Davis County
Natural Hazard Pre-Disaster Mitigation Plan

Produced by Davis County, and Respective Cities and Special Service Districts

Assistance and Guidance Provided by
Utah Division of Emergency Management
2016

Davis County

With a total area of 630 square miles and only 223 square miles of usable land, Davis County is the second smallest county in Utah. Antelope Island in the Great Salt Lake adds another 42 square miles to the land area with the remaining portion part of the Great Salt Lake. Davis County is the third most populous county in the state with a population density of roughly 933 people per square mile. Morgan County bounds the county to the east, Salt Lake County to the south, Tooele County to the west, and to the north, Weber County. The western half of Davis County consists of the Great Salt Lake, while the eastern edge of the County is the front of the Wasatch Mountains, much of that in the Wasatch National Forest.

Davis County includes 15 municipalities: ***Bountiful***, ***Centerville***, ***Clearfield***, ***Clinton***, ***Farmington***, ***Fruit Heights***, ***Kaysville***, ***Layton***, ***North Salt Lake***, ***South Weber***, ***Sunset***, ***Syracuse***, ***West Bountiful, West Point***, and ***Woods Cross***. Unincorporated areas with significant populations are limited to ***Hill Air Force Base,*** the ***Val Verda*** area between the communities of North Salt Lake and Bountiful and the ***Mutton Hollow*** area between Kaysville and Layton. The percent of land ownership within the county is 10.9% Federal, 12.0% State, 24.9% Private and Local Government, and 52.2% under the Great Salt Lake (also owned by the State).

Most of the early settlers in Davis County were ranchers and farmers. The fertile ground produced sugar beets, tomatoes, alfalfa, grain, corn, potatoes, onions and extensive fruit orchards were developed on the bench areas. Cattle ranching and dairy farming were also leading agricultural activities.

As the county population continued to grow, Davis County developed a commercial and industrial base. The military became an important part of the County economy with the development of the Naval Supply Depot and Hill Air Force Base. The Naval Supply Depot was sold to private developers in the 1960's and it became the Freeport Center, which is the largest distribution center in the United States. Hill Air Force Base has been the economic backbone of Davis County for many years and is a fundamental economic component of the community. The current economy has many components including manufacturing, trade, services and government. Some of the largest employers include Hill Air Force Base, Davis County School District, Lifetime Products Inc., Smith's Marketplace, Utility Trailer Manufacturing and Wal-Mart (UDWS 2007b). Davis County's population is large and growing and the housing and community demands are high. Mean household income in 2014 was $70,388 and the 2014 per capita income was $26,309.

Hazard History

Within the mitigation planning process, it is important to remember that the past is the key to the future. Identifying past hazard events provide a starting point for predicting where future events could occur. The following historical hazard event statistics were consolidated from the Spatial Hazard Events and Losses Database for the United States (SHELDUS) of the Hazards and Vulnerability Research Institute. This database records reported natural hazard events which cause greater than $50,000 in damages.

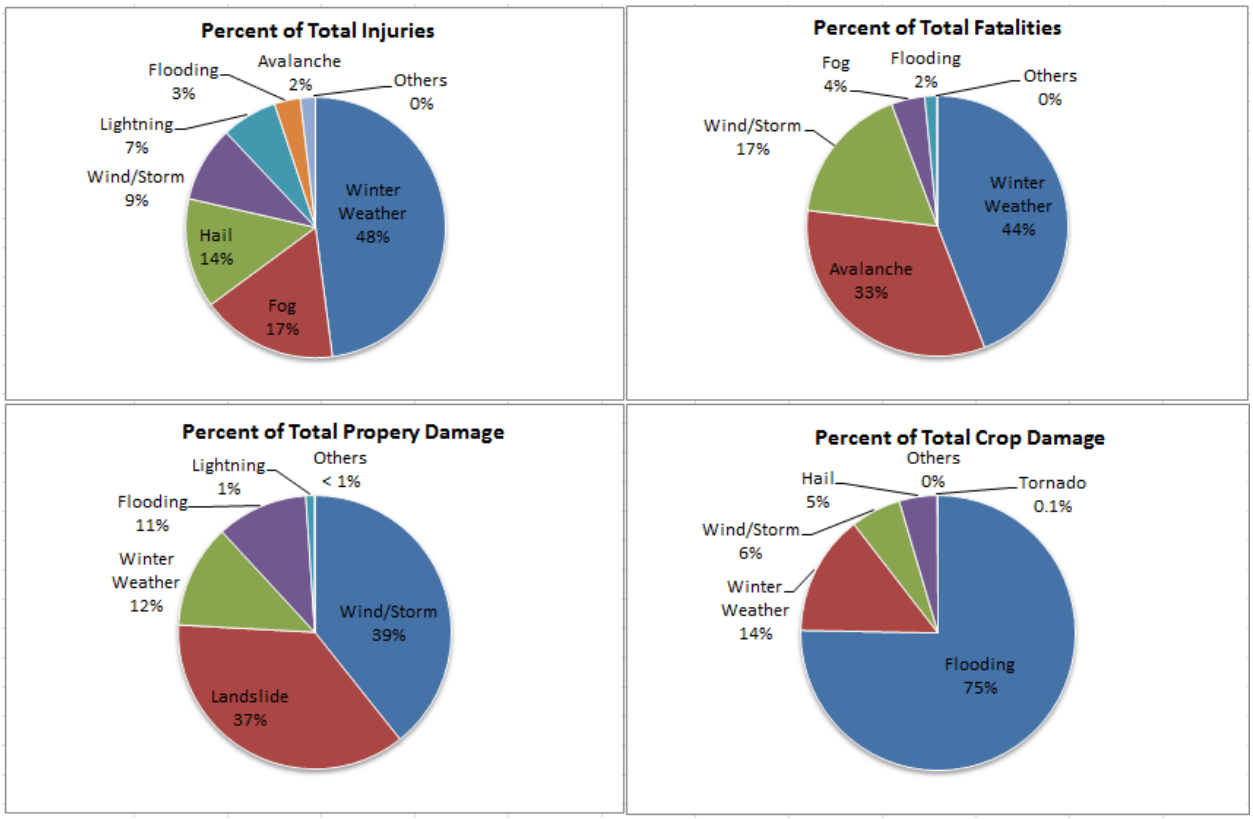
Risk Assessment

The risk assessment process revealed the following for Drought, Earthquake, Flood, Infestation, Landslide/Slope Failure, Severe Weather, and Wildland Fire. Drought, Infestation and Severe Weather are regional hazards and can be found in Part VII. Refer to Part VI for an explanation of the risk assessment methodology. According to this data, there are a total of 130 identified critical facilities within Davis County. For the complete list, refer to Appendix D.

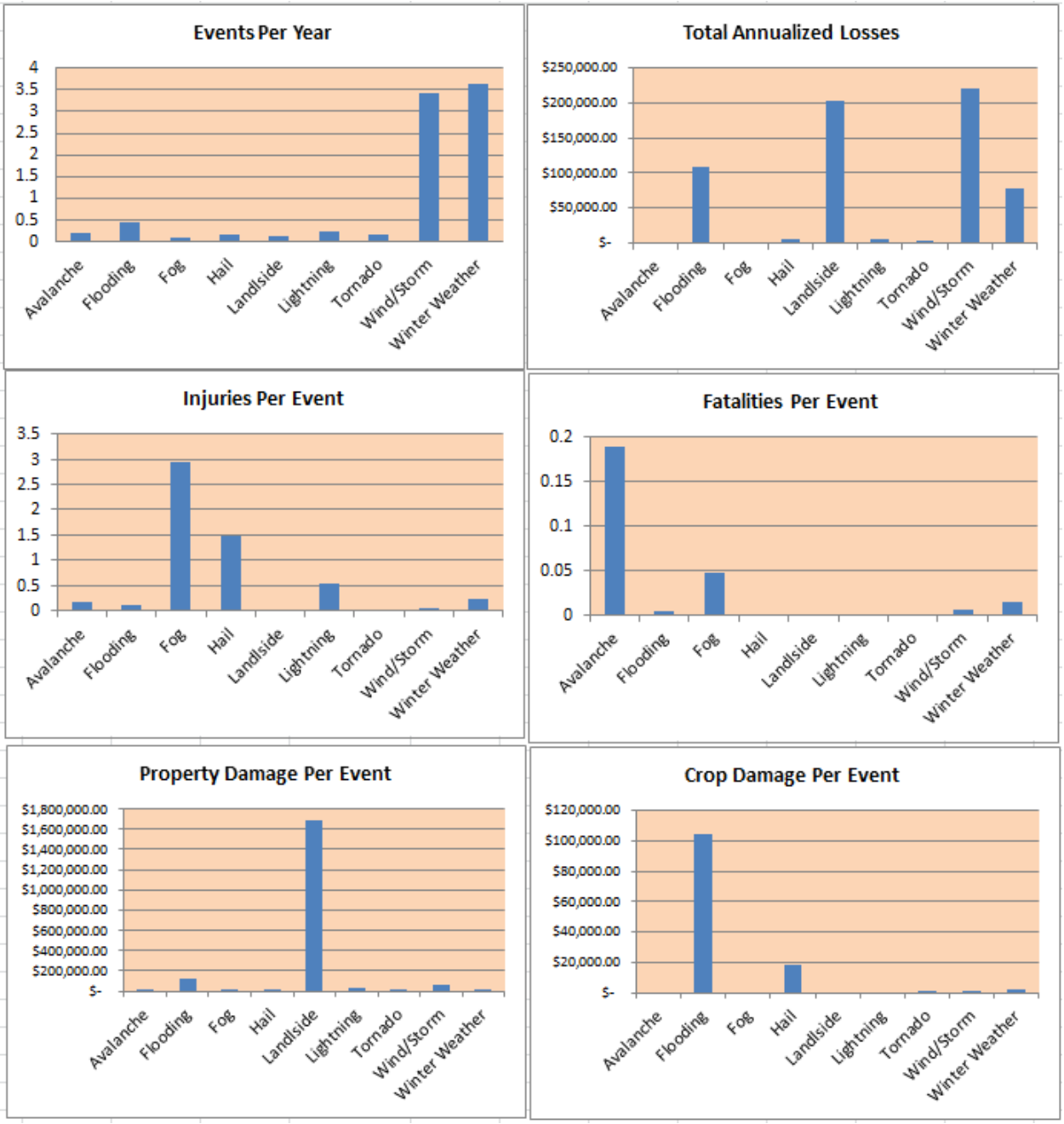
Number of Structures with Moderate or Greater Vulnerability (% of Total)

Critical Facilities	Total	Dam Failure	Flood	Ground Shaking	Liquefaction	Problem Soils	Slope Failure	Wildfire
Amateur Radio Repeaters	**12**	1 (8%)	2 (17%)	12 (100%)	5 (42%)	0 (0%)	1 (8%)	12 (100%)
Public Safety Repeaters	**9**	0 (0%)	0 (0%)	9 (100%)	1 (11%)	0 (0%)	1 (11%)	6 (67%)
Electric Generation Facilities	**1**	1 (100%)	0 (0%)	1 (100%)	1 (100%)	0 (0%)	0 (0%)	0 (0%)
Emergency Operations Centers	**1**	1 (100%)	1 (100%)	1 (100%)	1 (100%)	0 (0%)	0 (0%)	0 (0%)
Fire Stations	**16**	2 (13%)	1 (7%)	15 (100%)	9 (60%)	0 (0%)	0 (0%)	1 (6%)
Hospitals	**3**	0 (0%)	0 (0%)	2 (100%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)
Oil Facilities	**7**	1 (14%)	0 (0%)	7 (100%)	7 (100%)	0 (0%)	0 (0%)	0 (0%)
Police Stations	**14**	3 (21%)	2 (14%)	14 (100%)	12 (86%)	0 (0%)	0 (0%)	0 (0%)
Schools	**88**	14 (17%)	3 (3%)	88 (100%)	69 (78%)	0 (0%)	1 (1%)	0 (%)
Water Treatment Facilities	**3**	0 (0%)	1 (33%)	3 (100%)	3 (100%)	0 (0%)	0 (0%)	0 (0%)

Davis County Critical Facility Hazard Risk Assessment



Major Disaster Event Averages 1962-2011, Davis County, Percentages (HVRI 2011)



*Major Disaster Annual and Per Event Averages 1962-2011, Davis County, Counts (HVRI 2011) *Does not include losses from wildfire*

Executive Summary

Plan Mission

The Davis County developed this PDM Plan in partnership with the jurisdictions it serves to substantially and permanently reduce the County's vulnerability to natural hazards. The Plan is intended to promote sound public policy and protect or reduce the vulnerability of the citizens, critical facilities, infrastructure, private property and the natural environment within the County. This can be achieved by increasing public awareness, documenting resources for risk reduction and loss-prevention and identifying activities to guide the development of a less vulnerable and more sustainable community.

Plan Update

This Plan represents an update of the PDM Plan that was approved by the cities, counties, the State and by FEMA in 2009. All of the demographic data, maps, vulnerability assessments and mitigation strategies have been revised to reflect the constant growth throughout Davis County. Development pressures in hazard areas will continue to increase the risk to residents. The entire plan was reviewed and analyzed by the planning team throughout the planning process and again at the final draft stage before submittal to the state and FEMA.

