a fire. He stated that the chances for grants are slim for CV since we are so small but since we had started our own hazard mitigation planning process we could be eligible for more funding including a 75/25 split and the town could donate in kind, and be responsible for the permits and other town policies.

Duncan thanked Croft and Bartholomew for coming and stated that the meeting would proceed as normal.

**2. Public Comment**

Bob Russell working on the communications aspect of CV's mitigation plan inquired about how other communities dealt with poor communications.

Bartholomew stated that he had not dealt with that end of the hazards and that was more of a response to hazards.

Bill Rau inquired about power outages in other communities.

Bartholomew stated that he had not seen power outages on other community plans and that having it in our plan was huge.

Pat Drake stated that if the culvert went out under CV Drive no one would be able to come or go out of the valley, and if the power went out or 911 isn't working there could be major trouble, and all of these things have happened in Castle Valley.

Bartholomew stated that he could get CV into contact with their Emergency Operations sector. He stated that often the process of creating the Mitigation Plan is more valuable than the plan it's self.

There was discussion around improving emergency communications in Castle Valley.

**3. Approve Jan. 8th 2014 Minutes**

The minutes were Tabled.

**4. Work on history of hazards**

Duncan talked about the severe weather planning and hoped to get more information from Ron Drake.

There was discussion around Utah and the four corners hosting the least amount of natural disasters.

Rau stated he had been figuring out cost for the total amount of power outages with a cost at $10 an hour.

Jazmine stated that Leta V had gotten data together for rock fall hazard but was not in attendance.

Mayor Erley stated that there is a spread sheet with property values that could be used to plug in properties that are in danger or certain hazards. He stated that he added two hazards: no winter maintenance and the possibility of no access for the homes in the upper 80.

There was discussion around entering data into the spreadsheet to determine values for hazard loss.

There was discussion around past hazards that had not been recorded and how to record them.

Russell reported that he had gone to a meeting with Frontier Communications and the Grand County Sherriff. If 911 went down the Sheriff's office would be notified and the CV Fire District pagers would inform them that 911 is down so they could set up an emergency communications location where they would be able to radio emergencies in via radio. He stated that the Fire Chief now has a satellite phone that will be available in emergencies if the towers at Bald Mesa were ever to go down.

**5. Discuss format for plan**

**6. Set goals for next meeting depending on where everyone is in Risk Assessment**

Duncan stated that the group should try to finish their Hazard histories by next meeting.

There was discussion around the different places where hazards may have been recorded and the different events that residents remember that may not be recorded anywhere.

Mayor Erley stated that he knew there had been work done on Shafer in the past due to flooding.

**7. Other needs**

Duncan stated that she is ready to hear other needs and to move on with the process.

Pat Drake stated that she didn't like the idea of *making* people buy flood insurance especially given the unique folks in CV.

Duncan stated that fortunately most of the unique folks in the valley do own their property out right.

Mayor Erley stated that it didn't seem too likely for FEMA to do a flood study any time soon, he stated that is it a big risk to have shipping containers and trailers in flood zones not tied down and that this will be a big community discussion. As a Level 'A' community it appears that manufactured homes and trailers/containers are not even allowed and that more research would need to be done.

Duncan stated that the Town does not have the regulatory power to not allow those structures and storage containers.

Pat Drake stated that in the past there have been rules and regulations put in place and a lot of those things have not been enforced so why put more regulations out there.

Duncan hoped to get through histories, begin prioritizing hazards in the next meeting based on occurrences. She stated that going through the hazards and finding mitigation tactics will hopefully prevent damage from hazards in the future and the Town will be able to nip things in the bud.

There was discussion around rehabbing areas that have been destroyed by fire to help slow flooding. The group discussed reaching out for funding as well as other ideas to help rehab damaged land.

Mayor Erley stated that the SITLA land swap did happen with the BLM. He stated that Bruce Keeler was an unsung hero for the work he did with water analyzing and septic studies and quenched SITLA's thirst for developing Castle Valley.

Duncan adjourned the meeting at 8:48p.m.

**Adjournment**

**Approved:** Jazmine Duncan 3/19/14 **Attested:** Mar 19.14

**Jazmine Duncan, Chair** **Date:** **Alison Fuller, Town Clerk** **Date:**

5

HAZARD MITIGATION MEETING
Town of Castle Valley
Wednesday, Feb. 12th, 2014 at 6:00 p.m.
CASTLE VALLEY COMMUNITY CENTER
2 CASTLE VALLEY DRIVE

Please Sign In:

Jennie Dunn
JH Carsen
Mark Webster
Dave Erley
Tom Noel
Jake Burnett
Jack Campbell
Laura Cameron
Pam Hackley
Bruce Keeler
Ted R. Bay
Ron DRAKE
PAT DRAKE
John CRAIG
BRAD BARTHOLOMEW
Pamela Gibson
Jocelyn Bucks
Pat Rutter
David Smith

Thank You!

**MINUTES HAZARD MITIGATION COMMITTEE**
**March 12th, 2014 6:00P.M.**
**CASTLE VALLEY TOWN HALL 2 CASTLE VALLEY DR.**

**Members Present:** Dave Erley, Jazmine Duncan, Bill Rau, Bob Russell, Leta Vaughn, David Smith, Greg Halliday, Ron Drake, Pat Drake.

Jazmine Duncan called the meeting to order at 6:05p.m.

1. **Public Comment**
2. **Minutes Approval**

***Jan. 8, 2014 Minutes**

Halliday stated that on pg. 1, Item 2, 4th paragraph, he would add "partially" in front of "returned to that route...". He also added "for a 5 ft. culvert" after "...$35,000" on pg 3, 3rd paragraph.
The minutes were approved by Rau, Vaughn, Duncan, Russell, Halliday & Smith.
**Abstained** – Dave Erley.

***Feb. 12, 2014 Minutes**

Erley moved to approve the minutes as presented, the motion passed unanimously.
**Abstained** – Leta Vaughn.

3. **Finish work on history of hazards**
   - **A. Profile hazards**
   - **B. Inventory assets**
   - **C. Estimate losses**

Duncan explained the process and the importance of the process itself. She stated that it is more difficult to estimate loss, specific incidents are easier to estimate what was lost.
There was discussion around the cost of fixing roads and estimating loss when they are damaged.
There was discussion around constructing things in a way so they'll survive the harsh elements in the valley.
The group discussed talking with the community to assess past losses and get an inventory of what had been lost or damaged and what the cost was.
They discussed reaching out through the Castle Valley comments to get input from the community.
Rau stated that he contacted Rocky Mountain Power and came up with a figure from 5 years of documented outages rated at $10 an hour based mostly upon inconvenience with a total at $316,000 or figured at $50 an hour which would equal half a million. He stated that the outages really affect home businesses who are losing a lot more than electricity when the power goes out.
Pat Drake stated that there are many people in CV that need electricity for their oxygen & health.
There was discussion about the need for electricity during harsh conditions where the consequences of outages could be life threatening.
There was discussion around using generators to mitigate the hazards of power outages, and how to work with community members that have generators already.
There was discussion around compiling the hazard data everyone has collected and using spreadsheets.
The group discussed specific areas that are more prone to different hazards such as particular power poles and church steeples that have been struck repeatedly.
Ron Drake stated that there were 80 calls during a certain period and 31% were lighting strikes, 10% were

vehicles, 72% were brush and weeds, most fires happened in the month of June.

**Review example plan**

Duncan reviewed the State's mitigation plan and the definitions of hazards within it. She suggested using the same definitions of their hazards since the plan had been approved. She also presented Alabama's Hazard Mitigation Plan as a good example to work off of.

Duncan discussed the need to describe the process within CV's plan, documenting public hearings, meetings etc. She discussed the other subjects that should be addressed that would be unique to the demographic in Castle Valley. She discussed including a Plan Maintenance process to update the plan once it is finished.

**3. Begin step 3, develop mitigation plan**

**A. Prioritize hazards**

The group discussed and created a priority list for hazards and discussed how they may affect one another and what priority they should be in based on the # of properties affected by the hazard and likelihood.

There was discussion around the power outage issue as a hazard and how better equipment could mend a lot of issues.

Erley suggested making a chart of hazards with the probability, how catastrophic it could be, and how to mitigate and remedy the hazards.

Russell stated that fire, flood and severe weather are most relevant to CV and power outages would be # 4 because of it far reaching effects.

David Smith suggested infectious disease as a hazard they had not considered using the Hanta Virus as an example.

The Group decided on the Hazard Priority list in the following order:

1-Fire, 2-Flood, 3-Severe Weather, 4-Power Outages, 5-Rock Fall, 6-Drought, 7-Water Contamination, 8-Earthquake.

**B. Identify mitigation actions**

Duncan spurred the discussion to begin mitigations for the #1 Hazard, Fire.

The group discussed fire mitigation tactics like, mowing roadsides, policy changes, raising community awareness among landowners to manage tumbleweeds & fire fuel, control burning.

Erley stated that some properties endanger and pass fire to the rest of the valley much more easily than other lots.

There was discussion around dealing with tumbleweeds and the fire danger they incur.

Ron Drake stated that they have been getting stretched very thin with so many controlled burns.'

Duncan stated that perhaps getting more personnel to help with control burns would be part of the fire mitigation.

There was discussion around requiring a higher standard for landowners to prepare themselves for a controlled burn to make it safer and easier on the fire crew.

David Smith suggested getting a chipper for the Town to cut down on burning all together.

There were other suggestions for dealing with the tumbleweeds such using specialized tumbleweed machinery, pelletizing them for woodstove, pig food, composting, and possible goat grazing. Tumbleweed seed is viable for 2 years and effects could be noticeable after that period.

Duncan inquired about mitigations for structural fires.

The group discussed providing a structural maintenance list to the community to prevent fires such as cleaning

the gutters, checking electrical after a home reaches a certain age, cleaning the stovepipe, and fuel storage.
Duncan stated that fuel storage could be something that could be written into a policy.
Erley stated that there is a lot of room for education and some things should be written into policy. He questioned if the Town should be a depository for oils and paints & other waste materials to prevent hazards all over the valley.
Duncan stated at the next meeting they will finish identifying fire mitigation actions and move through the Hazard List identifying mitigation actions for each. She encouraged the group to compile their own mitigations for the Hazard List for the next meeting. She stated that the documentation process will start once the strategies are prepared.