Plan Organization

The Plan was developed and organized within the rules and regulations established under 44 Code of Federal Regulations (CFR), Section 201.6. The Plan contains a discussion on the purpose and methodology used to develop the Plan, a profile on communities within Davis County, as well as a hazard identification study and a vulnerability analysis of eight hazards. To assist in the explanation of the above-identified contents there are several appendices included which provide more detail on specific subjects. This is intended to improve the ability of communities within Davis County to respond to emergencies and disasters. It will also document valuable local knowledge on the most efficient and effective ways to reduce loss.

Plan Funding

The Plan has been funded and developed under the PDM Program provided by the Federal Emergency Management Agency (FEMA) and the Utah Department of Public Safety, Division of Emergency Management (DEM).

Plan Participation

Plan participation was completed as a result of a collaborative effort between Davis County, DEM, city and county emergency managers, fire departments, sheriff's office, public works departments, planning commissions, assessor's office, city and county geographic information systems (GIS) departments, special service districts, school district, elected officials, public employees and citizens of the cities in Davis County.

Interviews were conducted with stakeholders from the communities and workshops were conducted during the Plan development phase. Additionally, through public hearings, workshops and draft Plan displays, ample opportunity was provided for public participation. Any comments, questions and discussions resulting from these activities were given strong consideration in the development of this Plan.

Hazards Identification

The PDM Plan addresses earthquake, flood, landslide, problem soils, wildfire, dam failure, and severe weather. The hazard identification study recognized the following natural hazards as being the most prevalent and posing the most potential risk to Davis County. It is recognized that dam failure is not a natural hazard. However, the impact from a catastrophic dam failure would likely be so severe that it warrants inclusion into the Plan.

- Earthquake
- Flood
- Drought
- Landslide
- Wildfire
- Dam Failure
- Severe Weather

Acknowledgements

Davis County would like to extend their appreciation to the following agencies, which assisted in the development of this Plan.

- Utah Division of Emergency Management
- Federal Emergency Management Agency
- National Weather Service
- National Climate Data Center
- Utah Army Corps of Engineers
- Utah Geologic Survey
- Utah Division of Forestry, Fire and State Lands
- Utah Department of Agriculture
- Utah Avalanche Center
- Utah Automated Geographic Resource Center
- University of Utah
- University of Utah Seismic Station
- Utah State University
- Wasatch Front Regional Council (WFRC)
- Associations of Governments
- Davis County and municipalities
- Bountiful
- Centerville
- Clearfield
- Clinton
- Farmington
- Fruit Heights
- Kaysville
- Layton
- North Salt Lake
- South Weber
- Sunset
- Syracuse

- West Bountiful
- West Point
- Woods Cross
- Davis County elected officials
- Davis County Emergency Manager Sgt. Ellis Bruch, Davis County Sheriff's Office
- DeeEll Fifield, Consultant
- Davis County agencies including;
- Public Works
- Local Emergency Planning Committee (LEPC)
- Fire Departments
- Davis School District
- Special Service Districts
- Weber Basin Water Conservancy District

Part I. Introduction

Utah is vulnerable to natural and technological (human-caused) hazards that threaten the health, welfare and security of our citizens. The cost of response to and recovery from potential disasters can be substantially reduced when attention is turned to mitigating their impacts and effects before they occur.

Hazard mitigation is defined as any cost-effective action that has the effect of reducing, limiting, or preventing vulnerability of people, property, and/or the environment to potentially damaging, harmful, or costly hazards. Hazard mitigation actions, which can be used to eliminate or minimize the risk to life and property, fall into three categories: first, those that keep the hazard away from people, property and structures; second, those that keep people, property and structures away from the hazard; and third, those that do not address the hazard at all but rather reduce the impact of the hazard on the victims such as insurance. This mitigation Plan has strategies that fall into all three categories.

Hazard mitigation actions must be practical, cost effective, environmentally and politically acceptable. Actions taken to limit the vulnerability of society to hazards must not in themselves be more costly than the anticipated damages.

Capital investment decisions must be considered in conjunction with natural hazard vulnerability. Capital investments can include homes, roads, public utilities, pipelines, power plants, chemical plants, warehouses and public works facilities. These decisions can influence the degree of hazard vulnerability of a community. Once a capital facility is in place, few opportunities will present themselves over the useful life of the facility to correct any errors in location or construction with respect to hazard vulnerability. It is for these reasons that zoning ordinances, which could restrict development in high vulnerability areas, and building codes, which could ensure that new buildings are built to withstand the damaging forces of hazards, are the most useful mitigation approaches that a county or city can implement.

Often, hazard mitigation may be a neglected aspect within emergency management. When local governments place a low priority on mitigation implementation activities relative to the perceived threat, some important mitigation measures may be neglected in favor of higher priority activities. Mitigation success can be achieved, however, if accurate information is portrayed through complete hazard identification and impact studies, followed by effective mitigation management. Hazard mitigation is the key to greatly reducing long-term risk to people and property from natural hazards and their effects. Preparedness for all hazards includes response and recovery plans, training, development, management of resources and the need to mitigate each jurisdictional hazard.

A. Purpose

The purposes of this Plan are (1) identify threats to the community, (2) create mitigation strategies to address those threats, (3) develop long-term mitigation planning goals and objectives, and (4) to fulfill federal, state and local hazard mitigation planning obligations.

Mitigation actions would serve to minimize threats that have an undesirable impact on the citizens, economy, and the environment of Davis County. This Plan is intended to enhance the awareness and to provide mitigation strategies for elected officials, agencies and the public of these hazards and their associated threat to life and property. The Plan also details what actions can be taken to help prevent or reduce hazard vulnerability to each jurisdiction.

B. Scope

The Davis County Natural Hazards Pre-Disaster Mitigation (PDM) Plan was developed in accordance with the requirements of the FEMA Section 322 regulations, the Utah Division of Emergency Management (DEM) and local planning agencies. The goal of this Plan is to assist Davis County in reducing the costs of natural disasters by providing comprehensive hazards identification, risk assessment, vulnerability analysis, mitigation strategy an implementation schedule. Regulations set forth by FEMA were followed during the development of this Plan. All participating jurisdictions are listed. Future monitoring, evaluating, updating and implementation will occur annually or following any natural disaster. A major revision will occur every five years. Annual or any interim Plan review, updates and revisions will be the responsibility of each adopting jurisdiction.

C. Authority

1. Federal

Public Law (PL) 93-288 as amended, established the basis for federal hazard mitigation activity in 1974. A section of this Act requires the identification, evaluation and mitigation of hazards as a prerequisite for state receipt of future disaster assistance outlays. 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. When PL 93-288 was amended by the Stafford Act, several additional provisions were added that provide for the availability of significant mitigation measures in the aftermath of Presidential declared disasters. Civil Preparedness Guide 1-3, Chapter 6- Hazard Mitigation Assistance Programs, places emphasis on hazard mitigation planning directed toward hazards with high impact and threat potential.

President Clinton signed the Disaster Mitigation Act of 2000 (DMA 2000) into law on October 30, 2000. Section 322 defines mitigation planning requirements for state, local and tribal governments. Under Section 322, states are eligible for an increase in the federal share of hazard mitigation, if they submit a mitigation plan (which is a summary of local and/or regional mitigation plans) that identifies natural hazards, risks, vulnerabilities and actions to mitigate risks.

2. State

Some examples of legislation enhancing the ability of government and persons to mitigate, respond and recover from natural disasters include 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 11, and the Emergency Interim Succession Act, 63-5B.

3. Local

Local governments play an essential role in implementing effective mitigation. For the purposes of this Plan, local governments include not only cities and counties, but also special service districts with elected boards. Each local government will review all present or potential damages, losses and related impacts associated with natural hazards to determine the need or requirement for mitigation action and planning. In the cities making up the Davis County the local executives responsible for carrying out plans and policies are the county commissioners and city or mayors and administrators. Local governments must be prepared to participate in the post-disaster hazard mitigation team process and pre-mitigation planning as outlined in this document in order to effectively protect their citizens. All jurisdictions in Davis County participated in the development of this plan.

D. Goals and Objectives

The goals and objectives of the PDM Plan include coordinating with local governments to develop a County planning process that meets each planning component identified in the FEMA Region VIII Crosswalk document, Utah Division of Emergency Management (DEM) planning expectation and local input. Another goal is to meet the need of reducing risk from natural and technological hazards in Utah through the implementation of and updating of County plans.

1. Short Term Local Goals

The following general goals were used in the development of the PDM Plan. They are shown from highest to lowest priority.

a. Life safety protection.
b. Eliminate and/or reduce property damage.
c. Protect emergency response capabilities (critical infrastructure).
d. Protect/create communication and warning systems.
e. Protect emergency medical services and medical facilities.
f. Ensure mobile resource survivability.
g. Protect critical facilities.

h. Ensure government continuity.
i. Protect developed property, homes, businesses, industry, education opportunities and the cultural fabric of a community. Combine hazard loss reduction efforts with the environmental, social and economic needs of the community.
j. Protect natural resources and the environment.
k. Promote public awareness through education of community hazards and mitigation measures.
l. Preserve and/or restore natural features.

2. Long Term Local Goals

a. Eliminate or reduce long-term risk to human life and property.
b. Aid private and public sectors in understanding the risks they may be exposed to and identify mitigation strategies to reduce those risks.
c. Avoid risk of exposure to natural and technological hazards.
d. Minimize the impacts of risks that cannot be avoided.
e. Mitigate the impacts of damage as a result of identified hazards.
f. Accomplish mitigation strategies in such a way that negative environmental impacts are minimized.
g. Provide a basis for prioritizing and funding mitigation projects.
h. Establish a County platform to enable the community to take advantage of shared goals and resources.

3. Objectives

The following objectives are meant to serve as a measure upon which individual hazard mitigation strategies can be evaluated. These objectives become especially important when two or more projects are competing for limited resources.

a. Identify persons, agencies or organizations responsible for implementation.
b. Project a time frame for implementation.
c. Explain how the project will be financed including the conditions for financing and implementation (as information is available).
d. Identify alternative measures, should financing not be available.
e. Be consistent with, support, and help implement the goals and objectives or hazard mitigation plans already in place.
f. 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.
g. Projects should be practical, cost-effective and environmentally sound after consideration of the options.
h. Projects should address a repetitive problem, or one that has the potential to have a major impact on an area or population.
i. Projects should meet applicable permit requirements.

j. Discourage development in hazardous areas.
k. Projects should contribute to short and long term solutions.
l. Project benefits should outweigh the costs.
m. Projects should have manageable maintenance and modification costs.
n. Projects should accomplish multiple objectives when possible.
o. Projects should be implemented using existing resources, agencies and programs when possible.

Part II. Adoption Process and Documentation

The Davis County Plan was developed as a multi-jurisdictional Plan. Therefore, to meet the requirements of Section 322 of the local hazard planning regulations, the final Plan must be adopted by each of the municipalities as well as the county. This section documents the adoption process of each local government in order to demonstrate compliance with this requirement. The Plan will be adopted following FEMA Region VIII approval. Tables 2-1, 2-2, 2-3, 2-4 and 2-5 identify the communities that participated in the planning process and will adopt the Plan. All of these jurisdictions are seeking plan approval. A sample of the adoption resolution is given at the end of this section. Each of these jurisdictions also participated in and adopted the previous PDM Plan in 2009.

Jurisdiction	Participated (Yes/No)	Resolution Adoption Date
Davis County	Yes	
Bountiful	Yes	
Centerville	Yes	
Clearfield	Yes	
Clinton	Yes	
Farmington	Yes	
Fruit Heights	Yes	
Kaysville	Yes	
Layton	Yes	
North Salt Lake	Yes	
South Weber	Yes	
Sunset	Yes	
Syracuse	Yes	
West Bountiful	Yes	
West Point	Yes	
Woods Cross	Yes	

Participating Communities

Specialized Local District	Participated (Yes/No)	Resolution Adoption Date
Weber Basin Water Conservancy District	Yes	
Davis School District	Yes	
South Davis Fire District	Yes	
North Davis Fire District	Yes	
South Davis Recreation Board		
Utah Transit Authority (UTA)	Yes	
North Davis Sewer District		
Central Davis Sewer District		
South Davis Sewer District		
Davis and Weber Counties Canal Company		
Benchland Water Improvement District		
Haights Creek Water Improvement District		

Participating Specialized Local Districts

Sample Resolution

RESOLUTION NO._____

A RESOLUTION ADOPTING THE NATURAL HAZARD PRE-DISASTER MITIGATION PLAN AS REQUIRED BY THE FEDERAL DISASTER MITIGATION AND COST REDUCTION ACT OF 2000.

(Name of Jurisdiction) Johnson City_____
(Governing Body) City Council_____
(Address) 100 Main Street, Johnson City, UT 84001_____

WHEREAS, President William J. Clinton signed H.R. 707, the Disaster Mitigation and Cost Reduction Act of 2000, into law on October 30, 2000; and,

WHEREAS, the Disaster Mitigation Act of 2000 requires all jurisdictions to be covered by a Pre-Disaster Hazard Mitigation Plan to be eligible for Federal Emergency Management Agency post-disaster funds; and,

WHEREAS, the *Natural Hazard Pre-Disaster Mitigation Plan* has been prepared in accordance with FEMA requirements at 44 C.F.R. 201.6; and,

WHEREAS, Johnson City is within Davis County and participated in the update of the multi-jurisdictional Plan, the *Natural Hazard Pre-Disaster Mitigation Plan*; and,

WHEREAS, Johnson City is a local unit of government that has afforded its citizens an opportunity to comment and provide input in the Plan and the actions in the Plan; and,

WHEREAS, Johnson City is concerned about mitigating potential losses and has determined that it would be in the best interest of the community to adopt the *Natural Hazard Pre-Disaster Mitigation Plan*;

NOW THEREFORE, BE IT RESOLVED by Johnson City Council that Johnson City adopts the *Natural Hazard Pre-Disaster Mitigation Plan* as this jurisdiction's Multi-Hazard Mitigation Plan.

ADOPTED this XX day of XX, 2008 at the meeting of the Johnson City Council.

Signed: Chief Elected Official_____
City Council_____
_____

Part III. Planning Process

This updated Plan was prepared by the Davis County Sheriff's Office staff and consultant DeeEll Fifield, with support from the planning committee, and other local and state personnel. Additional county and municipal agencies that have aided in the planning process include; city and county geographic information systems (GIS) departments, elected officials, local officials, emergency managers, fire, planning departments, public works departments, and local governmental agencies. The planning process was based on Section 322 requirements of the Disaster Mitigation Act of 2000 (DMA 2000) and supporting guidance documents developed by FEMA and the Utah DEM.

The planning process included the following steps:

Step 1: Organize Resources

Utah DEM contracted with Davis County to update the 2009 Wasatch Front Region's Pre-Disaster Mitigation Plan and to develop a 2015 Davis County Pre-Disaster Mitigation Plan under the planning guidelines included in the DMA 2000.

Davis County designated a core planning team made up of members outlined in Table 3-1. These members were the main constituents of the planning process from the initiation of the Plan, to the development and coordination, and resolution of the Plan's adoption. In addition to the core planning team, a planning committee was created to review the 2009 PDM Plan and recommend revisions. The planning team was also instrumental in guiding the Plan's overall revision process and content. Every jurisdiction in Davis County, plus representatives from special service districts were invited to provide a representative to serve on the planning team. Some jurisdictions were not able to provide a representative; however, relevant input was solicited and obtained from every jurisdiction in the county.

Name	Organization
Sgt. Ellis Bruch	Davis County Emergency Management Director
DeeEll Fifield	Consultant, DeeEll Fifield Consulting

Core Planning Team

Name	Organization
Brad Bartholomew	Utah Division of Emergency Management
Eric Martineau	Utah Division of Emergency Management
DeeEll Fifield	Davis County Sheriff's Office, Emergency Services (Consultant)
Ellis Bruch	Davis County Sheriff's Office, Emergency Manager
Barry Burton	Davis County Community & Economic Development
Paul Child	Centerville City
Cheryl Larsen	Davis County GIS

Richard Fisher	Clearfield City
Emily Thomas	South Weber City
Dave Olsen	Clinton City
Scott Anderson	Woods Cross City
Jason Meservy	West Bountiful City
Paul White	Farmington City
Jim Mason	Layton City
Scott Paxman	Weber Basin Water Conservancy District
Dena Eckardt	Davis Hospital
Tami Timothy	Lakeview Hospital
Brad Bartholomew	Utah DEM
Eric Martineau	Utah DEM
Kimberly Giles	Utah DEM
Michelle Villegas	Davis Hospital Medical Center
Bob Fowler	Davis County Citizens Corps

Planning Committee

Step 2: Planning Process Timeline

To ensure the public and County officials were supportive of the planning process, a series of public meetings were conducted throughout the planning period. Additionally the Davis County Emergency Manager attended and briefed the County Commission on the progress at several Commission meetings. The Davis County Emergency Manager also briefed the Jurisdiction Mayors and Councils on this process. The chart below provides PDM meetings associated with the planning process.

Year	Date	Meeting Attendees	Activity	Purpose
2013	**March**	Ellis Bruch – Davis County Paul Child - Centerville Jason Meservy – West Bountiful Richard Fisher – Clearfield City Jim Mason – Layton City Emily Thomas – South Weber City Dave Olsen – Clinton City Scott Anderson – Woods Cross City Dena Eckardt – Davis Hospital Tami Timothy – Lakeview Hospital Cheryl Larsen – Davis County GIS Brad Bartholomew – Utah DEM Kimberly Giles – Utah DEM Paul White – Farmington City	Kickoff meeting	An overview of the PDM process was presented by the State and an agreement to participate made by those in attendance.

Year	Date	Meeting Attendees	Activity	Purpose
	May	Ellis Bruch – Davis County Paul Child - Centerville Jason Meservy – West Bountiful Richard Fisher – Clearfield City Jim Mason – Layton City Emily Thomas – South Weber City Dave Olsen – Clinton City Scott Anderson – Woods Cross City Dena Eckardt – Davis Hospital Tami Timothy – Lakeview Hospital Cheryl Larsen – Davis County GIS Brad Bartholomew – Utah DEM Kimberly Giles – Utah DEM Paul White – Farmington City	PDM Planning	Review and assess mitigation strategies from the 2009 County PDM
	October	Ellis Bruch – Davis County Paul Child - Centerville Jason Meservy – West Bountiful Richard Fisher – Clearfield City Jim Mason – Layton City Emily Thomas – South Weber City Dave Olsen – Clinton City Scott Anderson – Woods Cross City Dena Eckardt – Davis Hospital Tami Timothy – Lakeview Hospital Cheryl Larsen – Davis County GIS Brad Bartholomew – Utah DEM Kimberly Giles – Utah DEM Paul White – Farmington City	Plan review meeting	Review 2009 PDM plan and extract Davis County Data. Gather information
2014	**August**	Ellis Bruch	State PDM training	County Director attended meeting with the Sate PDM Coordinator and it was determined that a consultant would be contracted to assist in plan development.
	December	Terry Turner, Morgan Co. EM Director Ellis Bruch, Davis Co. EM Director DeeEll Fifield, Consultant Eric Martineau, State PDM Manager Brad Bartholomew, State Hazard Mitigation Officer Julie Baxter, FEMA	Meeting at State DEM with state and FEMA PDM managers, and DeeEll Fifield Consulting.	Review and discuss PDM program requirements and outline project milestones.
2015	**January 6**	Eric Martineau, State PDM Manager DeeEll Fifield, Consultant	Meeting with the State PDM program manager and DeeEll Fifield	Update and review new FEMA PDM guidance
	May	Ellis Bruch, Davis Co. EM Director Davis County Commission	Davis County Commission Meeting	Approval of a consulting contract with DeeEll Fifield Consulting
	June	Ellis Bruch, Davis Co. EM Director DeeEll Fifield, Consultant	2009 PDM plan review and coordination meeting	Go through the 20019 PDM plan, review data, and determine planning direction and milestones

Year	Date	Meeting Attendees	Activity	Purpose
	August 12	Ellis Bruch, Davis Co. EM Director DeeEll Fifield, Consultant	Coordination meeting	Progress update and strategy review. Consultant met with county director to develop responses to the 2009 PDM strategies. This was presented to the technical committee at the August LEPC.
	August 27		LEPC Meeting	Consultant presented a review of the 2009 PDM strategies and obtained input from those in attendance on the status of each of the strategies.
	September 24	Ellis Bruch – Davis County DeeEll Fifield - Consultant Paul Child - Centerville Jason Meservy – West Bountiful Jim Mason – Layton City Scott Anderson – Woods Cross City Kimberly Giles – Utah DEM Sharon Hoel - Davis County VIPS Brett Larkin - Kaysville Fire Dept Carl Shupe - Davis County Health Dept Chris Bateman - Davis County Health James Ray - Utah DEM Loretta Cole - Children's Justice Ctr. Barry Burton - Davis County Planning	County Emergency Managers Meeting	Reviewed the status of the 2009 PDM strategies and obtained input on them. Also started to develop the 2015 PDM strategies.
	October 5	DeeEll Fifield - Consultant Eric Martineau - State PDM Manager	Coordination Meeting	Met to discuss product status, milestones, and general direction.
	October 5	DeeEll Fifield - Consultant Jeff Oyler - Davis County Planning	Coordination Meeting	Met with Davis County Community and Economic Development to obtain updated county economic and demographic information.
	October 22	Ellis Bruch – Davis County Paul Child - Centerville Jason Meservy – West Bountiful Richard Fisher – Clearfield City Jim Mason – Layton City Emily Thomas – South Weber City Dave Olsen – Clinton City Scott Anderson – Woods Cross City Dena Eckardt – Davis Hospital Tami Timothy – Lakeview Hospital Cheryl Larsen – Davis County GIS Brad Bartholomew – Utah DEM Kimberly Giles – Utah DEM Paul White – Farmington City	LEPC Meeting	Discussed PDM strategies and mitigation projects that local jurisdictions have planned and developed over the past 6 years.
	November 18	DeeEll Fifield - Consultant Ellis Bruch - Davis County Marci Fifield - Admin Assistant	Coordination Meeting	Review and update 2015 PDM Strategies and prepare for County Emergency Manager's Meeting

Year	Date	Meeting Attendees	Activity	Purpose
	November 24	Ellis Bruch - Davis County DeeEll Fifield - Consultant Richard Fisher – Clearfield City Brad Wheeler - Clearfield City Mike Carlson - Centerville City Steve Maughan - Bountiful City Scott Anderson – Woods Cross City Scott Paxman - Weber Basin Water Michelle Villegas - Davis Hospital Elyse Greiner - South Weber City Bob Fowler - DC Citizen Corps Kimberly Giles – Utah DEM	Emergency Manager's Meeting and Planning Committee	Review and revise 2009 strategies and begin development of the 2015 PDM Strategies
	December 1	DeeEll Fifield - Consultant Scott Paxman - Weber Basin Water		
2016	**January 29**	Ellis Bruch - Davis County DeeEll Fifield - Consultant Scott Anderson – Woods Cross City Bob Fowler - DC Citizen Corps Scott Paxman - Weber Basin Water Kimberly Giles – Utah DEM Dave Olsen – Clinton City Paul Child - Centerville Jason Meservy – West Bountiful Dave Olsen – Clinton City Paul Child - Centerville Jon Rueckert - NSL City Wendy Brimhall - Clearfield City Steve Maughan - West Bountiful Darren Frandsen - Fruit Heights City Jason Fielding - DC Public Works Chris Ence - USAF-Hill AFB Kevin Ward - Layton Fire Dept.	Emergency Management Meeting	Review and revise 2009 strategies and begin development of the 2015 PDM Strategies

Year	Date	Meeting Attendees	Activity	Purpose
	February 25	Ellis Bruch - Davis County DeeEll Fifield - Consultant Linda Ebert - DC Health Department Jon H - Kroger Layton Joe Hill - Kern River Gas Tami Timothy - Lakeview Hospital Tawnya Zeidler - Lakeview Hospital Todd Walker - Futura Industries Carol Stewart - Fruit Heights City Scott Paxman - Weber Basin Water Tracy Roddom – DC Animal Control Scott Adams - Layton Fire Dave Spence - DC Health Dept. Elyse Greiner - South Weber Rachelle Blackham - DC Health Dept. Matt Mikkelsen - Futura Jo Hamblin - Syracuse Fire Dept Christine Martinez - UTA Kimberly Giles - State DEM Evan Nelson - West Point City Houston Smith - Plains Pipeline Kevin Christensen - Northern Utah Health Coalition Scott Anderson - Woods Cross City Colt Farley Pioneer Pipeline/Phillips 66	LEPC Meeting	Review and revise 2009 strategies and begin development of the 2015 PDM Strategies
	March 24	DeeEll Fifield - Consultant Ellis Bruch - Davis County Kevin Christensen - Northern Utah Health Coalition Kimberly Giles - State DEM Evan Nelson - West Point City Michelle Villegas - Davis Hospital Darren Frandsen - Fruit Heights City Jason Meservy – West Bountiful Chris Ence - USAF-Hill AFB Carl Shupe - Davis County Health Dept Debbie Olsen - Centerville City Kevin Ward - Layton City Kenton Pies - Kaysville Marty Peterson - North Salt Lake City Jon Rueckert - North Salt Lake City Dean Hunt - Layton Fire Department Lloyd Davis - UTA Police Department Dave Edwards - Bountiful City	Emergency Managers Meeting	Review draft 2015 PDM strategies

Year	Date	Meeting Attendees	Activity	Purpose
	June 23	DeeEll Fifield - Consultant Ellis Bruch - Davis County Kevin Christensen - Northern Utah Health Coalition Kimberly Giles - State DEM Evan Nelson - West Point City Michelle Villegas - Davis Hospital Darren Frandsen - Fruit Heights City Jason Meservy – West Bountiful Chris Ence - USAF-Hill AFB Carl Shupe - Davis County Health Dept Debbie Olsen - Centerville City Kevin Ward - Layton City Kenton Pies - Kaysville Marty Peterson - North Salt Lake City Jon Rueckert - North Salt Lake City Dean Hunt - Layton Fire Department Lloyd Davis - UTA Police Department Dave Edwards - Bountiful City	LEPC Meeting	Review draft 2015 PDM strategies
	August 25	DeeEll Fifield - Consultant Ellis Bruch - Davis County Kevin Christensen - Northern Utah Health Coalition Elyse Greiner - South Weber Rachelle Blackham - DC Health Dept. Loren Allen - DC Health Dept. Ivy Melton - Sales DC Health Dept. Chris Bateman - DC Health Dept. Kellison Platero - DC Health Dept. Jo Hamblin - Syracuse Fire Dept Eric Frorier - Syracuse Fire Dept Wade Francis - State Fire Marshal Richard Mosely - State Fire Marshal Colt Farley Pioneer Pipeline/Phillips 66 Kevin Ward - Layton Fire Dept. Scott Adams - Layton Fire Dept. Jason Meservy – West Bountiful Scott Anderson - Woods Cross City Loretta Cole - CJCC Brad Wilcox - DCSO Bruce Cox - Centerville City Kirk Sackett - Holly Frontier Tina Pastrana - DC School District Jeff Bassett - South Davis Metro Fire Gary Davis - ARES Karen Anderson - ARES Phil Langhos - HAFB Mark Larsen - South Weber City	LEPC Meeting	Review and adopt final draft of the PDM Plan. A motion was made and seconded to adopt this draft of the plan and submit to the State for preliminary approval.