**C. Prepare mitigation strategy**
**D. Document the planning process**

4. **Other needs?**

Bob Russell inquired about an Emergency Operations Plan.
Duncan stated that an Emergency Operations Plan does not exist in Castle Valley yet and that it may be a part of addressing some of the hazards in CV and they may create one as a part of this process.
Erley stated that the Town has a siren but is not sufficient to alert the valley and perhaps they could install more than one if that seemed like the best option.
Ron Drake stated that the siren works and has been maintained in the past.
There was discussion around testing the siren on a regular basis, and having codes that would alert the community to the kind of hazard at hand.
Ron Drake stated that the siren operates on electrical power and if it goes out the siren is useless.
Leta moved to adjourn the meeting, Erley seconded, the Motion passed unanimously.
Duncan adjourned the meeting at 7:35p.m.

**Adjourn**

**Approved:**

Jazmine Duncan

**Jazmine Duncan, Chair** **Date:**

**Attested:**

4.9.14

**Alison Fuller, Town Clerk** **Date:**

3

HAZARD MITIGATION COMMITTEE MEETING

Town of Castle Valley

Wednesday, March 12th, 2014 at 6:00 p.m.

CASTLE VALLEY COMMUNITY CENTER

2 CASTLE VALLEY DR.

Please Sign In: Jamie Dunn 259-1064

Bob Rudder

DAVE ERLEY

David Smith

Greg Halliday

LETA VAUGHAN

Bill RAU

Ron Drake

Pat Drake

Thank You!

# MINUTES
# HAZARD MITIGATION COMMITTEE
# APRIL 30TH, 2014 AT 6:00 P.M.
# TOWN HALL - 2 CASTLE VALLEY DR.

**Present:** Jazmine Duncan, Bob Russell, Pat Drake, Ron Drake, Greg Halliday, Leta Vaughn, Nancy Van Ausdle.
**Recorder:** Alison Fuller

**CALL TO ORDER**
Jazmine Duncan called the meeting to order at 6:04 p.m.

**1. Public Comment**
Nancy stated that it seemed the group seemed very competent.

**2. Approval of the April 9th, 2014 Minutes**
Leta Vaughn moved to approve the minutes, Bob Russell seconded, the Motion passed unanimously.

**3. Continue Step 3: Develop Mitigation Plan**

**A. Prioritize hazards – Working on Flood Hazard**
**B. Identify mitigation actions**
**C. Prepare mitigation strategy**
**D. Document the planning process**

Duncan stated the group should brainstorm strategies to mitigate floods.

Halliday stated that the flood mitigation strategy is moving water from point A to point B as quickly as possible. He reviewed the Placer Creek drainage as it runs through the valley & stated that a critical point is the ditch diversion between lot 308 and 328. He stated that if enough water passed through that area it will cut across to its' old channel threatening many developed properties. He reviewed the course the water had taken in past floods and indicated several areas where there are insufficient culverts for flooding.

Duncan asked what they would do to mitigate the flooding.

Halliday stated that making a wider channel, reinforcing an extending the berm that is there would be a good strategy. He stated that in the 09' flood the water went around the berm and that it currently was not complete and would let water through.

Russell asked if the work would have been done before the 09' flood if it would have held the water.

Halliday stated that he thought that it would have been a lot better and kept most, if not all of the water in the creek. He stated that the work he described is only at one choke point by lots 308 and 328 and he was not sure if the whole creek could take all of the water downstream. He stated that the big flood after the fire was huge but it was not outside the bounds of happening again. He stated that in the big flood (2009) the water went over several roads including Pope and Shafer.

Russell stated that when the roads were flooded they created a barrier and no one on the north east side of the flood could get out except the people that lived on Shafer Lane.

Halliday stated that the flood water hits Castle Creek once it gets to Buchanan west of lot 110 & east of lot 109. Upstream on Placer Creek between lot 361 and 360 there was a culvert that had been completely damaged and what is left is a drive thru drainage. He stated that the Town does not have an easement for the upper 80 lots except for a few and there are no plans of changing that drainage because in the 2009 flood the entire channel was filled with a foot deep of water on either side.

Duncan stated that flood mitigation strategies will probably consist of securing easements to enable flood mitigation.

Pat Drake asked if there was a way to put in more material than just dirt in the berm such as rock or cement to prevent erosion. Halliday stated that the channel is currently 2-3' wide and they want to make it 8-10' wide. He stated that ideally the water would funnel through and not pick up or drop anything and that is why it's critical that the weeds are burnt out of the culverts because they stop

proper drainage. When he started the Roads Manager job the culverts were 75-80% full, he stated that there has to be enough drop for them to flow properly. He said the critical points on Placer Creek are the border of lot 308 & 328 at the ditch diversion, and lot 233 and 242 on Miller. He said that the culvert on Miller is longer than the Town's easement and the Town is working on getting more easements in that area.

Duncan asked what they would do to mitigate the flooding on Miller Lane.

Halliday stated that excavation would be enough to remedy the problem as the culvert is already starting to self clean. He stated that there is about 150 yards of channel to excavate and the amount of material created is staggering. He stated that previous work that was done on the drainage put the excess material in a drainage that has since been carved out and deposited downstream. He stated that the culverts are $10,000 and the Town can not afford to replace them. He stressed the importance of Placer Creek not leaving its' channel and how bad it would be if it went back to the historical drainage. He reviewed where the historical drainage would flow; through developed properties and culverts that are not large enough to handle that amount of water.

Pat Drake asked when the drainage path was changed from the historical channel to the current channel.

Halliday stated that the Ranch (Porcupine) changed it and the property owners did not buy their land with drainages on them.

The group reviewed the worksheets and rated the potential benefit, financial viability, and political viability for the mitigation efforts for each flood site.

Halliday stated that everything drains to a few historical low points, lot 220 and lot 231. He stated that the Placer Creek ditch is on a hill & if the culvert failed it would return to those low points and wash out the road preventing people from getting out of the valley.

The group reviewed securing easements as a mitigation strategy. They discussed what they would do if they could not secure easements and the right to work on drainages if life or property is being threatened.

Halliday stated that the Town has easements for almost all the areas with drainage issues. He stated that if anyone built at ground level in the historic drainage they would be in trouble in a 1000 year flood.

Duncan asked if the group wanted to discuss what would happen if the mitigation efforts didn't work and people did end up getting stuck and there was an emergency.

There was discussion around how they would assist people in medical need that may be trapped by flooding. A helicopter could be used to pick up patients in a flood.

Russell stated that designating landing locations for helicopters beforehand is not necessary as they like to land as close as possible to the patient. Ensuring the landing is clear of power lines and other obstructions is the best way to prepare for a helicopter.

The group agreed preventing the roads from flooding in the first place would be best.

Ron Drake stated that an old timer that grew up in the valley had seen alfalfa bales picked up from the valley and floated all the way down to Joe Kingsley place, lot 373.

Halliday stated that on lot 369 at the end of Shafer Lane it meets Castle Creek with 3 culverts, a 10' and 2, 6', he stated that the channel needs to be excavated so the culverts can flow freely. He stated that the drainage is actually a ditch and is not the original channel. He said that it is also up on a hill and can flood to a low point if it left the channel. He stated that above the Castleton Campground there is a berm that needs to be maintained to keep the water in the appropriate channel.

Ron Drake stated that he thought the POA had worked the upper berm on Castle Creek in the past.

The group discussed access to land that needs to be maintained on Castle Creek.

Halliday stated that there is a 36" culvert that the water has gone around in the past and he had bermed it to prevent the water from going through the access road. He graded out a basin and did more berming to direct the flow of water. There is a dip just before Fire Station One to get the water to go back into the drainage.

Duncan stated that mitigating that issue would be maintaining the berm.

Halliday stated that the big culvert on Castle Valley Dr. on lot 371.3 and lot 447 is in need of replacement. The water has been head cutting the road and the drainage study the Town had done called for 2, 10 foot culverts.

Ron Drake stated that the culvert was put in before the drainage study was done.

Duncan stated that the mitigation for this is replacing the culvert.

Halliday stated that it was likely that a bridge would replace the culvert, he stated that there is not enough room to put in another culvert

and the culvert would create a check dam. He stated that if major water came down all of the drainages the culvert would probably wash out.

Nancy stated that she had seen places where the water had washed away the land all the way around the bridge.

Pat Drake stated that they had not ever seen the water go over Castle Valley Dr. but they had seen it come close.

There was discussion around debris getting picked up and clogging the culvert and how they could mitigate that.

Halliday there had been some houses built on the Town's Greenbelt property down in the drainage. He stated that there are a lot of campers, trailers, and other material that could be picked up in the drainage in a big flood event.

There was discussion around rating the Castle Valley Drive culvert and removing the manmade & natural debris in the creek bed. Duncan discussed arranging the easement on Shafer Lane to allow for the community to use that access while work is done on the Castle Creek, Castle Drive crossing.

Ron Drake inquired about using the old Castle Creek road crossing on lot 447 while work is done on a bridge or otherwise.

Halliday stated that Placer and Castle Creeks are the biggest issues.

Russell asked if any old ponds were causing any problems.

Halliday stated that 2 had breached and one was completely silted in. The one off of west Holyoak was the only viable check dam.

Pat asked if the ponds were something that they wanted.

Halliday stated that as far as he knows there is not anyone who maintains those ponds.

**4. Other Needs**

Duncan stated that the next meeting will be the normal 2nd Wednesday of the month at 6pm.

Halliday moved to adjourn, Russell seconded, the Motion passed unanimously.

Duncan thanked Halliday for all the hard work and adjourned the meeting at 7:30 p.m.

**ADJOURN**

**APPROVED:** Jazmine Duncan 5/14/14

**Jazmine Duncan, Chair** **Date:**

**ATTESTED:** 5.14.14

**Alison Fuller, Town Clerk** **Date:**

3

HAZARD MITIGATION COMMITTEE MEETING

Town of Castle Valley

Wednesday April 30th, 2014 at 6:00 p.m.

CASTLE VALLEY COMMUNITY CENTER

2 CASTLE VALLEY DR.

Please Sign In!:

BOB RUSSELL

Tymis Dunn

Greg [illegible]

Ron [illegible]

PAT DRAKE

LEON VAUGHN

Nancy Van Ausdle

Amy [illegible]

Thank You!

# MINUTES
# HAZARD MITIGATION COMMITTEE
# APRIL 9TH, 2014 AT 6:00 P.M.
# TOWN HALL - 2 CASTLE VALLEY DR.

**Present:** Jazmine Duncan, Bill Rau, Bob Russell, Pat Drake, Ron Drake, Dave Erley, Greg Halliday, Leta Vaughn.
**Recorder:** Alison Fuller

## CALL TO ORDER

Jazmine Duncan called the meeting to order at 6:05p.m.