Planning Process Timeline

Step 3: Public Officials Outreach

To ensure the public and their officials were supportive of the Plan, the Davis County emergency manager attended County Councils of Government meetings. These public meetings have

representation from each chief elected official in the county. Additionally, some communities recommended meeting with their city council to better inform the community.

Step 4: Establish Continuity in the Planning Process

To meet the requirements set forth by DMA 2000, Davis County was contracted by DEM to update this multi-jurisdictional PDM Plan.

Step 5: Data Review and Acquisition

The 2009 WFRC PDM Plan was reviewed by the Davis County Working Group and it was determined that all Plan sections would need to be updated and revised. Contact was made with the County GIS technician and/or planning commission staff in cities to assess available data at the local level. Agreements were made to allow for the exchange of data between the local jurisdictions and Davis County. Mapping data layers obtained included some or all of the following: local roads, plot maps, county tax assessor's data, hazard data, flood maps, topographic data, aerial photographs and land development data.

Step 6: County Hazard Identification and Profile

These steps were conducted by gathering data on the hazards that threaten the planning region. This information was gathered from local, state and federal agencies, organizations, newspapers and other local media accounts, state and local weather records, conversations with the public and local officials, surveys, interviews and meetings with key personnel within the planning area. County-level mitigation planning meetings were held during this process and are explained in further detail in Table 3-8 (page 29). During these meetings, attendees had the opportunity to review hazard information and provide comment. These meetings also provided a forum for discussion on the background information that was needed to gain a general understanding of the geography, geology, recreation and natural resources of the planning region.

Step 7: County Vulnerability Assessment

This step was conducted through a review of local base maps, topographical maps, floodplain maps, United States Geological Survey (USGS) and Utah Geological Survey (UGS) maps, Automated Geographic Reference Center (AGRC) maps, FEMA hazard maps and climate maps from the National Climatic Data Center (NCDC). A detailed vulnerability assessment was completed with the use of GIS software for each county within Davis County. The FEMA modeling program Hazards United States – Multi-Hazards (HAZUS-MH) was used to determine vulnerability to earthquakes and floods. Loss estimation methodology was developed by the core planning team, with assistance from the technical team, to determine vulnerability from each identified hazard. Transportation Analysis Zone (TAZ) and Census 2000 data were used to estimate the number of residents and households that could be affected by the hazard. Utah State sales tax and Equifax Business data were used to find the total number of businesses and annual sales vulnerable to hazards. HAZUS-MH infrastructure data was used to analyze the amount of infrastructure vulnerable to hazards.

Step 8: Review Existing Local Mitigation Actions

This step was conducted through a review of the governing documents of the county, as well as, conversations, interviews and meetings with interested community leaders and members. This step identified what goals are already established and adopted for the county.

Step 9: Form Local Working Groups

Davis County organized a working group. The working group was comprised of individuals with an interest in hazards mitigation, as well as, technical experts from the government sector having mitigation expertise. The committee included city planners, city engineers, county and city GIS staff, floodplain managers, sheriff and fire staff, and city and county emergency managers. Each completed section of the updated Plan was reviewed and analyzed for accuracy by the working groups, individual county emergency mangers and Davis County staff. Every section of the Plan was updated and revised as part of the planning process.

Step 10: Risk Assessment Review

The working groups were tasked with reviewing county risk assessments for accuracy and completeness and with developing mitigation strategies for all natural hazards threatening the county. Changes or additions were conveyed to the Core Planning Team for revision.

Step 11: Mitigation Strategy Development

Developing the mitigation strategies was a process in which all of the previous steps were taken into account. The County evaluated, identified and profiled the hazards, and vulnerability assessment. Each Mitigation Strategy developed underwent a cost/benefit analysis to determine the best action to take given limited budgets allocated to hazard mitigation efforts at the local level.

Step 12: Prioritization of Identified Mitigation Strategies

DMA 2000 requires state, tribal, and local governments to show how mitigation actions were evaluated and prioritized. The prioritization process was completed by the core planning team, the technical team and the local planning teams over a series of planning meetings. Prioritization was accomplished using the STAPLEE method as explained in the FEMA How to Guide, Document 386-3. This process resulted in each Mitigation Strategy given a High, Medium or Low priority by the planning teams.

Step 13: State Review

DEM created a formal PDM Plan review committee to insure local plans met the requirements of DMA 2000. This committee reviewed the Plans from July to August 2016 subsequent to submission to FEMA for final review and acceptance.

Step 14: Adoption

The Plan went through a public adoption process from November to December 31, 2008, and was adopted by the cities and counties listed in Table 2-1 of Part II, Adoption Process and Documentation.

Year	Date	Activity	Purpose

Year	Date	Activity	Purpose
2016	August	Submitted Plan to State DEM for initial review and comment	Requirement

Planning Process Timeline

Public Involvement

Public involvement opportunities were available and incorporated throughout the development of this Plan. Such opportunities included a public website and public meetings for comment review. Emergency managers, fire and sheriff departments, state and local agencies, business leaders, educators, non-profit organizations, private organizations, and other interested members that could be affected by a hazard within the region or other interested members, were all a part of the planning process.

The first draft of this Natural Hazard Mitigation Plan was placed on the Davis County website for a 30-day public comment and review period. There were no public comments received on that draft of the Plan. Members of the public and elected officials from each jurisdiction were notified of the public comments at county Council of Government meetings.

Information Sources

Background information and data for this Plan was obtained from the sources listed below. From these sources, the Planning Consultant extracted relevant information and data. That information and data was subsequently submitted to the County Work Groups for their consideration and approval for inclusion into the Plan.

- Federal Emergency Management Agency (How-to Guides)
- National Weather Service (hazard profile)
- National Climate Data Center (drought, severe weather)
- Utah Division of Emergency Management (Salt Lake City Mitigation Plan, GIS data, flood data, HAZUS data for flood and earthquake)
- Utah Geologic Survey (GIS data, geologic information)
- Utah Division of Forestry Fire and State Lands (fire data)
- Utah Avalanche Center, Snow and Avalanches,
- Utah Department of Transportation (traffic data)
- Utah Automated Geographic Resource Center (GIS data)
- University of Utah Seismic Station (earthquake data)
- Utah State University (climate data)
- Councils or Government

- Association of Governments
- Utah Association of Special Districts
- State Office of Education
- Davis County and municipalities (Emergency Operations Plan, histories, mitigation actions, public input, data: GIS, assessor, transportation, property and infrastructure)
- Earthquake Safety in Utah
- Utah Natural Hazard Handbook
- Utah Statewide Fire Risk Assessment Project
- A Strategic Plan for Earthquake Safety in Utah
- State of Utah Wildfire Plan 2008
- State of Utah Drought Plan 2007

Part IV. 2009 Mitigation Goals and Objectives Review

The Davis County Mitigation Strategies Working Group developed the following Mitigation Strategies. The Working Group revised and expanded on strategies implemented in the 2003 PDM Plan. Information on Working Group members can be found in Part III.

Dam Failure

Problem Identification: Many high hazard dams and irrigation impoundments are located above inhabited areas in Davis County. "High hazard" does not mean that these dams have a high likelihood of failing, but that if they did fail, the magnitude of damage would be considerable. Additionally the Weber Basin water aqueduct traverses the county on the high bench along the Wasatch mountain front between the mouth of Weber Canyon and Bountiful. The aqueduct transports several thousands of gallons of water daily. Any event that caused a break in that water line would result in massive flooding, threatening many residents due to the fact that there are only manual valves in the system. Irrigation canals and associated secondary water distribution systems require regular inspection and maintenance.

Goal #1: Increase awareness of potential hazard from dams and water distribution systems in the county.

Objective 1.1 (Priority MEDIUM): Educate public on water system/dam failure hazard.

Action 1: Compile inundation data/maps for high-risk dams/irrigation impoundments.

Status: Accomplished: The County has worked with Weber Basin Water Conservancy District (WBWCD) and the United States Bureau of Reclamation (BOR). WBWCD provided a copy of their Hazard Mitigation Plan to the county. See following section on WBWCD. The BOR has provided flood inundation maps for their high-hazard dams to the county. A Dam Inundation Table-top exercise with the BOR, Davis and Morgan Counties was conducted in March 2016.

Action 2: Provide information to residents on the hazard.

Status: Ongoing: The county and local jurisdictions regularly conduct emergency preparedness fairs and each fire department in the county annually conduct fire safety open houses in October. Emergency preparedness information on all hazards is distributed at these events. See following County and Local Jurisdiction Mitigation Activities section for specifics.

Objective 1.2 (Priority MEDIUM): Lessen the impacts of flood damage caused by irrigation system infrastructure failure.

Action: Inspect irrigation canals/debris basins.
Status: Ongoing: Local jurisdictions, public works and water improvement districts at least annually inspect, repair, and modernize water distribution infrastructure.

Earthquake

Problem Identification: Davis County is located in the heart of the Wasatch Fault between the shores of the Great Salt Lake and the foothills of the Wasatch Mountain Range. The majority of the population lives within 5 miles of the fault. The only major traffic artery runs north and south, and numerous water and petroleum pipelines either cross over or run within ½ mile of the fault. Five moderately sized petroleum refineries located in the southern end of the county are subject to severe damage from ground movement and liquefaction. A major earthquake in the area would result in hundreds of millions of dollars in damage to residential structures, industry, and of critical infrastructure, and likely some loss of life.

Goal #1: Reduce loss of life and limit damage to property.

Objective 1.1 (Priority HIGH): Provide education on seismic hazards and mitigation, to Davis County residents and homeowners.

Action: Public Education

Status: Ongoing: The county and several of the jurisdictions have conducted numerous preparedness fairs and public outreach presentations designed to educate the public on the earthquake threat. Additionally, the county and most of the local jurisdictions participated in the 2012 Great Utah Shakeout earthquake exercise, activating the county Emergency Operations Center for the 3 days of the exercise. The county also participated in subsequent Shakeout exercises in 2013 through 2016. See following County and Local Jurisdiction Mitigation Activities section for specifics. Based on the lessons learned from the shake out exercises, EMI training, the county has developed a plan for updating their EOP with a projected completion date in 2017.

Objective 1.2 (Priority MEDIUM): Increase quality and quantity of available natural hazards data to facilitate better decision-making.

Action: Update fault zone and liquefaction maps for the county.

Status: Ongoing: The United States Geological Survey (USGS) in conjunction with the Utah Geological Survey (UGS) have updated and revised the seismic risk hazards maps for Davis County. These maps have been made available as an online planning tool for the public and planning officials as well. The new earthquake hazard map is included in this plan on page 105. Davis County sponsored 84 city and county participants to attend FEMA's Emergency Management Institute June 2015, as part of an Integrated Emergency Management Earthquake (IEMC) exercise course. The 5-day training focused on a 6.5 magnitude earthquake in Davis County. County and local officials received earthquake specific training and conducted a functional earthquake exercise. See following County and Local Jurisdiction Mitigation Activities section for specifics.

Problem Identification: A number of critical structures within the county do not meet current building criteria and could sustain considerable damage or suffer total destruction from ground shaking. This could delay life-saving rescue operations and hamper efforts to restore order in the event of a disaster.
Goal #2: Protect emergency response capabilities and critical facilities.

Objective 2.1 (Priority HIGH): Ensure critical emergency service and water distribution facilities meet current construction codes, to allow for prompt response operations after an earthquake.

Action 1: Retrofit or construct new fire department facilities for earthquake resistant standards.

Status: Ongoing: New fire stations have been constructed in Clinton, South Davis Metro Fire, Syracuse, North Davis Fire, Kaysville, and Layton, also to the highest seismic building codes. Kaysville, North Salt Lake, Clinton, West Bountiful have constructed new police departments/EOC's. Layton city is planning to construct a new public safety building in the near future. See following County and Local Jurisdiction Mitigation Activities section for specifics. Davis County completed construction on a new county administration building in 2013. This building houses several county government offices and was constructed to the latest seismic building codes. The Historic Davis County Courthouse is more than 70 years old and in need of seismic retrofit. The county is planning to budget for this project beginning in 2017.

Action 2: Retrofit high risk Weber Basin Water facilities including the Davis South water treatment plant filter building, well houses and nonstructural components District wide.

Status: Ongoing: The Weber Basin Water Conservancy District (WBWCD) has been seismically retrofitting a large portion of their water delivery system aqueduct along the east bench of the county. WBWCD also retrofitted their South Davis Water Treatment Plant Filter Building. WBWCD has participated in FEMA Mitigation Grant Funding for several years to assist in funding this project. WBWCD has spent in excess $5 million on these projects and has plans to continue in the system upgrade which is projected to cost more than $10 million. See WBWCD section below.

Flooding

Problem Identification: Many citizens are not fully aware of the flood hazard in Davis County. Because of this, development has been allowed to occur in areas of previous flooding.

Goal #1: Educate citizens of Davis County about flood hazard.

Objective 1.1 (Priority HIGH): Increase the level of understanding in homeowners, city officials, permit authorities and title companies/realtors.

Action: Create a brochure about flood hazards and disseminate.

Status: Ongoing: Rather than develop and disseminate a printed flood hazard brochure, the Davis County Health Department has offered the services of their interns to create digital all hazards information that will be accessible on the County Emergency Management website. See following County and Local Jurisdiction Mitigation Activities section for specifics.

Objective 1.2 (Priority HIGH): Reduce loss of life and property damage due to flooding by providing current building code and NFIP maps to cities.

Action: Encourage city planners to update building codes.

Status: Ongoing: FEMA has updated and revised several Flood Insurance Rate Maps (FIRM) throughout Davis County over the past 6 years. County Emergency Management participated in the public meetings that were conducted during the public comment phase of this project and information was disseminated throughout the project. The FIRM maps were provided to county and local jurisdiction planning staff as part of updates to building and zoning plan revisions. See following County and Local Jurisdiction Mitigation Activities section for specifics.

Problem Identification: Debris basins and other flood control infrastructure require regular inspection and maintenance. Stream channels may also change with heavy flow events. Proper flood control measures should be an ongoing priority.

Goal #2: *Reduce flood hazard*

Objective 2.1 (Priority HIGH): Increase the capacity of streams to better handle runoff.

Action: Clean/ maintain stream channels.

Status: Ongoing: Every spring, all local jurisdictions and Davis County conduct a thorough assessment and debris removal of stream channels, debris basins, and other waterways as part of their regular flood mitigation activities. See following County and Local Jurisdiction Mitigation Activities section for specifics.

Problem Identification: Flooding in Davis County often occurs rapidly. For citizens to adequately protect themselves against the threat, sufficient warning needs to be given.

Goal #3: Increase warning lead times to reduce the vulnerability of persons and property to flood hazards.

Objective 3.1 (Priority MEDIUM): Quickly notify persons of flood event.

Action: Implement a flood notification system.

Status: Completed: Davis County has implemented a county-wide flood notification process utilizing the CodeRED Emergency Notification system. CodeRED has successfully been used to notify residents of many types of emergencies, including flooding.

Objective 3.2 (Priority MEDIUM): Establish a county-wide warning/notification system.

Action: Improve on the existing ***"emergency notification"*** warning system.

Status: Completed: Davis County purchased and implemented two completely different Emergency Public Notification Systems. The first system "City Watch", was purchased by the county in 2001 as an "emergency notification" type of system. Dispatch could identify and notify distinct parts of any community in the event of any type of emergency. However, the City Watch system proved to be prone to break down and was unreliable. A new and improved notification system was purchased by Davis County in 2014. This program, CodeRED is also a emergency notification system type of system but has proven to be much more reliable and user friendly than the previous system. Davis County utilized Homeland Security Grant funding as part of the Region 1 Coalition to purchase this software to help assure interoperability within the region. This system is continuously used in exercises and real emergency events. The cost for the Region was $104,000 per year for the purchase annual maintenance of the CodeRED system. Layton City utilizes a different emergency notification system system than the county has. However, Layton City participates in the county CodeRED network as well. The Davis County School District does not participate in the CodeRED system and has purchased their own public notification systems.

Severe Weather

Problem Identification: Most presidential disaster declarations are the result to severe weather. Davis County is prone to the affects of severe weather as are many other counties in the state. These are usually thunderstorms and snowstorms. However, we are also prone to extremely severe wind events referred to as "East Winds." Historically, Davis County has experienced gusts of over 110 mph and sustained winds of 80+ mph. These can result in millions of dollars in damage. On average we experience at least one every year. Severe storms result in secondary and tertiary problems mostly dealing with power, heating and travel. Severe weather has resulted and will continue to result in serious travel problems, as well as power and heating difficulties.

Goal 1: Assist residents protect themselves from the affects of severe weather.

Objective 1.1 (Priority HIGH): Support programs to prepare residents for adverse weather conditions.

Action 1: Encourage all cities to participate in the Storm Ready program.

Status: Completed: Davis County has achieved Storm Ready status in 2014 from the National Weather Service (NWS). The county will work closely with each city to become Storm Ready certified in the next six years.

Action 2: Encourage avalanche preparedness for county backcountry users.

Status: Ongoing: Davis County participates in the Avalanche Warning System Forecast Center in Salt Lake City. The county has a public service broadcast station, AM 700, that is utilized to continually broadcast NWS forecast information for severe weather.

Action 3: Install avalanche warning signs in Farmington Canyon.

Status: Completed: Davis County has installed avalanche information warning signs at the entrances to Farmington, Bountiful, and North Canyons. Unfortunately, these signs are periodically vandalized, requiring repair and/or replacement.

Problem Identification: Davis County cities near the mountain front are subject to strong easterly canyon winds. These high winds can result in serious disruption of essential public services and communications for emergency responders have been severely hampered in the past by high wind damage to communication infrastructure.

Goal 2 – Ensure communication during severe weather events.

Action: Reinforce towers and infrastructure.

Objective 2.1 (Priority MEDIUM): Harden communications capabilities to ensure post event functionality.

Status: Completed: The powerful east canyon wind event of 2011 damaged the south communications tower at the Sheriff's office. It was repaired and strengthened to better withstand the east winds. New 800 mhz digital radios were purchased by the county for emergency personnel, and new repeater and battery backup solar panels were installed on Antelope Island's Beacon Hill radio site. Davis County experienced a major wind event in 2011 resulting in extensive damage throughout the county. Easterly canyon winds in excess of 146 mph were recorded. Thousands of trees were toppled during this event in addition to hundreds of homes receiving wind damage. Davis County received a Presidential Disaster Declaration for Public Assistance as a result of this incident. The total Public assistance received for this incident was $4,144,235. Additionally, the Natural Resources Conservation Service (NRCS) provided more than $270,000 to provide for cleanup assistance following this disaster.

Slope Failure

Problem Identification: Numerous canyons, large and small exist along the east bench of Davis County. They were formed over thousands of years by debris flows and mudslides. Now, many hundreds of homes and other structures, pipelines, power lines and roadways have been constructed on top of or through the alluvial fans produced by these events. Nature continues to construct these canyons.

Landslides and debris flows will continue to occur over time, thus threatening residents and critical infrastructure.

Goal 1 – Avoid risk or exposure to landslides through informed planning and zoning decisions.

Objective 1.1 (Priority HIGH): Educate planning commissions.

Action 1: Provide city-planning commissions with information concerning landslides and debris flows.

Status: Ongoing: There has been some outreach to the County and local jurisdiction Planning Commissions to educate them on the hazards associated with slope failures. The county plans to step up their efforts in this area.

Action 2: Encourage cities to adopt a standard of requiring geo-technical studies in identified landslide and debris flow areas.

Status: Ongoing: There have been two significant road collapses on Farmington Canyon road over the past six years. In 2011, the road suffered a major failure due to a collapse of the land above. A significant section of the road, over a quarter mile in length was lost. The Forest Service redesigned and rebuilt the damaged road, however it remained closed for over a year. In the spring of 2015, heavy precipitation caused some large boulders to break loose above the roadway which closed it for several days until debris clearance efforts were completed.

There have been two significant slope failures in Davis County over the past six years. The Utah Geological Survey (UGS) has been monitoring conditions at the Springhill landslide in North Salt Lake, Davis County since 1998. In the late 1990s, residents in the Springhill area of North Salt Lake, Davis County began noticing cracking and other distress related to relatively minor movement of the landslide. By 1998, a house at 160 Springhill Drive that straddled the northern boundary of the landslide was severely damaged and condemned. Relatively severe distress also occurred to several houses along Valley View Drive (formerly 350 E) and Springhill Circle. Little movement or damage occurred during a dry period between 1999 and 2004, but the rate of movement accelerated during the 2005 wet year. Since 2005, the amount of movement each year has increased, except in 2007 and 2011-2012 (dry years), resulting in an increased amount of damage and distress, particularly to houses in the upper and lower parts of the landslide and to Springhill Drive.
The Springhill landslide is about 720 feet long and about 290 feet wide where it is crossed by Springhill Drive. The local relief (change in elevation) is about 150 feet and the average slope of the landslide is approximately 21 percent (the ground rises 21 feet over a distance of 100 feet). The depth of the landslide varies along its length. Along the north edge of Springhill Circle, the landslide is about 48 feet deep and likely deeper than 70 feet beneath Springhill Drive. The landslide is shallower along its southern edge, and in the head and toe. The landslide mitigation is now complete. The Parkway Landslide (except for possible lawsuits) has also been mitigated.

North Salt Lake has revised and updated building codes and development plans with State assistance.

On June 28, 2012, the City of North Salt Lake announced that they had been awarded an almost $2 million matching fund Federal Emergency Management Agency Pre-Disaster Mitigation Grant to buy and demolish 11 homes and turn the landslide site into an open-space park. The grant requires a local match of about $600,000. The city plans to apply for other grants, hold fundraisers, and use park funds to get the matching money.

Problem Identification: There are a number of canyons that do not currently have debris basins constructed to contain debris flows. Others are insufficient in size. These need to be built or reconstructed in order to provide protection to residents.

Goal 2: Reduce or eliminate landslide damage due to debris flows.

Objective 2.1 (Priority MEDIUM): Reduce loss of life and damage to property by providing a means to control debris and water from debris flows.

Action 1: Construct additional debris basins and retrofit others.

Status: Ongoing: Several local jurisdictions have developed or rebuilt a number of debris basins over the past 6 years. See following County and Local Jurisdiction Mitigation Activities section for specifics.

Action 2: Rehabilitate watershed areas affected by wildfire.

Status: Ongoing: The US Forest Service in conjunction with Farmington City Fire Department has rehabilitated an area above Farmington.

Objective 2.2 (Priority MEDIUM): Lessen the impacts of flood damage caused by irrigation canal failure.

Action: Place isolation valves in the Weber Basin irrigation pipeline.

Status: Ongoing: Weber Basin Water Conservancy District (WBWCD) has plans for replacement of all isolation valves throughout their water system. The estimated cost is over $500,000 and is part of their long range plan over the next 10 years.

Wildland Fire

Problem Identification: Much of the inhabitable land within Davis County is on the east bench. Numerous homes and subdivisions have been and are being constructed in these areas. Many of these structures border the Forest Service boundary or are in areas of old scrub oak growth. The potential for catastrophic damage from wildfire increases yearly. High voltage power lines in the Farmington bench

area prevent firefighting helicopters from the ability to draw fire suppression water from irrigation reservoirs

Goal #1: Reduce or eliminate the threat of a wildland fire, resulting in loss of life and property.
Objective 1.1 (Priority HIGH): Increase the level of wildfire knowledge for home and business owners in the Urban Wildland Interface area.

Action 1: Public awareness and education

Status: Ongoing: Fire Departments and Emergency Managers countywide regularly conduct public outreach at frequent Emergency Preparedness fairs. These events include a focus on wildland fire threat awareness and preparedness by encouraging participation in The Firewise Communities Program, which provides homeowners and businesses with simple steps to reduce wildfire risk. Wildland fire safety articles will also be included in community newsletters, as well as websites and social media. Additionally, citizens are actively encouraged to participate in the "Utah, Let's Do Our Part" campaign, which is the result of an interagency effort to reach the public with fire prevention messages relevant to Davis County.

Action 2: Provide wildland fire training to city and county planning and zoning officials and staff.

Status: Ongoing: The Davis County Fire Warden has a cost sharing agreement with the state to conduct wildland fire training to local officials.

Objective 1.2 (Priority HIGH): Maintain fire breaks.

Action: Routinely maintain fire breaks in preparation for wildfire season.

Status: Ongoing: A firebreak road was constructed above 1800 E. in Fruit Heights in 2014/2015 as part of the Bonneville Shoreline Trail System. Additionally, a new draining system for firebreak roads county-wide over the past 5 years to allow for better drainage and to provide firebreak road maintenance.

Objective 1.3 (Priority HIGH): Provide firefighting helicopter access to irrigation reservoirs in the Farmington bench area

Action: Relocate high voltage power lines in the Farmington bench area

Status: Ongoing*:* Efforts to relocate high voltage power lines in the Farmington Bench area have not occurred due to the high cost involved. Centerville City developed Freedom Hills Park, located on the border between Farmington and Centerville. It is designated as a wildland fire airbase station. A water tank was installed that would be used for providing water supply for helicopter fire suppression efforts. See following County and Local Jurisdiction Mitigation Activities section for specifics.

Problem Identification: Given that wildfire is a hazard that can be managed through effective fuel control and the lack of defensible space in one home could threaten other homes nearby in subdivisions, ordinances requiring residents to maintain defensible space around their respective homes would greatly reduce the fire hazard in these areas. Programs could be established to assist residents in performing this requirement or to encourage rebates for property insurance.

Goal #2 – Require homeowners to maintain defensible space around homes and businesses to more effectively mitigate the wildfire hazard.