**1. Public Comment**

**2. Approval of the March 12th, 2014 Minutes**

Bob Russell moved to approve the minutes, Dave Erley seconded, The Motion passed unanimously.

**3. Continue Step 3: Develop Mitigation Plan**

Duncan reviewed the Fire prevention mitigation and asked for input and additions.

Rau stated that he had observed that the fuel is different throughout the different levels of the valley and it seemed there needed to be something done to handle fuels located on part-time resident lots. He stated that there is a fire ordinance in the Town that is very vague and it could be updated along with the mitigation strategies the committee may form.

There was discussion around different locations for water sources to fight fire. They discussed finding water sources that do not require electricity and using trucks that could pump water into their tanks when there is not electricity. They discussed other heavy equipment that would be useful for fighting fires and forming a list of residents who are willing to volunteer with their heavy equipment in an emergency.

Erley stated that when the Town does get a new water truck that is something to be considered.

Duncan described that through out the preparation of the Hazard Mitigation Plan the group could also develop the Emergency Operation Plan.

Russell wondered if pre-planned fire breaks would be a good idea for mitigation, especially to address part time residents' lots.

Ron Drake inquired about widening roads as fire breaks.

Erley discussed the challenges of executing preventative measures on private property and stated that the Town would keep the roadsides mowed, and if there was life or property at risk the Town had the right to go onto properties to remove risk in the case of flooding and drainages, he thought that perhaps it would be the same with fire risk. He stated that there would need to be an MOU created between the Town and the Fire District to clarify jurisdiction.

The group discussed the extreme fire danger the tumbleweeds have created.

There was discussion around creating an ordinance to require property owners to clean up fire hazards and to possibly take responsibility for hazards they create.

They discussed other options for helping the less fortunate clean up their lots.

The group discussed enforcing the ordinance and possibly using a State inspector to review lots.

Halliday stated that the fire danger is already high and it is extremely dry.

Duncan stated that the group needed to figure out a list of questions to assess, prioritize, and analyze their Hazard Mitigation List.

The group discussed the physical ability to create mitigation efforts, the community acceptance, the fiscal ability, and benefit cost analysis.

Rau inquired about the total number of people that stopped by the Firewise Booth at the Spring Clean-up.

The group discussed Chipper day scheduled for May 5th & 6th, 2014. The Fire District was overseeing the chipping event.

Erley discussed the Town's need to make a long term plan for the Greenbelt, for wildlife, flood mitigation and fire prevention.

Halliday stated that across from Floyd Stoughton's place he had burned before and scorched the outside of the conduit. He said he didn't burn it but he came close.

There was discussion around power lines that are buried that could be burned and acquiring a map of all the power lines and phone lines in the valley from the utility companies.

Halliday stated that on Shafer there are really deep tumbleweeds that would burn 40' high.

Erley stated that they need to find out what right the Town has to step in and take action on private property. He wanted to know if it would be the responsibility of the Town or the Fire District, and that a MOU should definitely be established between the two entities.

Pat Drake stated that property owners who do not live locally do not seem to understand the fire risk.

Russell stated that the Firewise booth was a real success & the Fire District should continue to do it at the annual Spring Cleanup.

Duncan stated that the grant she got to clean up a citizen's lot and make it fire safe was something she wanted to see happen annually as well.

The group discussed meeting another Wednesday in April since there were 5 Wednesdays in the month, they decided to meet Wednesday April 30th.

Duncan provided maps for the group to review and a support tool to help develop their plan.

Erley stated that he had spoken with an engineer about the Town's drainage issues who had done a lot of work with the CIB and felt that the Shafer Lane easement should be a part of the grant plan and that a pre-fabricated bridge may be a good answer for the Castle Valley Drive crossing. He stated that it would be a several year plan but it would be good to get started on it now.

Rau stated that he felt that the fire issue should be handled soon because the danger is bad now and next year would not be soon enough. He stated that he would love to move this through the PLUC but would need some guidance.

There was discussion around residents being able to afford property maintenance.

**A. Prioritize hazards**

**B. Identify mitigation actions**

**C. Prepare mitigation strategy**

**D. Document the planning process**

**4. Other Needs**

Pat Drake moved to adjourn, Dave Erley seconded, the Motion passed unanimously.

Duncan adjourned the meeting at 7:10 p.m.

**ADJOURN**

**APPROVED:** Jazmine Duncan 4/30/14

**Jazmine Duncan, Chair** **Date:**

**ATTESTED:** 4.30.14

**Alison Fuller, Town Clerk** **Date:**

2

HAZARD MITIGATION COMMITTEE MEETING

Town of Castle Valley

Wednesday, April 9th, 2014 at 6:00 p.m.

CASTLE VALLEY COMMUNITY CENTER

2 CASTLE VALLEY DR.

Please Sign In:

Jamie Burr

Bob Risser

Ron Drake

PAT DRAKE

DAVE EARLEY

Thank You!

# MINUTES
## HAZARD MITIGATION COMMITTEE
## May 14TH, 2014 AT 6:00 P.M.
## TOWN HALL - 2 CASTLE VALLEY DR.

**Present:** Jazmine Duncan, Bill Rau, Bob Russell, Pat Drake, Ron Drake, Greg Halliday, Leta Vaughn, Rick Bailey.

**Recorder:** Alison Fuller

**CALL TO ORDER**

Jazmine Duncan called the meeting to order at 6:04 p.m.

**1. Public Comment**

There was discussion around the DNR (Division of Natural Resources) activity in the valley.

Rick Bailey introduced himself to the group as the new emergency manager for Grand County. He stated that the sheriff wanted him to attend the committee meeting and he was happy to be there.

**2. Approval of the April 30th, 2014 Minutes**

Greg Halliday moved to approve the minutes Pat Drake seconded, the Motion passed unanimously.

**3. Continue Step 3: Develop Mitigation Plan**

**A. Prioritize hazards – Working on Flood Hazard**

**B. Identify mitigation actions**

**C. Prepare mitigation strategy**

**D. Document the planning process**

Duncan stated that it would be nice to evaluate the 'Upper 80' flood mitigation strategies with their worksheets.

Halliday discussed the upper Placer Creek crossing and the group discussed the need for gaining easements in order to properly mitigate flooding in that area.

Russell inquired about the drainage from the rain over the weekend.

Halliday stated that the drainages all worked properly.

Pat Drake inquired about the state requiring private property owners to take certain measures when manipulating streams.

There was discussion around the Town's right to work on properties when life and property are in danger.

The group rated the financial & political viability and potential benefit of each flood mitigation site in the "upper 80" and the other major flood zones from their last meeting.

They discussed the number of people affected by the Placer Creek crossing as well as the fire danger in that area that could not be reached while that crossing is flooded. That area also has the advantage of offering another road out of the valley in a high clearance vehicle.

Duncan stated that the group should rate the pre-fabricated bridge with their worksheets.

There was discussion around pre-fabricated bridges and how they are installed.

Rick Bailey stated that the $250,000 estimate for the bridge sounded accurate based on his recent work elsewhere.

Halliday reviewed maintenance for culverts, fjords, and other areas that flood throughout Castle Valley. On Cliffview Lane lot 403 & 412 has a culvert that needs to be monitored and maintained. Lot 405 & 410 has a fjord but could use a culvert because the property owner filled in the drainage when he built his driveway. A property owner on Cliffview had used old carpet to prevent the water from cutting the drainage any deeper. He stated that the work had been completed on Placer Ditch for mitigating flooding at lot 308 and 328. He stated that on lot 233 the drainage was prepared for flooding now as well. He was glad that those projects were completed because they were in serious need of work.

There are culverts on Castle Valley Drive at lots 3 & 428, 14 & 9, 35 & 29, ~~30~~ 35 & ~~31~~ 34, 56 & 50, 87 & 76, 118 & 117, 161 & 137, 209 & 179, 250 & 226, 284 & 267, 311 & 302, 327 & 328. The mitigation strategy for all the CV culverts is to maintain them by keeping them clean & clear.

Halliday reviewed areas that may need maintenance in big rain events; a culvert on East Pace Ln. lot 117 & 313, a shoulder on east Buchanan carries a lot of water, a culvert on lot 137-140, and lot 161 feeds the previously stated ditch and a berm would need to be maintained. Lot 155 & 142 has Placer Creek that flows through a 60" culvert. 157 & 140 has a 48" culvert that is in the historic drainage for Placer Creek.

All of the culverts in the valley need to be maintained by clearing the sediment and getting rid of the weeds so they can flow freely and remain clear.

Pat Drake asked about the standing water on Lazaris Ln. and if it needed any work.

There was discussion around mosquitoes breeding in standing water.

Halliday reviewed other areas that need to be maintained; on Shafter Lane lots 209 & 179 have a culvert, there is a shoulder ditch from lot 179 to 181. Lot 206 & 181 have a 48" culvert, lot 203 & 184 have a 5' culvert that carries Placer creek & lots 196 & 191 have a 6' culvert. On Miller Lane lot 250 & 226 there is a major culvert as well as a road site ditch that carries substantial water between 250 & 267 which then takes water to Pope on lots 264 & 267. Pope has a roadside ditch on lots 288-284. Lots 284 & 267, 289 & 263 have culverts that need to be monitored & maintained as well.

The group used their worksheets to rate all the flooding areas and mitigation strategies by their financial & political viability and potential benefit.

Duncan stated that at the next meeting they will rate the Fire Mitigation strategies with their worksheets.

**4. Other Needs**

**A. Need to put the Fire strategies into the worksheets.**

Leta moved to adjourn, Pat seconded, the Motion passed unanimously.

Duncan adjourned the meeting at 7:33 p.m.

**ADJOURN**

**APPROVED:** **ATTESTED:**

Jazmine Duncan 6.11.2014

**Jazmine Duncan, Chair** **Date:** **Alison Fuller, Town Clerk** **Date:**

2

HAZARD MITIGATION COMMITTEE MEETING

Town of Castle Valley

Wednesday May 14th, 2014 at 6:00 p.m.

CASTLE VALLEY COMMUNITY CENTER

2 CASTLE VALLEY DR.

Please Sign In!:

BOB SCHUMAKER

RICK M. BAILEY rbailey@grandcountysheriff.org

Bob Russell

Jamie Dunn

Bill Rau

Greg [illegible]

LORA VAUGHAN

Ron Drake

PAT DRAKE

Thank You!