Objective 2.1 (Priority HIGH): Establish ordinances requiring the maintenance of defensible space by homeowners, businesses, and government

Action 1: Draft ordinance requiring defensible space

Status: Ongoing: The draft county wildland interface fire ordinance has been adopted and is in the process of being updated. Defensible space requirements are also part of the Community Wildland Protection Plan (CWPP). Several communities have adopted CWPPs. They have been completed for Bountiful, Farmington, Layton and North Salt Lake. Fruit Heights, Centerville and South Weber are in the process of developing their CWPP.

Action 2: Educate citizens about new defensible space requirement

Status: Ongoing: There have been a number of Community Emergency Preparedness fairs conducted in local jurisdictions county wide over the past 6 years. Wildland Fire Protection is always a part of these fairs. See following County and Local Jurisdiction Mitigation Activities section for specifics.

Objective 2.2 (Priority HIGH): Establish program to assist/encourage homeowners in creating/maintaining defensible space.

Action: Start a bi-yearly effort to help homeowners create defensible space through yard waste removal and trimming assistance.

Status: Ongoing: Efforts to create defensible space are largely promoted through local jurisdiction fire department efforts. Several communities have either actively promoted, or conducted wildland fire mitigation projects. See following County and Local Jurisdiction Mitigation Activities section for specifics.

County and Local Jurisdiction Mitigation Activities 2009-2015

Jurisdiction	Year	Activity
Davis County	2009	• DSB Rebuild- DSB was rebuilt to the 100-yr design flow • 2600 S Sediment Basin- The 2600 S sediment basin on North Canyon Creek was reconstructed with a concrete floor and flash board risers to increase sediment removal and ease of maintenance • Hooper Draw Relined- +/-1700' Hooper Draw was slip lined with Ulraflo pipe in a section with failed corrugated pipe. • Haights Creek Culvert Crossing- Culvert Crossing was upsized from 36" CMP to dual 48" RCP. • Holmes Creek Standpipe - Installed a stand pipe at the Fairfield Rd crossing to prevent a culvert obstruction from over topping the road • Holmes Creek Culvert Upsizing-Rose Wood Culvert replace 36" RCP with 4'x10' Box Culvert • Mutton Hollow Basin Upgrades - Established a perimeter road and secure fence to help with access and maintenance. • Ricks Creek Culvert Reline- 60" Ricks Creek CMP Culvert was relined with Gunnite to repair failed flow line. • Parish Creek Basin Upgrades- Installed a concrete floor in the Parrish Creek Sediment Basin at the Frontage Rd. $3,205,242.07
	2010	• 200 S Low Flow Piping- A 24" low flow pipe was installed and the channel cross-section was increased to convey the 100-yr design flow with 2' freeboard. • Duel Creek Debris Basin - A large debris basin was built on Duel Creek to minimize debris flow damage as well as flood flows. • Frontage Rd Culvert Project- Culverts on Parrish, Barnard, Ricks and Davis were upsized on the frontage Rd to meet 100-yr design flow. • North Salt Lake Detention Basin - NSL Detention Basin had 119,000 Tons of material removed to increase the size of the basin to better detain large storm events. North canyon was also piped coming into the basin to ease maintenance. The outlet structure was rebuilt to gain better control of the function of the Basin. • Clinton Drain Low Flow Piping- A 36" low flow pipe was installed and the cross-section was increased to convey the 100- yr design flow with 2' free-board. • Holmes Creek Culvert- A replacement 60" pipe was jack and bored under I15 for the N Fork of Holmes Creek. • Barton Creek Culvert Project- 3000' of Barton Creek was upsized to better handle large storm events. • Duel Creek Channel Lining- Duel Creek was rebuilt and relined just west of I15 to convey the 100-yr design flow • NSL Channel Maintenance- undersized crossings were removed and the channel cross-section was increased in the NSl Drain next to Redwood Rd. • Parrish Creek Culvert Upsize- The culvert at 1250 W and Parrish Creek was upsized to convey the 100-yr design flow $10,348,257.40

Jurisdiction	Year	Activity
	2011	• Clinton Drain Low Flow Piping - Continuation of low flow piping and channel reshape downstream of 2010 project. • 200 s Flume - Channel was upsized to a 15'x7' concrete flume just east of Schneiters Bluff Golf Course. • Duel Creek - Additional 54" rcp was jack and bored across I-15 • Hooper Draw Drop Structures - Drop structures were added to Hooper draw to control velocities and reduce flooding • Haights Creek - Channel was piped to prevent erosion and flooding on the golf course. • Barton Creek - Channel capacity was increased across I-15 with a new 9x4 overflow box culvert. • Stone Barton- 84" CMP was replaced with an 12.5'x9.5' concrete flume, relining the existing 84" cmp that crosses the rr tracks with a cure in place pipe liner and jack and bored a new 60" RCP parallel to the existing 84" • South Fork Holmes Creek - A 300' Section of channel was cleaned and reshaped to increase capacity prevent flooding at Main Street. • North Salt Lake Drain - An additional 8'x4' Concrete box culvert was installed across center street and Redwood Rd to reduce flooding at this location. $14,393,407.30
	2012	• Kays Creek - 48" rcp high flow pipe was installed just west of hyw 89 to prevent flooding. • North Fork Holmes Creek- A new 66" rcp was jacked under I-15 and the railroad tracks to increase capacity of Holmes Creek. • North Fork Holmes Creek - Channel cross-section was increased to better handle new 66" RCP under I-15 $8,149,564.73
	2013	• 700 S - Channel Piping to increase capacity and reduce maintenance. • Clinton Drain - Continued the low flow piping and increased cross-section of the channel to handle the 100-yr design flow. • Farmington Creek- Upsized the culvert crossing at the D&RG trail to handle the 100-yr design flow and significantly reduce the flood plain in the area. • Mutton Hollow - The detention basin at Boynton Rd was increased in size to better handle the 100-yr design flow. $4,409,413.19
		• Baer Creek - Channelization and velocity control structures • Haight Creek - Installed stand Pipe and culvert liner to prevent flooding at 1475 south. • Davis County Flood Control is tasked with ensuring that all designated channels are

Jurisdiction	Year	Activity
	2014 2015	properly functioning, free and clear of any obstructions and are built to the proper size and dimensions to convey the 100-yr design flow. We check grates and culverts after every rain storm and during runoff, clean sediment basins as necessary, remove fallen trees and other obstructions when needed as well as oversee all construction in or near the channels. As the budget allows we rebuild worn out culverts and other infrastructure and upsize infrastructure that is undersized and presents a flooding hazard. • Propose projects for the future Include enclosing the portion of Duel Creek from Main St to I-15, to increase flow capacity to the 100 yr design flow as well as remove a traffic hazard. We are also planning on building a diversion on Holmes Creek to channel water to our Mutton Hollow Detention Basin. This will give us some control on Holmes Creek in attenuation of large storms. There is an opportunity on Baer Creek to build a detention basin west of Highway 89 which will control flood flows and help reduce the erosion that has caused us problems downstream. • In addition to these larger projects we will continue to monitor and maintain the channels in Davis County. Replacing culverts and other infrastructure as necessary as well as repair erosion damages, remove obstructions and debris. $4,067,643.46 2015 $3,837,357.99 Total: $48,410,886.14
Bountiful	2009-2016	**Flood Water Mitigation:** • Bountiful City completes semi-annual retention basin and runoff route maintenance to include debris and sediment removal, and access improvement. This process is comprehensive and involves each of the canyon/creek drainages through the city, at each retained elevation as flow moves down the mountain to the West. **Communications:** • Bountiful City operates a PSAP providing emergency and 911 communications for five South Davis County cities. In 2012, Bountiful City purchased ($256,000) an integrated 911 telecom system as part of a Wasatch area multi-node system. This system provides secondary sites for continuity of operations, allowing Bountiful dispatchers to operate from Weber County, VECC, or Salt Lake City PSAPs in the event of evacuation or disaster. Additional integration software for call handling was purchased ($53,000) allowing CAD system integration with other PSAPs in 2015. • Mobile Emergency Operations Center: Bountiful City has invested $183,000 and is investing an additional $43,000 to purchase and equip a mobile EOC for both Command and operational functions with scalable function to meet needs of any emergency in the city.

Jurisdiction	Year	Activity
		Community Engagement: • Bountiful City created a Neghborhood Emergency Preparedness Council in 2013, to coordinate volunteer and citizen preparedness efforts. The Council has implemented city wide preparedness trainings and seminars which are held quarterly to educate citizens on preparedness topics. **Community Wildfire Protection Plan (CWPP)** • In 2015, Bountiful conducted seminars that precluded development of the CWPP. The plan is under development.
Centerville	2009-2015	Centerville City has participated in the following mitigation activities: **Flooding** • A partnership project agreement with the City, UDOT, and the County resulted in improvements to critical drainage systems. Larger aqueducts/pipelines were installed in the Lone Pine and Deuel Creek drainages. Additionally, a larger drainage pipe was installed under I-15 at Porter Lane. The City's share exceeded $300 thousand. Working with Davis County and West Bountiful, the open canal through West Bountiful was also repaired and enlarged. • A community volunteer event was conducted to thin out growth in the Ricks Creek Canyon drainage. • Working with Davis County, made improvements to the storm drain system by clearing open ditches on Porter Lane. • Increased enforcement of illegal discharge and dumping in curb & gutters and drainage systems. • Increased the size of a drainage pipe under the Lower Pipeline Road which will allow water to flow better into Farmington Bay and decreasing the potential for back up of water which could flood parts of the Industrial Park. • Completed a $2 million cement dam in Centerville Canyon which has created a very large debris basin, significantly reducing the potential for a flood/debris flow coming out of that canyon. The City funded 15% of the cost. Each of the canyons above Centerville now have retention basins in place, providing very effective mitigation from the impact of a large debris flow and flooding. This project was completed in 2011. As a result, 181 homes were removed the special flood hazard list by FEMA. **Earthquake** • The City co-sponsored a community Disaster Preparedness Fair in 2014. Vendors and emergency preparedness specialists distributed information to participants on preparedness, response, and recovery from earthquakes. • Eight City employees attended a Davis County Community Specific IEMC training in FEMA's EMI in 2015. The exercise scenario was based on a 6.5 magnitude earthquake. • The City conducted Community-wide functional exercises in 2010 and 2013 focused on Earthquake response. • The City conducts two “Rapid Damage Assessment and Communication” drills each year.

Jurisdiction	Year	Activity
		• Each year the City participates in the Great Utah "ShakeOut" Earthquake Exercise and encourages all residents to also participate. • The City conducted an earthquake hazard assessment for all city buildings. Items needing to be better secured were identified, and steps were taken to secure them. • Several improvements have been made to the communications infrastructure of the city, including the installation of a robust fiber optic system which each business and residence can take advantage of. This system will provide resilient access to internet, phone, and cable services. The fiber optic lines are encased in a hazard resistant underground conduit. In addition to the UCAN 800 Mhz police/EMS/FD communication radio all of Centerville Police Vehicles are equipped with a VHF radio which adds additional communication capacity. • The City has purchased an additional portable 20 KW generator which can be used to power a building or a city well. • A new water well was drilled and installed that has a natural gas/propane powered 180 KW generator. This well was installed and engineered to withstand a major earthquake. • The City Water Department created a “Communication Loss Plan” which would enable the water system to work properly even if all the computer systems fail. They have also installed back-up lower water pumps in the wells which require less power to operate. • Replaced 4000 feet of old cast iron water pipe with new ductile pipe which is more resilient and will have a better chance of surviving an earthquake. • The City developed a redundant and effective VHF/UHF radio community communication network and regularly tests this system. • The Police Department has a rapid damage assessment plan which is exercised by the Police Department during each of the "ShakeOut" exercises. • All employees meet once a year for emergency preparedness training and employee incentives are provided for completing preparedness activities in their homes, such as; securing their water heaters, assembling 72 hour kits, conducting fire drills, etc. All Police Department Officers has been given a “go bag” with survival supplies enabling them to be deployed for long periods utilizing the supplies. **Severe Wind Events** • The City experiences strong easterly canyon winds on a recurring basis and closely monitors National Weather Service broadcasts on its recently installed weather alert radio in the Police Department. • Prior to the 2011 severe wind incident, the City issued a phone message to each household advising of the storm and providing emergency preparedness recommendations to mitigate high wind impacts. The City Emergency Operations Center was activated and proactive measures were taken to reduce the likelihood of injury and damage. Due to the efforts of preparation, the City was able to maintain good communications with community leaders and other government agencies. Prior to the storm, contact was made with a construction company building a very large apartment complex and warned to take measures to secure loose plywood sheets, reinforce walls and other parts of the structure that was vulnerable to damage by high wind.