**MINUTES**
**HAZARD MITIGATION COMMITTEE**
**June 11TH, 2014 AT 6:00 P.M.**
**TOWN HALL - 2 CASTLE VALLEY DR.**

**Present:** Jazmine Duncan, Bob Russell, Pat Drake, Ron Drake, Greg Halliday, Leta Vaughn.

**Recorder:** Alison Fuller

**CALL TO ORDER**

Jazmine Duncan called the meeting to order at 6:07p.m.

**1. Public Comment**

Halliday stated that the Fire District Website would be good for public notices.

**2. Approval of the May 14th, 2014 Minutes**

Halliday corrected page 2, 2nd paragraph, lot 50 &51 should be lot 35 & 34 instead for a CV Dr. culvert.

Ron Drake moved to approve the minutes with the presented correction, Bob Russell seconded, the Motion passed unanimously.

**3. Continue Step 3: Develop Mitigation Plan**

Halliday met with Nick Jones from the Utah State University who reviewed the road issues in the valley with the Mayor and himself. Jones recommended a GBS bridge that would be a 1/4 of the price of a normal bridge. Based upon the equipment the Town has all the flood mitigation that could be done, has been. Jones was surprised that Keogh Lane was so steep and stated that when he worked for Provo City as their Roads Engineer driveways were not permitted to be built as steep as ~~parts of~~ the 20% slopes on Keogh. Jones recommended an ordinance that would require lots in the flood plain be built 3 ft higher than the current grade.

There was discussion around what residents have done that have built in flood plains as well as below grade.

Pat Drake inquired about the lifespan of a bridge.

Halliday thought perhaps 30 years and thought it would last longer than a culvert.

**A. Prioritize hazards – Go back and run our mitigation strategies for Fire Hazard through the worksheets.**
**B. Identify mitigation actions**
**C. Prepare mitigation strategy**
**D. Document the planning process**

The group discussed mowing the roadsides, policy changes, raising public awareness & controlled burning as mitigation strategies and rated them with their worksheets for their potential benefit, financial & political viability.

There was discussion on how controlled burns also prevent future fuels however the risks are very high.

The group rated identifying lots with lots of over growth and educating fire defensible space for the potential benefit, financial & political viability. There was discussion around the benefits of identifying fuel laden lots.

Bob Russell mentioned the red rock, green rock system of assessing property's safety to fight fires. A red rock would mean the property is not safe enough for fire fighters to come onto the property and fight the fire.

The group rated investing in equipment to reduce fuels with their worksheets with the above measures.
Halliday discussed the pit falls of the boom mower and recommended a 3 point hitch mower instead.
The group discussed using livestock for fuel/weed control and rated the strategy with their worksheets.
They discussed using a variety of livestock, and not limiting regulations even more to not allow for this type of mitigation.
The group discussed and rated fire mitigation strategies with their worksheets: fire inspections on structures, pre-planned fire breaks, policy changes to regulate fuel and hazardous material storage, & locating potential water sources for firefighting.
The group discussed and rated creating a program for the Town siren and creating an emergency plan for when the siren goes off.

**4. Other Needs**

**A. Discuss fire mailing, help with draft if needed.**

Duncan stated the Fire Commissioners and Bill Rau are working on a document to send out for fire awareness and prevention practices and if anyone has anything they would like to add they should get in touch with Rau or the Fire District.

**B. Begin strategies for hazard #3: Severe Weather, if time permits.**

Halliday moved to adjourn, Vaughn seconded, the Motion passed unanimously.

Jazmine Duncan adjourned the meeting at 7:43p.m.

**ADJOURN**

**APPROVED:**

**Jazmine Duncan, Chair** **Date:**

**ATTESTED:**

**Alison Fuller, Town Clerk** **Date:**

2

HAZARD MITIGATION COMMITTEE MEETING

Town of Castle Valley

Wednesday June 11 th, 2014 at 6:00 p.m.

CASTLE VALLEY COMMUNITY CENTER

2 CASTLE VALLEY DR.

Please Sign In!:

BOB RUSSELL

LOTTA VAUGHAN

PAT DRAKE

Ron Drake

Jennie Denny

Thank You!

**MINUTES**
**HAZARD MITIGATION COMMITTEE**
**July 9TH, 2014 AT 6:00 P.M.**
**TOWN HALL - 2 CASTLE VALLEY DR.**

**Present:** Jazmine Duncan, Bill Rau, Bob Russell, Pat Drake, Ron Drake, Greg Halliday, Leta Vaughn, Jack Campbell

**Recorder:** Alison Fuller

**CALL TO ORDER**

Jazmine Duncan called the meeting to order at 6:07p.m.

**1. Public Comment** – Comments noted 6.30.14 from Jack C. regarding brush around power poles.
Campbell wondered if there was anything in place to see that residents clear fuel around power poles and transformers.
There was discussion around who has easements and who is responsible for clearing fuel around those utilities.
Ron Drake stated that sometimes the transformers have started fires themselves.
Campbell stated that it was a relief to make it through another 4th of July.

**2. Approval of the Minutes - June 11th, 2014.**
Halliday stated that the prefabricated bridge in the minutes is called a GBS bridge.
Halliday moved to approve the minutes with the presented change, Russell seconded, the Motion passed unanimously.

**3. Continue To Develop The Mitigation Plan**

**A. Prioritize hazards – Go back to mitigation strategies for Flood, rate missed strategies.**

(The worksheets rate the financial & political viability and the potential benefit)
The group rated documenting and mapping drainages with the NRCS study and an all weather access at the upper 80 Placer Creek crossing as mitigation strategies.
The group rated getting transformers and power infrastructure surveyed & located and having contractors remove brush and weeds from around the power poles as hazard mitigation strategies.
Campbell inquired about the transformers being fused and if one pole goes down how will it affect the rest of the valley.

**B. Identify mitigation actions for severe weather. Rate with worksheets.**

The group rated getting back-up power at the town building, fire stations, and the churches, as a mitigation strategy.
Duncan stated that another big topic is to raise public awareness about being prepared for emergencies.
There was discussion around not depending heavily on the county for support because there could be times when the County wouldn't be able to reach Castle Valley.
The group discussed the feasibility of a helicopter landing in heavy snow, and the local resources the Town has.
Campbell recommended propane generators since it is more stable than gasoline.
Russell inquired about adequate warning systems for the community to prepare for severe weather.
The group rated development & use of a warning system for the community during severe weather as a mitigation strategy for severe weather.

1

The group discussed "Reverse 911" as a warning system and if it is really reliable and should be tested.
The group discussed & rated identifying heavy power lines and trees that could block accesses & roadways as a mitigation strategy.
The group rated creating a staging area at the town building with Emergency First Responders (EMR's) when the power is out.
The group discussed & rated public education and awareness as a mitigation effort.
There was discussion around more affordable options to reach everyone in the valley besides a town mailing.
The group discussed & rated getting generators for back-up power at a central point during power outages & creating an emergency protocol throughout the Town and Fire District for prolonged power outages.
Campbell inquired about someone in the community who knows about the power circuits in the valley and suggested a liaison from the Town to work with the power company.
There was discussion around the power installation in the early phases of the valley that had no forethought involved.
Campbell discussed bringing public awareness to the community about what a power outage might mean for them related to their heat and other resources.
There was discussion around other resources that would be needed for prolonged power outages and incorporating those needs into public awareness messages. The group rated preparing back up resources as a mitigation strategy such as gasoline, propane, fire wood, water, and food.

**C. Prepare mitigation strategy**

**D. Document the planning process**

**4. Other Needs**

**A. Discuss fire mailing, help with draft if needed.**

Bill Rau stated that he had incorporated other comments from the community into the fire mailing letter and was ready to move forward.
There was discussion around language in the letter for people who are available to clear and mow brush and fuel.
Campbell stated that he thought it would be a good idea to let people know of the odd ways that fires had started in the valley. He recalled a story of a glass jug in the back of a truck starting a fire from the sun and igniting books and propane tanks that were also in the truck.
The group discussed putting the odd fire stories in the Castle Valley Comments to help get the word out.

Vaughn moved to adjourn, Rau seconded, the Motion passed unanimously.

Duncan adjourned the meeting at 7:49 p.m.

## ADJOURN

**APPROVED:**

**Jazmine Duncan, Chair** **Date:**

**ATTESTED:**

8.13.14

**Alison Fuller, Town Clerk** **Date:**

2

HAZARD MITIGATION COMMITTEE MEETING

Town of Castle Valley

Wednesday July 9th, 2014 at 6:00 p.m.

CASTLE VALLEY COMMUNITY CENTER

2 CASTLE VALLEY DR.

Please Sign In!:

Greg Pattison

Jamie Dunn

Bill RAU

Jack Campbell

PAT DRAKE

Ron Drake

Bill Russo

LORA VAUGHAN

Thank You!

# MINUTES
## HAZARD MITIGATION COMMITTEE
## AUGUST 13TH, 2014 AT 6:00 P.M.
### TOWN HALL - 2 CASTLE VALLEY DR.

**Present**: Greg Halliday , Ron Drake, Pat Drake, Rick Bailey, Bob Russell, Leta Vaughn, Bill Rau, Jazmine Duncan.
**Recorder**: Alison Fuller

**CALL TO ORDER**

Jazmine Duncan called the meeting to order at 6:03 p.m.

**1. Public Comment**

Halliday stated that the flood mitigation strategies have almost been all finished.

**2. Approval of the Minutes - July 9th, 2014.**

Halliday moved to approve the minutes as presented, Pat Drake seconded, the Motion passed unanimously.

**3. Continue Step 3: Develop Mitigation Plan**

**A. Prioritize hazards – Discussion & addition of mitigation strategies involving: emergency services, communications, utilities, transportation & infrastructure.**

Fuller stated that Rocky Mtn. Power hazard reps. will be joining the September meeting to hear the needs of the group for utility maps.

Duncan discussed the issue of the upper 80 crossing that could use infrastructure to help with flooding. She asked Rick Bailey about the grants available for hazard mitigation projects.

Bailey stated that the grants are highly competitive and are nation wide. He discussed the rural development grants that are better for getting equipment and usually have the municipalities provide 20% of the cost. He discussed the Community Impact Board (CIB) grants, Rural Development grants and the Community Development Block Grants (CDBG).

The group discussed getting a back-hoe through the Rural Development grants or the CIB.

Pat Drake inquired about a utility box that can be used to turn the utilities back on from the valley.

The group discussed how to prepare for a major disaster along with power outages.

They discussed medical supplies that are available through out the valley and how to prepare for being isolated in an emergency.