Jurisdiction	Year	Activity
		• The City utilizes WebEOC and has conducted several training sessions for city employees. • The City building code requires high-wind rated shingles on homes. **Slope Failure:** • In 2011, a debris basin was completed at the entrance to Centerville Canyon. All of the canyons above the City are now protected by debris basins. In the event of a canyon slope failure resulting in a debris flow, these retention basins will protect life and property in the community below. • City ordinance does not allow for development on the steep foothills above the City. **Wildland Fire** • The City recently completed development of Freedom Hills Park on the north end of the city adjacent to Farmington City. The park is designed to accommodate fire-fighting helicopters with a designated Helispot/Helibase which is situated away from powerlines. A fire hydrant was installed nearby. Additionally, helicopters will not be flying over any homes. • The City Public Works Department has an ongoing maintenance program on the "Firebreak" road above Centerville. This road is subject to constant degradation due to use and erosion. • Centerville is currently working with South Davis Metro Fire to develop a Wildland Fire / Urban Interface Plan. In 2015, members of the community met with the fire chief and other fire professionals to prepare for and mitigate the effects of a wildfire. • Centerville City has restricted the use of fireworks by ordinance for the past several years in areas prone to grass fires. The city uses a variety of methods to inform home owners and residents of the restrictions and the Police Department enforces the law. • Improvements have been made to the "Lower Pipeline" Road which is an interface area between grasslands and development. • In a cooperative effort between Centerville City, Davis County and South Davis Sewer District the firebreak road received substantial repair work and improvements to keep the road from eroding away into the creek at Rick's Creek.
Clearfield	2008-2015	• The city installed a new 1 million gallon water tank in the Freeport Center area to service the needs of residents on the west side of the city at a cost of $1 million. The water tank was designed and built to a high level of seismic standards. This water tank replaces an older one that was very vulnerable to earthquakes. • Major east/west connector roads in the city have overpasses vulnerable to earthquakes. Both of these transportation arteries require viaducts over Union Pacific and Frontrunner rail lines. The former viaducts were more than 50 years old and subject to collapse during an earthquake. The city partnered with Utah Department of Transportation (UDOT) to design and seismically rebuild these transportation structures at 300 North and 700 South. • The city replaced the roof on a water tank on 700 South that was vulnerable to collapse from an earthquake. • The city purchased a 20 VHF FCC Narrowband Compliant (FCC Part 90), 20 UHF FCC Narrowband radios, and 10 VHF, UHF Dual band radios, compatible with current emergency services radios, that would be used in an emergency.

Jurisdiction	Year	Activity
Clinton	2008-2009	• Clinton City Civic Center Project- Designed and built five city buildings meeting the seismic design category D2. Existing buildings did not mean that standard. The City buildings are as follows; a 21,000 SF City Hall, a 16,000 SF Fire Station, a 9,000 SF Police Station, a 5,000 SF Recreation Administration building. Cost $9,000,000 (Building Cost only) • Participated with HAFB and Davis County in a functional EOC exercise on May 20 to prepare for the planned 2009 Open House and Air Show at the Base. The exercise scenario focused on a natural and technological hazards event on base during the air show. • The Clinton Fire Department conducted an open house on October 1st and distributed all hazards safety information to attendees.
	2010	• Clinton City Cert established May 2010 • The Clinton Fire Department conducted an open house on September 30th and distributed all hazards safety information to attendees. • Conducted 1 Community Emergency Response Team (CERT) courses this year with Mock Disaster event at the end of the course. • Aug.11-10 Davis County Train the Trainer class for Instructors. Held at Layton Fire Dept. Clinton had 4 participants certified as Cert instructors.
	2011	• Conducted 4 CERT courses this year with Mock Disaster events at the end of each course. • The Clinton Fire Department conducted an open house on October 6th and distributed all hazards safety information to attendees. • Monthly CERT refresher training - These training classes are for all Certified CERT Team members. To continue practicing and updating their skills. Using the CERT Training manuals and FEMA's 4 Fundamental Table Top Exercises as a guide. • Participated in the Utah Great Shakeout with Clinton Elementary school. They conducted an Evacuation drill off school property. • CERT - Basic Hazmat training on decontamination taught by Clinton Fire. • CERT invited to participate in Clinton 4th ward Preparedness Fair. Demonstrated splinting with cardboard, first aid, water storage and disinfection. • Davis County Train the Trainer classes Sept.9th and 10th. Will be held in Kaysville Fire station. Instructors have to be recertified. New FEMA Cert manuals coming out. Clinton had 5 taking certifications.
	2012	• Purchased Parlant Emergency Alert Messaging System. Now called Cloudspeaker. Cost $10,163.00 annually. This system gives the City the ability to communicate with the Citizens of Clinton in the event of an emergency or disaster via, Phone, Text or E-mail. • Conducted 3 CERT courses this year with Mock Disaster events at the end of each course. • The Clinton Fire Department conducted an open house on October 4th and distributed all hazards safety information to attendees.

Jurisdiction	Year	Activity
	2013	• The Clinton City Police Department conducted lockdown drills with at least one Elementary School in our response area annually. • The Clinton Fire Department conducted an open house on October 3rd and distributed all hazards safety information to attendees. • Monthly CERT refresher training - These training classes are for all Certified CERT Team members. • The Great Shake Out. April 17th. Clinton Fire Department and CERT participated in an emergency evacuation drill with Country Pines Assisted Living. 47 residents evacuated. With everyone's help it took 11 minutes. • CERT Participated in Clinton 26th Ward Preparedness fair. • The Clinton City Police Department conducted lockdown drills with at least one Elementary School in our response area annually. • Conducted 4 Community Emergency Response Team (CERT) courses this year with Mock Disaster event at the end of the course.
	2014	• In 2014 Davis County made significant improvements to the main storm drainage channel on 2050 North, greatly improving capacity and reducing the need for maintenance. This improvement will eliminate the flooding incidents that occurred during major storm events in the past. • Participated with HAFB and Davis County in a functional EOC exercise on May 14th to prepare for the planned 2014 Open House and Air Show at the Base. The exercise scenario focused on a natural and technological hazards event on base during the air show. • The Clinton Fire Department conducted an open house on October 2nd and distributed all hazards safety information to attendees. • Monthly CERT refresher training - These training classes are for all Certified CERT Team members. • Cert Community Preparedness Fair Feb. 21st at Clinton Recreation Center. 10 am to 3:30 pm. Cert Demonstrations: Splinting on a Shoe String, Water Storage and Disinfection, Shelter in Place, Importance of Sanitation Portable Potty, and Portable Wash basin. Demo on 3 killers. How to Open Airway, stop spurting blood, recognize Shock. Vendors: Goal Zero Supplies, Honeyville Farms Wheat Grinding, Beehive Honey. Lectures Hourly: How to Make a Root Cellar, how to make Butter, Radon Gas can kill get kit and test, All about Honey and Beehives, USU Canning tips, Water Barrels and Home storage. Clinton Fire Department gave a demonstration of how to knock down a fire. • The Clinton City Police Department conducted lockdown drills with at least one Elementary School in our response area annually. • Registered for Be Ready Utah. The Great Shake Out. Apr. 17th at 10:15 am. Clinton City has asked Cert to help with urging everyone to go on line and sign-up for Clinton City Alert Messaging System. Take flyers around neighborhoods. Help neighbors post their info on website. • Participated in the American Red Cross Green to Red Program. 8 CERT Members

Jurisdiction	Year	Activity
	2015	started the program. • Conducted 4 Community Emergency Response Team (CERT) courses this year with Mock Disaster event at the end of the course. • The Clinton Fire Department conducted an open house on October 1st and distributed all hazards safety information to attendees. • Clinton City is in the process of completing a roadway project on 3000 west. This project is part of a larger project beginning on the south end in Syracuse continuing through West Point and Hooper with a new stretch of road completing the connection into Roy. This new connection North to Roy not only provides much greater mobility to residents on the west side of Clinton City but it also provides a possible evacuation route in the event of a disaster. • This Clinton City section of this project was funded primarily through federal highway funds with a matching portion from Clinton City. The total project cost was in excess of $4,000,000. • Participated in the UTA "Double Cross Mock" Drill in Wood Cross and the Front runner Station. Front runner train hit chemical tanker truck. • August 2015 Clinton City Water purchased 2 portable chlorine injection pumps that will allow for the injection of chlorine into strategic areas of the water system if another incident of contamination occurred. Staff recognized that Clinton needs at least two of these types of injectors to be more capable of providing quick sterilization to localized areas of our water system, if the need ever arises again. The cost per pumps was $5,595. • In April of 2015 Construction began on an addition to the Clinton City well and pumphouse. This addition contains a gas chlorinator, all pumps, plumbing, electrical and necessary telemetering equipment. This system gives Clinton City water personnel the ability to increase the level of chlorine residual in the water that is purchase from the primary water supplier (Weber Basin Water) and the raw water that is pumped from the adjoining Clinton City Well. This major improvement to the Clinton City Water System was completed in December of 2015 at a cost of $297,000. • Several sections of 35 year old ductile iron water mainline that is failing has been replaced over the last few years including projects on 2300 N, 3000 W, 2000 W 800 N, 1000 W. These rusted out, leaking sections have been replaced with C900 plastic mainline. • During the 2015-16 budget year Clinton City purchased a new aerial bucket lift truck that is used for trimming trees, repairing street lights and other Miscellaneous jobs. This truck would have many possible uses during an emergency. • Monthly CERT refresher training - These training classes are for all Certified CERT Team members. • The Clinton City Police Department conducted lockdown drills with at least one Elementary School in our response area annually. • Conducted 4 Community Emergency Response Team (CERT) courses this year with Mock Disaster event at the end of the course. • CERT Community Preparedness Fair. Saturday February 21st at Clinton Recreation Center. 9:30 am to 4:00 pm.

Jurisdiction	Year	Activity
		• Cert Demonstrations during the Day. Splinting on a Shoe String. Splinting with Pillows, Cardboard, Sticks or boards. First Aid. Opening an Airway, How to stop Spurting Blood. Recognizing shock and what to do about it. How to Shelter in place. Emergency Sanitation, Water Storage and Disinfection. How to renew old water. • Hourly Lectures: How to Make a Root Cellar. How to make Butter. And many other survival ideas. Beekeeping. How to store Honey, and how long. Keeping the Hive Healthy. Radon the Silent Killer. Get Radon Test kit at Davis Co. Health Dept. Test for Radon. Cooking without Heating Without power. Water Storage. What types of barrels? USU extension Service. Deadly sins of Canning. 12 steps for successful canning. Estimated 200 people attended. • Cert attended Clinton 7th Ward Preparedness and dinner. We were asked for comments. How Cert strengthens the Community. Cert members are someone with the knowledge to help at any time. Not just disasters. Cert continues to train for the good of the community. • Two Clinton City employees and one volunteer attended the FEMA Davis County Community specific training. Earthquake Response and Recovery course at EMI in June 2015.
Farmington		
Fruit Heights	2010-2015	• **Water Projects** Water Line Loop Main and Nicholls to Main and Fairyway Cove $85,000.00 Water Line replace (Asbestos Cement) & upsize Nicholls and Highway 89 to Nicholls and Main $270,000 • **Storm Drain Projects** Detention Basin and Storm Drain Line lower Nicholls Rd $180,000 • **Other Mitigation Projects** Fruit Heights installed a new backup generator at the public facility $21,000. Updated City Hall which is also the EOC to better serve in an emergency $32,000 Updated radio with a repeater to get better communication $5,200 Updated EOP in 2015 Provide training for CERT and other programs 2 times per year Annually participate in the Utah Shakeout Earthquake Exercise 2015 created a fire break road along the foothills approx 1 mile $20,000 2016 plan on extending fire break road another 1.5 miles est. $35,000
Kaysville	2009-2016	• The Kaysville Police Department has completed the following task in order to support the emergency management efforts in Kaysville City, Davis County. • Construction of new Kaysville Police Department with an Emergency Operation Center completed March 2015 • Conducted Emergency Operations form the EOC for the Kaysville/Fruit Heights 2015 4th of July Parade. • Conducted CERT training course September 2015 • Conducted CERT training course February 2016

Jurisdiction	Year	Activity
Layton City (Layton City regularly coordinates natural disaster mitigation with neighboring jurisdictions as part of the Northern Utah Homeland Security Coalition, Region 1.)	2009	• Conducted a tabletop exercise on March 31, using a mudslide scenario on the City's east side. This part of the city was identified in the 2009 PDM Plan as having a high-risk for slope failure. The city Emergency Operations Plan (EOP) was revised to reflect the lessons learned from this exercise. • Participated with HAFB and Davis County in a functional EOC exercise on May 20 to prepare for the planned 2009 Open House and Air Show at the Base. The exercise scenario focused on a natural and technological hazards event on base during the air show. • Conducted 5 Community Emergency Response Team (CERT) courses this year to better prepare citizens to respond to natural threats. • The Layton Fire Department conducted an open house on October 14 and distributed all hazards safety information to attendees. • Participated in monthly County Coordination meetings with the focus on better preparation for natural and technological hazards. The April meeting focused on the Davis County earthquake threat.
	2010	• In conjunction with Davis County and other jurisdictions, participated in an orientation from Utah Division of Emergency Management (DEM). To prepare for the planned 2012 Great Utah "Shakeout" Earthquake Exercise, the orientation included distribution of updated HAZUS maps with accompanying casualty and property damage projections. The 2009 PDM Plan was referenced during the discussion. • Conducted an earthquake orientation exercise on June 22, to test emergency response. • Conducted emergency drill in Layton Area Number 6 simulating damage assessment following an exercise on September 18. • Conducted a functional exercise on September 25 in the Layton East District to test rapid damage assessment and communications with the City and local churches. Conducted 4 CERT courses this year. • Established a Citizens Corps Council in 2010 to better prepare residents for response and recovery for all hazards. • Conducted a Ready Your Business workshop on March 15-16 to coordinate with the private sector on all hazards emergency response. • Distributed more than 17,000 brochures in March, to residents informing them about natural hazards and to encourage involvement in emergency preparedness.
	2011	• Conducted a Volunteer Coordination Center (VCC) tabletop exercise February 10. The exercise was designed to test the city's ability to manage volunteers following a natural or technological threat. • Hosted a Be Ready Utah Business Workshop June 14-15 to coordinate between the public and the private sector. • Hosted a City Preparedness Fair June 29, natural hazards information was provided to attendees. • Conducted a Training and Exercise Planning Workshop (TEPW) September 28, to assess natural hazards, vulnerabilities, and capabilities. • Conducted 7 CERT courses this year.