Ron Drake stated that he would like to see some basic supplies like MREs, water, cots, etc. stored at the Town building or Fire Station.

Bailey stated that there are some trailers with old medical supplies that the state brought down that has cots, blankets, bandages etc. There is a committee that is going to meet and decide what to do with those medical supplies. He stated that it takes the government about 72 hours to get paper work through their system in emergencies and having a 72 hour kit would be very important to a community like Castle Valley.

Duncan asked what would happen if the culvert went out at the Castle Creek crossing.

Bailey stated that most likely the county would come in and try to address the issue if the Town declared a state of emergency to the County. If the County didn't think that they could handle the issue they would declare an emergency to the State. It is a good idea to have a Continuity of Government Ordinance so that if a council member is out of town the Council could still vote to declare a state of emergency.

The group discussed the National Flood Insurance Program (NFIP) and that the PLUC had not recommended the NFIP and what to do about protecting citizens from flood. They discussed that the County is planning on adopting the NFIP after their public hearings.

**B. Identify mitigation actions for Rock Falls - Rate with worksheets.**

Drake stated that Rockville, Utah come to mind, where rock fall did kill some people in a rock fall zone.

The group discussed the rock fall map the town has and overlaying the street map onto it.

Drake stated that there was major rock fall above their house and the amount of dust that layered the closest house was about 1" thick.

Duncan inquired about stabilization equipment for big boulders. She also inquired about the process property owners have for lots that are in hazard zones and how people can be informed about the dangers that their lot may hold.

The Town building permit process does include forms for lots that are in hazard zones.

The group discussed how the town would not be liable for discouraging the sale of lots that may be in hazard zones. There was discussion about properties that are on roads that are not maintained during the winter or may be in areas that big equipment could not get to during certain times of the year if at all.

There was discussion around a mitigation strategy if a boulder landed and blocked a road.

**C. Prepare mitigation strategy – time frames?**

**D. Document the planning process – Discussion on putting our plan on paper**

Duncan presented a table of contents for the Mitigation plan and how the group could come together to put the plan on paper.

The group discussed how they would lay out the Mitigation Plan.

There was discussion around maps that the community could see inside the town building or library with the plat maps included on them. They discussed a pamphlet that could be given to new property owners that informed them about the unique issues Castle Valley faces and how to prepare for them.

**4. Discuss & list goals to prepare for Rocky Mountain Power representative during our September meeting.**

The group discussed: keeping power poles, and transformers clear of brush and debris, locating major points for maintenance to turn power back on, what the effects would be along the power line if one transformer goes out, what the value of the equipment is, if there is a way to find out how long power had been out on different circuits in the valley, what the major points in the system that should be protected, what to do in a wild fire, if they could send a rep. to do a training with the fire department.

Drake inquired about the new line they had been planning on putting in over the La Sals and if there are still plans for that.

Rau stated that the welcome pamphlet was great & in need of being updated & perhaps the PLUC could help with land use portions of it.

Leta Vaughn moved to adjourn, Greg Halliday seconded, the Motion passed unanimously.

Duncan adjourned the meeting at 8: 35 p.m.

**ADJOURN**

**APPROVED:** Jazmine Duncan 9/18/14

**Jazmine Duncan, Chair** **Date:**

**ATTESTED:** 9.18.14

**Alison Fuller, Town Clerk** **Date:**

2

HAZARD MITIGATION COMMITTEE MEETING

Town of Castle Valley

Wednesday August 13th, 2014 at 6:00 p.m.

CASTLE VALLEY COMMUNITY CENTER

2 CASTLE VALLEY DR.

*Please Sign In !*

Jennie Dunn

Ali Fuller

Greg Halliday

Bob Rusher

RICK M BAILEY

Ron Drake

PAT DRAKE

Thank You!

**MINUTES**
**HAZARD MITIGATION COMMITTEE**
**SEPTEMBER 10TH, 2014 AT 6:00 P.M.**
**TOWN HALL - 2 CASTLE VALLEY DR.**

**Members Present:** Jazmine Duncan, Bob Russell, Leta Vaughn, Dave Erley, Ron Drake.
**Recorder:** Alison Fuller

**CALL TO ORDER**

Jazmine Duncan called the meeting to order at 6:02 p.m.

Duncan stated that the Rocky Mountain Power discussion would take place first since the representatives were already on the phone.

**3. Rocky Mountain Power (RMP) representative phone discussion.**

Debra Dull the customer and community manager introduced herself; Dan Vink, the operations manager for the four corners & Amy Shingleton, the disaster risk planning manager.

The Hazard Mitigation Committee introduced themselves to the Rocky Mountain Power (RMP) representatives.

Duncan reviewed the priorities for the Hazard Mitigation Committee; identifying major areas to protect, the responsibility of clearing brush and debris for fire safety, utilities for fire fighting and road maintenance, gain an understanding of how the system works to inform the community regarding outages etc.

Bob Russell explained that the group is planning for disasters and wants to identify ways to remedy possible problems in emergencies.

Dave Erley stated that he would like to have an open dialogue surrounding the Rattlesnake power line and protecting and preserving that fragile line.

Duncan stated that the Town had requested a map of utilities from RMP in order to protect the lines in the events of major fire or flood & inquired about the best way to collaborate.

There was discussion around the level of maps needed and why they are needed by the Town.

Shingleton stated that there are multiple levels of maps and they are sensitive material.

Erley stated that RMP has utilities that are in harm's way and the Town would like to figure out the best way to protect the utilities. He reviewed a number of transformers that are currently surrounded by 8 inches of mud and inquired about proper protocol.

Shingleton stated that their employees may not find issues until they arrive in person & proper communication would inform them about any issues and would be greatly appreciated.

Greg Halliday stated that last winter there was an outage and the RMP representative that came out was unable to find the proper location to mend the problem and the power was out hours longer than need be. The Town felt it would be beneficial to have maps of the utilities to bring power back to citizens sooner.

The RMP representatives stated that, that incident was very odd and each truck is supplied with proper maps and tools and apologized for the incident.

Vink stated that he is a very hands on manager and when there are outages he can be reached at any time. He felt

that the incident in the winter was a onetime event and didn't feel like that would happen again.

Shingleton stated that it seemed best to put the situation back in their hands and to simply inform them of what is going on.

Duncan stated that it would be nice to get some kind of map to track where the lines are for the fire district and other emergencies. She stated that open lines of communication would be great as well as training for the Fire District to ensure proper protocol.

There was discussion around the utility maps being sensitive material and the possibility of the Fire Chief having a map for emergencies.

Vink stated that the best way to communicate during outages is to contact customer service, and he is willing to come to Castle Valley and review the Town's concerns.

Duncan stated that during power outages water is not available either because everyone operates on private wells; this can be very problematic during fires.

Vink stated that they are being proactive about maintaining the Rattlesnake power line to provide better service.

Erley stated that last November 911 was lost for 19 hours and the Town has since wanted to be more proactive with the utility companies in order to keep the community safe.

Dull stated that RMP had worked with several other rural communities in the past to help them find other options for communications during outages.

The group discussed the sheriff possibly holding a map of utilities just in case it is needed in the future.

Erley stated that it's great to develop a good relationship with RMP and have an open dialogue with them.

**1. Public Comment**

Erley stated that the Town is keeping the roads open from recent flooding but they would like to send the new roads manager to school before he does any major work.

**2. Approval of the Minutes – August 13th, 2014.**

Halliday moved to approve the minutes as presented, Russell seconded, the Motion passed. Erley abstained.

**4. Continue Step 3, develop mitigation plan.**

**A. Prioritize Hazards – Power outage, any left out mitigation?**

There was discussion around creating protocol for the Roads Department and Fire District when issues are discovered involving the utility companies.

The group discussed a formal protocol for power outages and utility issues and rated the mitigation strategy with their worksheets.

Halliday thought that the Town might have an old map of the power easements.

Duncan stated that it would be nice to know where the easements are in order to know who's responsible for clearing brush around utilities.

There was discussion around community members being proactive about notifying utility companies of any issues.

**B. Identify mitigation actions for earthquake drought, & water contamination & rate on worksheets.**

The group discussed ways to mitigate earthquakes and deal with the aftermath. They used their worksheets to rate a culinary water cistern for the community in emergencies.

The group discussed using other strategies for earthquakes as far as a 72 hour kit, back-up food, water, medications. etc.

The group discussed highway 128 getting shut down if there was an earthquake and rated keeping the La Sal loop road open year round when possible.

The group discussed what they would do in a drought.

Erley stated that the Town monitoring the town wells would help them understand what the water levels are in the aquifer; the group rated that mitigation effort with their worksheet.

The group discussed what the Town would do when water levels in wells get too low.

Erley discussed the ground water management plan and that its' purpose is to mitigate drought.

The group discussed a possible well that could be viable when other citizens' wells have gone dry.

The group discussed & rated rain water catchment for drought mitigation and possibly flood mitigation as well.

The group discussed & rated creating a large water catchment basin at the top of the valley to slow flooding and recharge the aquifer.

Duncan suggested doing the rest of the agenda items next time when there was more attendance, and the next meeting would be focused mainly on the Rocky Mountain Power representatives since they will be attending in person.

**C. Prepare mitigation strategy time frames?**

**D. Document the planning process – discussion on putting our plan on paper.**

Halliday moved to adjourn, Russell seconded, the Motion passed unanimously.

Duncan adjourned the meeting at 7:20 p.m.

**ADJOURN**

**APPROVED:** 10/8/14

**Jazmine Duncan, Chair** **Date:**

**ATTESTED:** 10.8.2014

**Alison Fuller, Town Clerk** **Date:**

3

HAZARD MITIGATION COMMITTEE MEETING

Town of Castle Valley

Wednesday September 10th, 2014 at 6:00 p.m.

CASTLE VALLEY COMMUNITY CENTER

2 CASTLE VALLEY DR.

*Please Sign In !*

Ali Fuller

Dave Erley

Bob Rennee

Greg [illegible]

Beth Vaughan

Thank You!

# MINUTES
# HAZARD MITIGATION COMMITTEE
# JANUARY 14th 2015 AT 6:00 P.M.
# TOWN HALL - 2 CASTLE VALLEY DR.

**Members Present:** Jazmine Duncan, Leta Vaughn, Ron & Pat Drake, Bill Rau, Greg Halliday, David Smith
**Recorder:** Alison Fuller

**CALL TO ORDER**

**1. Public Comment**

The group discussed several rock falls that had happened in the last few weeks in the valley and on Hwy 128, where the road had actually closed for clearing debris.

Some residents reported they heard cracking above the valley and more rock fall is expected.

**2. Approval of the Minutes – December 10th, 2014.**

Halliday made a motion to accept the minutes as presented, Pat Drake seconded, the Motion passed unanimously.

**3. Continue Step 3; Develop mitigation plan.**

**A. Prepare mitigation strategy time frames.**

**Bring hazard summary and histories.**

Duncan reviewed how the fire history was coming along.

Drake reported that he had compiled his notes and was working on that section of the plan.

The group discussed the formatting issues and how to compile the plan in a clean document.

Fuller volunteered to work on the formatting.

Rau stated that he would be willing to work on it as well if Fuller ran into issues.

Duncan stated she would talk to Water Agent John Groo about working on the Water Contamination section of the plan & she was working on the Earthquake section.

**B. Document the planning process - putting our plan on paper.**

**C. Review plan requirements**

Duncan reviewed the State approved planning process and stated that the group had successfully accomplished many of the steps. Public hearings will be held to get community input on The Plan and she wanted to give the community plenty of time to review the plan before the hearings are held.

The group discussed the best way to inform the community of the input the group wanted to get on The Plan.

Duncan stated that the group still needed to go through each mitigation effort and prioritize them as a whole.

Halliday stated that each project needs to break down the cost and benefit for each project but maintaining the projects also needs to be considered. He stated that the FEMA document has cost break downs for backhoe work, dump truck work, grader work etc.

Ron Drake stated that the State has costs for fighting fires they could use to calculate numbers for the fire portion of the plan.

Duncan inquired about finding cost break downs for public awareness mitigation efforts.

Halliday stated that for flooding there are several different projects and they could be broken down separately.

Pat Drake inquired about putting some type of screen in front of culverts to help keep the culverts clean.

Halliday stated that culverts keep themselves clean by not slowing down the velocity of the water in anyway, and the screen themselves could get blocked and cause the water to go over the road.

Duncan stated that for the plan it may be good to look at cleaning the culverts as a whole, and looking at areas that haven't had work and could use it, would be priority. Step 4; Plan Development. This step had a lot of work done, but the group may still need to identify specific resources and intelligence that would support mitigation efforts.

Things such as the Fire District, CV Road Department, The Town's Drainage Review Maps, Water Studies, CIB, Rural Development, Universities, NRCS, etc. were all listed as possible resources and intelligence they could list for The Plan.

Pat Drake stated that having the information and knowledge before an emergency so people know what to do is also important.

Duncan stated that she would like to see an Emergency Operational Plan be put in place so there are solid steps to take when there are emergencies and people know their job and how things should go. She reviewed the rest of the steps required, Plan Preparation and Plan Implementation.

Rau stated that it's necessary for the Communication portion to talk to Rocky Mtn. Power about what the cost analysis is that they put out to prevent hazards in CV.

David Smith asked if there was a way to ask the power company or other public services to mitigate possible hazards now to save them more money later.

Halliday asked if the Town would be required to outline their plan similarly to the County.

Duncan stated that it would be a way to break it down but CV would not be required to do it the same way.

Drake inquired about the issue of the phone lines being down and if the Town had found out the proper way to complain to the FCC.

Duncan stated that the proper route is not to complain to the FCC but to the Utah Public Utilities Commission.

The group discussed how they would deal with outages and who to complain to for improved service.

Ron Drake stated that last time the phones went down the service man had to fight a blizzard to get to CV and didn't arrive until 5:30a.m.

Duncan stated that it would be good for Frontier to have back-up systems in place to prevent issues in the first place.

The group discussed Frontiers lack of interest in helping CV with these issues and discussed other ideas for faster response time.

Duncan stated that CV had made up for Frontiers' poor service by creating the emergency post at the Town Lot when phones & power are out.

The group discussed how to let the surrounding area outside of the Town know about the emergency post that is set up when the power or phones are down, such as doing a mailing or collaborating with utility mailings to bring awareness to the area.

The group discussed how to make the community aware of the transition the Town is going through to bring services up to speed and 30 years ago people didn't even have phones in CV and public awareness of how CV really operates would be very beneficial.

The group discussed an emergency employee that resides in CV that could remedy the utility problems and avoid long phone & power outages.

Duncan stated that the plan will need to also keep in mind people that come to CV that are in illegal rentals or are just here for the weekend at a friends', and have no idea how CV operates. Awareness needs to be made to everyone that the services in CV are not the same as the rest of the world. She stated that it would be good to set some goals for the next meeting. She wanted; a list of resources and intelligence, to pick a map to use for the plan, to get a priority list for projects for each hazard.

Vaughn made a motion to adjourn, Smith seconded, the Motion passed unanimously.

Duncan adjourned the meeting at 7:18 p.m.

**ADJOURNMENT**

**APPROVED:** **ATTESTED:**

Jazmine Duncan 2/11/2015 Alison Fuller 2.11.15

Jazmine Duncan, Chair Date: Alison Fuller, Town Clerk Date:

2

HAZARD MITIGATION COMMITTEE MEETING

Town of Castle Valley

Wednesday January 14th, 2015 at 6:00 p.m.

CASTLE VALLEY COMMUNITY CENTER

2 CASTLE VALLEY DR.

Please Sign In !

Bill Rau

Lora Vaughan

Jamie Dunn

Don

Pat Drake

Ron Drake

Thank You!

**MINUTES**
**HAZARD MITIGATION COMMITTEE**
**FEBRUARY 11th 2015 AT 6:00 P.M.**
**TOWN HALL - 2 CASTLE VALLEY DR.**

**Present:** Jazmine Duncan, Bill Rau, Greg Halliday – David Erley arrived after the meeting closed.
**Absent:** Leta Vaughn, Bob Russell, Ron & Pat Drake, David Smith
**Recorder:** Alison Fuller

**CALL TO ORDER**

Duncan called the meeting to order at 6:00 p.m.

1. **Public Comment**
2. **Approval of the Minutes**
   ***January 14th, 2015.**

Halliday moved to accept the minutes as presented, Rau seconded, the Motion passed unanimously.

3. **Continue Step 3; Develop mitigation plan, bring hazard summary and histories.**
   **A. Document the planning process**
   **- Putting the plan on paper.**
   **- Develop list of resources.**
   **B. Add recommended projects for each hazard.**
   **- Do cost analysis on each hazard.**

Duncan stated that since the group was so small and they were going to be working on their computers a lot, she entertained closing the meeting and working on their computers together in a work session.

Rau moved to adjourn, Halliday seconded, the Motion passed unanimously.

Duncan adjourned the meeting at 6:07 p.m.

**ADJOURNMENT**

**APPROVED:**
Jazmine Duncan 3/11/15
Jazmine Duncan, Chair Date:

**ATTESTED:**
3.11.15
Alison Fuller, Town Clerk Date:

HAZARD MITIGATION COMMITTEE MEETING

Town of Castle Valley

Wednesday February 11th, 2015 at 6:00 p.m.

CASTLE VALLEY COMMUNITY CENTER

2 CASTLE VALLEY DR.

Please Sign In !

Dave Forley

Thank You!

**MINUTES**

**HAZARD MITIGATION COMMITTEE**

**MARCH 11th 2015 AT 6:00 P.M.**

**TOWN HALL - 2 CASTLE VALLEY DR.**

**Members Present:** Jazmine Duncan, Leta Vaughn, Ron & Pat Drake, Bill Rau, Greg Halliday, Bob Russell,
**Recorder:** Alison Fuller

**CALL TO ORDER**

Duncan called the meeting to order at 6:02 p.m.

**1. Public Comment**

**2. Approval of the Minutes: February 11th, 2015.**

Halliday made a motion to accept the minutes as presented, Rau seconded, the Motion passed unanimously.

**3. Continue Step 3; Develop mitigation plan. Finalize recommended projects for draft plan.**

Duncan stated that now they should do a cost analysis for the recommended projects for the plan. Rick Bailey stated that preparing an Emergency Operations plan for a community the size of Castle Valley would take about 15 hours.

The group thought since it would be the first time CV would take something like that on, adding another 5-10 hours would be good. The group estimated work costs at 22.50 an hour to create the Emergency Operations Plan and estimated it would cost around $600.

The group discussed completing entire drainage reviews of Castle Creek and Placer Creek annually. They discussed how much time it would take to survey those drainages and look for changes in the drainages annually that could affect the valley downstream.

The group discussed sending out Town Mailings 4 times a year to prepare the community for different hazards that can affect the town and ways for the community to be prepared for them. They discussed a number of different options for mailings involving sending out cards or magnets that have hazards and mitigations tactics printed on them for a quick reference.

The group discussed maintaining the ingress and egress out of the valley and the budget that would be required to do so. The annual road budget would cover the cost for that project which was $72,500 for 2015.

The group discussed back up power as a priority project and the costs involved.

Ron Drake stated that the generator would be free since it's on loan from a federal program and the expenses would be fuel and wiring installation on the Community Building, the Road Shed and Fire Station 2.

The group discussed powering the LDS church and Fire Station 1 and the wiring that would be involved for those buildings.

Halliday stated that the wiring should be fairly simple at Fire Station 1.

The group discussed resources that would be risked with a power outage; water, heat, & loss of freezer storage.

Bob Russell stated that it would be good to coordinate with Day Star Academy and possibly the river resorts.

The group discussed lodging for people who can't make it up Pace Hill in the winter and wondered if Red Cliff's Lodge or Sorrel would be willing to house people over night.

Ron Drake suggested working with the CV B&B to house people in times of need. He said Red Cliff's had the ability to make a lot of food at once for masses in their commercial kitchen.

The group discussed having good interagency interactions and possibly having the Town help with problems locally that are in a different agencies' jurisdiction such as fixing problems on Pace Hill and getting a local Frontier employee.

Rau stated that the Town's budget could be viewed as ~~laughable~~ understated in the eyes of Federal agencies and the Town should not be afraid to ask for more money to achieve some of their goals.

**4. Document the planning process – putting our plan on paper – Finalize list of resources for draft plan.**

The group reviewed the resource list and discussed other possible resources.

Rau wondered if the Town's insurance should be added to the list.

The group discussed the Town's insurance policy and its' ability to cover volunteers in an emergency scenario.

Fuller stated that the town would need to generate a list of volunteers to give to the insurance company before or after an event.

Russell stated that the Emergency Operations plan would also generate a list of volunteers to give to the insurance company.

The group added the LDS church space and their tables and chairs to the resource list, as well as the County Council.

Ron Drake stated that the Sheriff's department has a command center and transportable repeater and the County has a lot of emergency supplies.

The group discussed getting emergency supplies, cots, MRE's, etc. to have on hand for hazards. The group added getting those supplies to their projects list. They discussed methods for properly storing MRE's and emergency supplies.

The group discussed resources that would fit under private sectors and added, Frontier Communications, Rocky Mtn. Power, private tractors, water hand pumps, food storage, wood storage etc.

**5. Review, & tie up loose ends. Choose a date for public hearing on draft plan.**

The group reviewed the formatting in the Plan and discussed how to bring uniformity between the hazards.

The Town Clerk will review the plan and format the hazard sections to create more continuity between all the hazard sections.

Duncan asked who would be willing to make posters to advertize for feedback from the community.

Vaughn agreed to create the posters for public input.

The group discussed getting the draft plan prepared to present by April without a meeting and having the public hearing to get public input at the May Hazard Mitigation meeting.

Duncan said that the group should collect input from the public in any venue and record the feedback for the group.

The group discussed chainsaws, school buses, out buildings and root cellars as other resources to add to their list.

Rau stated that it would be good to keep in mind the town ordinances in the process and keep in mind if there are things that should be changed in them.

Duncan stated that she thought updating town ordinances to coincide with mitigation efforts should be on their Projects list.

There was discussion around ways to keep properties safe and looking at other ways to raise public awareness.

Halliday made a motion to adjourn, Rau seconded, the Motion passed unanimously.

Duncan adjourned the meeting at 7:36 p.m.

**ADJOURN**

**APPROVED:** **ATTESTED:**

Jazmine Duncan 5/13/15 — Jazmine Duncan, Chair, Date:

Alison Fuller 5.13.15 — Alison Fuller, Town Clerk, Date:

HAZARD MITIGATION COMMITTEE MEETING

Town of Castle Valley

Wednesday, March 11th, 2015 at 6:00 p.m.

CASTLE VALLEY COMMUNITY CENTER

2 CASTLE VALLEY DR.

Please Sign In !

PAT DRAKE

BILL RALL

Thank You!

**MINUTES**

**HAZARD MITIGATION COMMITTEE REGULAR MEETING &**

**PUBLIC HEARING ON THE CASTLE VALLEY HAZARD MITIGATION PLAN DRAFT**

**MAY 13th, 2015 AT 6:00 P.M. TOWN HALL - 2 CASTLE VALLEY DR.**

**Members Present:** Jazmine Duncan, Leta Vaughn, Ron & Pat Drake, Bill Rau, Bob Russell, Dave Erley
**Others Present:** Jack Campbell , Ron Mengel, Joclyen Buck, Faylene Roth
**Recorder:** Alison Fuller

**CALL TO ORDER**

Jazmine Duncan called the meeting to order at 6:01p.m.

Duncan thanked everyone for coming and stated that there was plenty of time for comments and she would love to listen to everything that everyone has to say.

**1. Public Hearing on the Castle Valley Hazard Mitigation Plan Draft.**

Jack Cambpell stated that the 'Scope' included the incorporated and unincorporated areas and in the 'Profile' it seemed to lean a little more towards just the incorporated boundaries and continuity would be good. Page 4 has different miles listed for road lengths than other lengths of road sections. He thought on Pg. 34 the 'Community Access' section seemed out of place. He thought that the closure of the access to the hospital during events should be considered in the plan.

Erley stated that perhaps with bigger events there could be an ambulance or helicopter on standby to be available for emergency calls.

Campbell stated in the 'Fire' section it could be interesting to know the percent of lots that are still wild & undeveloped. Pg. 16 could use 'to create a fire break' after '1. Mowing roads' in the 'Fire Mitigation Strategies'.

Erley stated that once the Shafer lane access is complete Shafer would be managed as a main artery in the Town.

Duncan stated that side streets that have lots of wildland may deserve more mowing as well.

Campbell stated that on pg 17 adding 'reducing fuel around…' on number 5 & 6 'Fire Mitigation Strategies'. He suggested some kind of incentive to promote folks to clear their power poles of fuel. He suggested more awareness around the odd ways that fires are started and another mailing every few years. He also suggested figuring out other ways to fight fires creatively.

There was discussion powering wells when there are fires and no power.

Erley stated that perhaps back up power for the water pumps that the town relies on for water would be good to invest in, in turn for the years of water use from those private property owners.

Campbell thought that there were a lot of interesting facts that could be included in the Flood section that were very dramatic about the land and amount of water that can run through it.

Ron Mengel asked if the Town was still using the 1988 Drainage Master Plan as the primary plan.

Erley stated that the town is currently using that plan and changes have occurred but felt that the overall plan seemed fairly accurate.

Campbell asked about the part of the Drainage Master Plan that had not been implemented. He inquired about putting in the correlation between the vegetation on the mountains and the flooding that can occur without vegetation there to soak up the water.

There was discussion around the amount of vegetation effecting the flooding and that the land after the Porcupine Fire had healed with human help, luck with the weather and the permitee who grazes cattle in the area managing his cattle in a responsible way.

Erley stated that oak coming in aggressively after the fire in the CV watershed is a concern that will need to be confronted in the future. He was opposed to wilderness designation where he felt oak would need to be masticated.

Duncan stated that working with the permitee that is in the CV watershed should be a part of their planning process.

Mengel stated that it appeared that the Castle Creek culvert flooding possibility was missed in the risk assessments. He inquired about #9 in the 'Flood Risk Assessments' and wondered if the town was planning to insure property owners for flooding.

There was discussion around the meaning of #9, the word insure should be ensure, and the way the land use code is written currently regarding height limits and how they are currently measured could detour homeowners from proper flood mitigations .

Campbell suggested on pg. 41 adding 'grazing' to this section. He thought that the watershed should be defined by the BLM and

Forest Service to protect the CV watershed. He would like to see the CV watershed labeled on the Forest Service's maps.

Erley stated that he is seeking to get the watershed clearly defined and recognized, thus protected.

Campbell added more possible hazards to 'Water Contamination' such as mining that could happen in Miner's Basin for known gold deposits. He mentioned a smaller miner who got a permit to mine gold in Placer Creek which could also pose a threat. He stated that nitrates from 'feed lots' could harm the aquifer, and pose a threat, especially to children.

Mengel asked if open or closed thermal wells were allowed and thought that they should be addressed as a Risk in Water Contamination section. He applauded the group for adding a sewer system as a mitigation effort. He asked about the definitions the group used for: Hazard & Catastrophic. Mengel inquired about the probability Analysis tables and how the percentages would be figured in the end.

The group stated that the tables had not been filled out and they would go off history and probability for their totals in them.

Jocylen Buck commended the committee for all their hard work and stated that her questions have been answered.

Faylene Roth also commended the committee on all their hard work and was impressed by the plan. She wondered if the Risk Assessments and Mitigation strategies were prioritized by their numbers.

Duncan stated that they had not prioritized them within the hazard sections but all of the mitigations will be prioritized for what projects should be done first.

Roth stated generally there seemed to be a lot of weight on residents' responsibilities to mitigate possible hazards, opposed to the town's responsibility as many of the topics are heavily weighted on one or the other. She inquired about how much the town wants to be involved in mandating certain practices within the town.

Buck asked what the final goal is for the committee in developing this plan.

Duncan stated that developing an Operation Emergency Plan is what the group hopes to create from this risk assessment. She felt that one of the biggest benefits of the plan is to find out what the town is lacking and fill in the gaps.

Buck thought it would be great to create a publication for residents drafted from the plan to prepare them for possible hazards.

Duncan thanked everyone for coming and taking the time to read the plan.

**REGULAR MEETING**

**2. Public Comment**

Erley stated that Tom Haraden had written a letter regarding the excessive speed and the hazard it creates.

Ron Drake stated that in the past a county sherriff said he would not issue tickets in Castle Valley.

**3. Approval of the Minutes**

***March 11th, 2015.**

Bill Rau requested that his statement in the minutes be changed from "laughable" to "understated".

Rau moved to adopt the minutes as amended, Russell seconded, the Motion passed unanimously.

**3. Continue Step 3; Develop mitigation plan. Review public input & incorporate in plan.**

**4. Document the planning process – fill in the blanks – added worksheets.**

**5. Review & tie up loose ends.**

Duncan stated that she will be gone for the scheduled meeting in June and asked if they would like to reschedule, or skip the June Meeting.

The group discussed filling in the blank tables in the plan, including FEMA definitions, updating it based upon the input received and skipping the June meeting. They were very satisfied with comments that were given and agreed to work on the plan and meet in July.

Russell stated that the group had done a lot of work but needed to prioritize the projects and figure out the installation part of the plan.

The group discussed the publication that Jocylen Buck suggested for property owners and creating that as a part of their priorities.

Ron Drake made a motion to adjourn, Russell seconded, the Motion passed unanimously.

**ADJOURN**

**APPROVED:** **ATTESTED:**

Jazmine Duncan, Chair Date: Alison Fuller, Town Clerk Date: 7.8.2015

2

HAZARD MITIGATION COMMITTEE
PUBLIC HEARING ON THE CASTLE VALLEY HAZARD MITIGATION PLAN DRAFT & REGULAR MEETING

Town of Castle Valley
Wednesday, May 13th, 2015 at 6:00 p.m.
CASTLE VALLEY COMMUNITY CENTER
2 CASTLE VALLEY DR.

Please Sign In !

Eglen Roth
Jazmin Duncan
Lois Vaughn
Donald Kelly
Ron Mengel 7:20
Ron & Pat Drake
Jane Nelson
Ron Drake
Rob Russo
Jack Campbell

Thank You!

# MINUTES
## HAZARD MITIGATION COMMITTEE MEETING
## JULY 8th. 2015 AT 6:00 P.M.
## TOWN HALL - 2 CASTLE VALLEY DR.

**Members Present:** Jazmine Duncan, Leta Vaughn, Ron & Pat Drake, Bill Rau, Bob Russell, Greg Halliday
**Others Present:** None
**Recorder:** Alison Fuller

**CALL TO ORDER**
Duncan called the meeting to order at 6:00 p.m.

**1. Open Public Comment**
**2. Approval of the Minutes**
***May 13th, 2015 Hazard Mitigation Meeting**
Vaughn moved to approve the minutes as presented, Halliday seconded, the Motion passed unanimously.

**3. Continue Step 3; Develop mitigation plan. Review public input & incorporate in plan.**
Duncan reviewed the State's review tool that indicated what the Draft Plan needs to meet the State's requirements for approval.
The plan needs resources listed as well as how the whole process was executed and who was involved.
Duncan presented a table the group could use to assess the risk, the impact, the duration, the severability of the risk, and if it is seasonal.
The group discussed what the probability of a large fire would be in Castle Valley and how to predict the probability of smaller fires.
They thought Castle Valley was close to 200 square miles and that if the conditions were perfect the whole valley could burn, but with more resources, homes and fire breaks a larger fire would be less likely.
They rated the potential magnitude of a fire hazard at critical with a highly likely possibility with most fires being limited.
The records used for the Fire History were from the Fire District and Ron Drakes' personal records from the last 30 years.
The group reviewed the resources the valley has to fight fires including some outside resources that would only be available when other big fires were not being fought elsewhere.
The committee worked on the flood probability analysis and decided that 25% of the valley is made of drainages thus it would have possible limited magnitude of damage The committee discussed the location of flooding occurring within the drainages but rarely occupying all of them. The most likely times for flooding occur in June thru October. The duration of flooding can span from minutes to hours while the clean-up may take hours to days.
The group discussed the magnitude of severe weather and thought that it was limited but it would be likely to happen anywhere with winds being worse in the spring, snow storms occurring in the winter, and later summer and fall yielding to monsoonal weather and heavy rains.
The Flood records used were from Grand County's Hazard Mitigation Plan and local Castle Valley road department records.
The group analyzed communications/power outages with the possible magnitude of damage reaching critical and is highly likely to happen anywhere in the valley. Outages are common seasonally with lightning, rain, snow & sleet being the main causes.
The group analyzed the probability of rock fall and thought that the magnitude was negligible with the probability being highly likely, affecting the cliff sides, Hwy 128 and Pace Hill. The town records, Grand County and local records were used to collect the rockfall data. Seasonal weather such as rain, freeze thaw cycles, and extreme heat can stimulate rockfall.
The group discussed drought being a catastrophic event that is possible in the desert and is looked at over a long period of time.
The group discussed water contamination being a possibly catastrophic event effecting more than 50% if the aquifer is contaminated.
The probability seemed possible and it would be possible to occur anywhere in the valley either effecting individual wells or possibly the entire aquifer. Currently the monitoring well samples are clean and the seasons do not seem to affect the overall water quality.

1

The group analyzed earthquakes magnitude and probability in the valley with a limited magnitude and not likely to happen.
Earthquakes would mainly affect the roads in & out of the valley and create more rockfall.
Duncan continued to go over the requirements that were not met in the States' review tool and assigned tasks to the group to fill in the blanks in the hazards.
The group discussed creating goals for the hazard mitigation plan itself as well as clearly stating a goal to reduce vulnerabilities from each hazard.
The group discussed their action plan projects and how the actions were prioritized, implemented, and administered in each jurisdiction. They discussed the Emergency Operations Plan, annual creek inspections, public awareness publications, maintaining the ingress and egress in the valley, back-up power for municipal buildings, as their actions plan projects. They discussed the timelines they would like the projects to be implemented and who would be involved.

**4. Document the planning process – fill in the blanks – added worksheets.**

**5. Review & tie up loose ends.**

The group left off on C6 in the State's Review tool of the plan and will return to it at their August meeting.
Rau made a motion to adjourn, Pat Drake seconded, the Motion passed unanimously.
Duncan adjourned the meeting at 7:47 p.m.

**ADJOURN**

**APPROVED:**

Jazmine Duncan, Chair — Date: 8/12/2015

**ATTESTED:**

Alison Fuller, Town Clerk — Date: 8.12.2015

2

HAZARD MITIGATION COMMITTEE MEETING

Town of Castle Valley

Wednesday, July 8th, 2015 at 6:00 p.m.

CASTLE VALLEY COMMUNITY CENTER

2 CASTLE VALLEY DR.

Please Sign In !

Ali Fuller

Jayme Dunn

Lotta Vaughan

Bob Russell

Bill Rau

Roy Drake

Pat Drake

Thank You!

**MINUTES**
**HAZARD MITIGATION COMMITTEE MEETING**
**AUGUST 12th, 2015 AT 6:00 P.M.**
**TOWN HALL - 2 CASTLE VALLEY DR.**

**Members Present:** Jazmine Duncan, Leta Vaughn, Ron & Pat Drake, Dave Erley, Greg Halliday
**Recorder:** Alison Fuller

**CALL TO ORDER**
Jazmine Duncan called the meeting to order at 6:04 p.m.
**1. Open Public Comment -** None
**2. Approval of the Minutes**
***July 8th, 2015.**
Leta Vaughn moved to approve the minutes, Greg Halliday seconded, the Motion passed unanimously.

**3. Continue working through the Review tool for the Hazard Plan and adding revisions.**
The group reviewed the State's review tool for the Hazard plan and saw that the needed requirements were met.
The committee discussed the 'Action Plan' that describes how the actions identified will be prioritized, including a cost benefit review, how it will be implemented & administered by each jurisdiction. They discussed using a table for the Action plan items with the projects listed by highest priority first. The group reviewed C6 in the Review Tool, regarding how they would integrate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvements plan and who would be involved.
The group discussed incorporating Grand County's emergency services, CV's Planning and Land Use Commission, the Town Council and the Fire District as all being a part of seeing that the mitigation efforts in the Hazard Plan be a part of their planning as well. The Shafer Lane emergency access is another capital project coming up that is also a part of the hazard planning process. The group discussed presenting the Hazard Plan to the different entities to insure that policies and planning from all groups would encompass aspects of the CV Hazard Mitigation Plan.
Erley stated that sitting down with the other entities and discussing the plan is a really important step in the process.
The group discussed reviewing the plan every 4 years so that Mayors and Town Council members will all be introduced and review the plan during their terms. The group discussed what would happen if the Town did not have a Mayor and how the Town would operate, especially in an emergency. The group had looked at a continuity of government resolution however; further assistance from an attorney is needed to find out more about the process.
Fuller stated that she had put in some other edits throughout the plan to meet requirements such as the reason CV is not participating in the National Flood Insurance Program is because CV is not mapped by FEMA.
The group discussed their plans for documenting the process for updating the plan in the future.
Duncan stated that the Plan will also need to include the meeting minutes, agendas, public hearings, etc.
The group discussed reviewing the plan in detail & ensuring that the States' requirements are met.
Erley stated that it would be good to have the Fire District and Town Council review the Plan before its final adoption.
The group discussed designating a year for the plan to be updated based on when the plan is adopted. They hope to have a public hearing on a draft of the Hazard Plan in October and adopt a Final Draft in November.
Pat Drake moved to adjourn, Ron Drake seconded, the Motion passed unanimously.

**ADJOURN**

**APPROVED:** Jazmine Duncan 9/9/2015
Jazmine Duncan, Chair Date:

**ATTESTED:** Alison Fuller 9.9.2015
Alison Fuller, Town Clerk Date:

HAZARD MITIGATION COMMITTEE MEETING

Town of Castle Valley

Wednesday, August 12th, 2015 at 6:00 p.m.

CASTLE VALLEY COMMUNITY CENTER

2 CASTLE VALLEY DR.

Please Sign In !

PAT DRAKE

Thank You!

**MINUTES**
**HAZARD MITIGATION COMMITTEE MEETING**
**SEPTEMBER 9th, 2015 AT 6:00 P.M.**
**TOWN HALL - 2 CASTLE VALLEY DR.**

**Members Present**: Jazmine Duncan, Leta Vaughn, Bill Rau, Ron & Pat Drake
**Recorder:** Alison Fuller

**CALL TO ORDER**
Jazmine Duncan called the meeting to order at 6:00 p.m.

**1. Open Public Comment**
**2. Approval of the Minutes**
***August 12th, 2015**
Rau moved to adopt the minutes, Vaughn seconded, the Motion passed unanimously.

**3. Review Hazard Plan updates and adding revisions as needed.**
The group discussed the edits that Town Clerk Fuller made to the plan. They discussed assessing the losses for the hazards and if infrastructure should be the only things assessed or if private property should also be included. They discussed assessing areas that have been repeatedly damaged by local hazards.
The Clerk would talk to the State Hazard Recovery Manager Brad Bartholomew about what is expected in the plan.
Town clerk Fuller included a Government section within the 'Profile', the group recommended adding Ordinances that would guide policies to that section as well. She also included the FEMA guide that was used to create the plan within the 'Planning Process'. She included other town plans and studies under the section "Integrating with existing Plans". She removed the specific names that contributed during the public hearing but will include the meeting minutes in the plan as it seemed too specific, especially if the plan was being done for a bigger community or county.
The group discussed what other county hazard mitigation plans did in the assessed losses. They discussed the flood damage and fire damage costs as well as damage from severe weather to crops, buildings, greenhouses, and damage from frozen pipes.
Duncan inquired about the cost to remove the inches of dirt out of the house that had a rock fall very close to it on Rim Shadow Ln.
The group discussed adding onto the 'Drought' section.
Duncan asked the group to find out locally how much hazards had cost their neighbors and community members that have been affected by the identified hazards.
Rau inquired about when the Hazard Mitigation Committee would meet with the PLUC and Town Council regarding the plan.
The group discussed the best time to work with the groups and hoped that they would become involved in the process before the Public Hearing in October.
The group discussed examples of mitigation strategies that would create new ordinances and how the community would accept particular new rules and if the government would agree to adopt new ordinances.
Rau stated that it could be very difficult to create some ordinances in accordance with some of the mitigation strategies.
The group agreed that the purpose of the plan was to identify the hazards and the mitigations that would meet those hazards and not all the mitigation strategies' would be accepted by the community. The group would hold a public hearing Oct. 14th, 2015.
Rau moved to adjourn, Pat Drake seconded, the Motion passed unanimously.
Duncan adjourned the meeting at 6:55 p.m.
**ADJOURN**

**APPROVED:** Jazmine Duncan 10/14/15
Jazmine Duncan, Chair Date:

**ATTESTED:** 10.14.15
Alison Fuller, Town Clerk Date:

HAZARD MITIGATION COMMITTEE MEETING

Town of Castle Valley

Wednesday, September 9th, 2015 at 6:00 p.m.

CASTLE VALLEY COMMUNITY CENTER

2 CASTLE VALLEY DR.

Please Sign In !

LOTA

Bill

PAT DRAKE

Jamie Dun

Thank You!

# APPENDIX 8

## Grand County Community Wildfire Preparedness Plan (CWPP)

## (Place Holder)