Jurisdiction	Year	Activity
	2012	• Conducted TEPW workshops in January, February, and March for preparation for the Utah "Shakeout" Earthquake Exercise in April. Post exercise TEPWs and evaluations were conducted in May, September, and November. An ATC-20 training course was conducted by DEM in August for building officials. • Conducted 11 CERT courses this year. • Hosted an Employee Preparedness Fair in June. • Hosted the annual Fire Safety Open House in October. Over 3,000 attended. Natural Hazards information was distributed. • Hosted a Be Ready Utah workshop in June for the business community.
	2013	• Conducted regular TEPW meetings throughout the year to prepare for, or evaluate and revise, the EOP for the Shakeout exercise in April. • Upgraded the EOC management software and revised the City Emergency Operations Plan this year. • Participated in the Utah "Shakeout" Earthquake Exercise April 17-18. • Conducted a wildfire simulation exercise for Adams Canyon June 6. • Hosted the annual Fire Safety Open House in October. Over 3,000 attended. Distributed 500 Be Ready Layton bags containing Natural Hazards information. • Drafted an Interlocal Agreement between Layton and Brigham City to mutually house computer backup software and hardware at each other's data facilities that would aid in recovery in a timely manner from a catastrophic event, as part of the continuity of operations plan. • Conducted 3 CERT courses this year.
	2014	• Conducted regular TEPW meetings throughout the year to prepare for, or evaluate and revise, the EOP for the "Shakeout" exercise in April. • Conducted a tabletop exercise June 19 at the alternate EOC. • Hosted an Emergency Preparedness Fair June 18, distributed National Hazards information to all participants. • Hosted the annual Fire Safety Open House in October. Over 3,000 attended. • Conducted 7 CERT courses this year.
	2015	• Conducted regular TEPW meetings throughout the year to prepare for, or evaluate and revise, the EOP for the Shakeout exercise in April and the FEMA IEMC in June. • Eight Layton City employees attended the FEMA Earthquake Response and Recovery course at EMI in June. • Participated in 2 Virtual Table Top Exercises (VTTX) exercises. The scenarios involved a 6.4 magnitude earthquake, a large office building collapse, severe infrastructure damage citywide, and associated recovery efforts. • Conducted 6 CERT classes in the first quarter. • The City has upgraded their 911 system with the Smart911 software. While this software is not a mass notification system, it is going to be beneficial in the event of a disaster on incoming calls. The city utilizes a Dialogistic Emergency notification system program. Additionally, the City also utilizes the internet based GeoCast Web and NXT, significantly adding additional simultaneous phone line capability than the previous standalone system. This upgrade effectively mitigates against the single point failure in the 911 system that the City experienced about 5 years ago.

Jurisdiction	Year	Activity
		• The City is also implementing a CAD2CAD project. • The City is also working together with the Davis County's Sheriff's Dispatch and Clearfield City on a grant for a shared 911 phone system, which will provide backup capability and improve redundancy in the system. • The Utah Communications Authority (UCA) is upgrading the microwave system in Davis County, which will provide redundant radio communication over the network. Currently, severe weather can temporarily take down 800 MHz communications in the county. This upgrade eliminates that. • The City has a fire station alerting system that allows any Public Safety Alert Point (PSAP) to activate fire station tones at any station in the county. **Public Works - Water System Mitigation Projects** • The water infrastructure improvements that the City has developed between 2008-20015 are extensive, totaling approximately $6.2 million. • Each of these projects involves replacing and/or constructing new infrastructure. • By replacing existing infrastructure, the design life of the asset is increased and • lessens the possibility of damage or of total loss following an emergency incident. For example, the existing East Layton water tank was in poor condition and determined to be at a high risk of catastrophic failure from a seismic event. It was replaced with a new 2 million gallon water tank at a cost of $2.44 million. The new water tank complies with current building code and design standards and is better equipped to handle a sizeable earthquake. Also including in this project was a new pump station and water line along Gordon Avenue that provides an alternate water delivery system to improve water/fire flow in the East Layton portion of the City. • Existing water systems on Cherry Lane, Cottonwood Drive, Fort Lane, Gentile Street, Wasatch Drive, Kays Creek Drive were also reconstructed for seismic resistance totaling $626,636. • New water lines were constructed on the Layton Parkway, North Fairfield Road, and South I-15 Project on Main Street that provides redundancy and fire protection in those areas of the community during an emergency event. • A new connection was developed to Weber Basin Water as an additional source for the 4 million gallon tank on the west side of the City. This improved pressures in the system and will provided the necessary flow/pressure to mitigate fires. • The City replaced and performed rehabilitation to its culinary wells to improve water and power efficiency for the system. With the construction of telemetry at pressure reducing stations, water system managers are better able to monitor and control culinary water and fire fighting systems during an emergency event. • The City is updating the water master plan and evaluating all water resources to meet the needs of the residents. **Stormwater and Flooding Mitigation Projects** • Approximately $7.18 million has been spent by the City on its stormwater and flooding infrastructure to mitigate against future flood threats in the City. • The City participated with Davis County, Holmes Creek, and Kays Creek developers to

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<tr><th>Jurisdiction</th><th>Year</th><th>Activity</th></tr>
<tr><td></td><td></td><td>construct new storm drain inlet facilities at the mouth of the canyon and to construct a new storm drain pipe to the reservoirs to manage and retain high flows in the channels in Hobbs Creek and Holmes Creek Reservoirs at a cost of $417 thousand. Kays Creek Irrigation District participated with a grant and provided labor for the construction. The City provided design, surveying, and construction management.
• The City took ownership from the County and enlarged the Fairfield and Adamswood stormwater basins and upgraded pipelines and drainage at the Chelsie Park detention pond to mitigate against future flooding. Stormwater detention basins were constructed at Greyhawk, Hillfield, 1200 west, and the Conference Center. The City also reimbursed developers for the construction of detention basins that helps to mitigate against flooding.
• New storm drain systems installed in new and existing roads totaled more than $5.37 million. These improvements increase the storm systems capacity and reduce flooding to homeowners during storm events.
• The City acquired a new Hyrdo Excavator to assist with maintaining the storm drain system to reduce flood potential.</td></tr>
<tr><td>North Salt Lake</td><td>2008-2015</td><td>Infrastructure Projects
Water Projects
<table>
<tr><th>Year</th><th>Project #</th><th>Project Description</th><th>Cost</th></tr>
<tr><td>2008</td><td>06-022</td><td>5480 Reservoir</td><td>$362,093.14</td></tr>
<tr><td>2008</td><td>06-032</td><td>1100 North Well Replacement</td><td>$257,093.22</td></tr>
<tr><td>2008</td><td>07-019</td><td>1100 North Well Pump Building</td><td>$375,423.18</td></tr>
<tr><td>2008</td><td>07-018</td><td>Pumps Upgrade at 350 E</td><td>$38,869.82</td></tr>
<tr><td>2008</td><td>07-049</td><td>Transmission Line: 3800 S</td><td>$640,079.68</td></tr>
<tr><td>2008</td><td>08-005</td><td>Morton 2MG Reservoir</td><td>$1,851,491.88</td></tr>
<tr><td>2008</td><td>08-050</td><td>Hughes Well</td><td>$445,342.41</td></tr>
<tr><td>2008</td><td>08-064</td><td>Morton Pump Station</td><td>$318,730.20</td></tr>
<tr><td>2011</td><td>11-037</td><td>Orchard Dr Water Line - Eaglewood Village to Center Street</td><td>$607,499.01</td></tr>
<tr><td>2011</td><td>11-038</td><td>Center Street Water Line - UPRR to US-89</td><td>$223,916.53</td></tr>
<tr><td>2013</td><td>13-022</td><td>1100 North Water Line - Main Street to Overland Road</td><td>$173,431.88</td></tr>
<tr><td>2013</td><td></td><td>1100 North Water Line - 400 West to Main</td><td>$496,989.20</td></tr>
<tr><td>2015</td><td>15-006</td><td>UDOT water line betterment @ 2600 South</td><td>$341,504.26</td></tr>
<tr><td>2015</td><td>15-026</td><td>400 East Water Line Cottontree to 900 North</td><td>$195,108.87</td></tr>
</table>
Storm Water
<table>
<tr><th>Year</th><th>Project #</th><th>Project Description</th><th>Cost</th></tr>
<tr><td>2011</td><td>11-017</td><td>Lacey Way Storm Drain</td><td>$128,954.31</td></tr>
<tr><td>2014</td><td>14-019</td><td>Nathan Clark Detention Basin</td><td>$28,881.10</td></tr>
<tr><td>2014</td><td>14-031</td><td>Pipe open ditch at Hughes Truck Shop</td><td>$19,864.00</td></tr>
<tr><td>2014</td><td>14-056</td><td>High Rustler Storm Drain - Pipe open ditches at Center and Redwood</td><td>$319,650.84</td></tr>
<tr><td>2014</td><td>14-055</td><td>Golf Hole #13 Flooding Protection</td><td>$26,882.10</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Jurisdiction</th><th>Year</th><th colspan="4">Activity</th></tr>
<tr><td></td><td></td><td>2015</td><td>15-028</td><td>Golf Hole #11 Flooding Protection above Crestpoint 3 subdivision</td><td>$5,000.00</td></tr>
<tr><td></td><td></td><td>2013</td><td></td><td>Deer Hollow Detention Basin</td><td>$1,232,329.63</td></tr>
<tr><td></td><td></td><td colspan="4">Other</td></tr>
<tr><td></td><td></td><td>Year</td><td>Project #</td><td>Project Description</td><td>Cost</td></tr>
<tr><td></td><td></td><td>2010</td><td></td><td>New City Hall Building</td><td>$5,505,443.21</td></tr>
<tr><td></td><td></td><td>2013</td><td></td><td>Upgrade of PW radios to narrow band</td><td>$9,679.80</td></tr>
<tr><td></td><td></td><td>2015</td><td></td><td>City Wide WIFI Project to link city buildings over high speed wireless</td><td></td></tr>
<tr><td>South Weber</td><td>2010-2015</td><td colspan="4">Infrastructure Projects

2010
• Fire hydrant replacements; $10,000
2011
• Fire hydrant replacements; $10,000
2012
• Fire hydrant replacements; $10,000
2013
• Fire hydrant replacements; $10,000
2014
• Fire hydrant replacements; $10,000
2015
• New Public Works dump truck; $141,113
• Leak detection on water lines; $10,000
• Fire hydrant replacements; $10,000

Training/Outreach

• 2011 – Table Top Exercise
• 2012 – Table Top Exercise, Utah ShakeOUT, Block Captain Exercise
• 2013 – Utah ShakeOUT Exercises
• 2014 – City Watch test, Table Top Exercise
• 2015 – Utah ShakeOUT Exercise, CodeRED test, 3 staff members went to IEMC at EMI, 1 Council Member went to EMI, passed out flyers to the public about the new CodeRED system at the City Country Fair Days (also advertised on City website & social media)</td></tr>
<tr><td>Syracuse</td><td></td><td colspan="4"></td></tr>
<tr><td>West Bountiful</td><td>2009-2015</td><td colspan="4">The City expended more than $2.1 million to upgrade vulnerable water, sewer, and stormwater infrastructure, 2009-2015 for earthquake mitigation. Also, conducted or participated in the following:
• West Bountiful Safety Fair – July 2012
• South Davis Preparedness Fair – October 2012
• West Bountiful Safety Fair – July 2013
• West Bountiful Safety Fair - July 2014
• South Davis Preparedness Fair – September 2014
• Lakeview Hospital Health Fair – May 2015</td></tr>
</table>

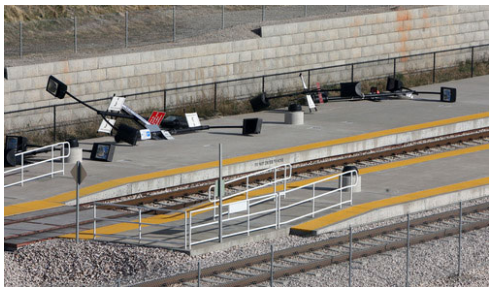
Jurisdiction	Year	Activity
		• West Bountiful Safety Fair – July 2015 Participants in these events received natural hazards information. Organized an Emergency Preparedness Advisory Committee in 2013. The purpose of the committee was to engage the citizens in the decision making process involving the emergency readiness. Monthly meetings are held. Through this organization the city has started training city employees and CERT members that are on the EmPAC board in Spontaneous Volunteer Management and a Red Cross First Aid Instructor course. Ongoing coordination with the school district for natural hazards preparedness and mitigation.
West Point		
Woods Cross	2009-2015	The following projects have been completed by Woods Cross to update critical infrastructure for earthquake resistance. **Water**: • Drinking water well, 1000 gpm w/standby generator - $1.5 million • 3.14 million gallon storage facility - $3 million • 2000 gpm Water Treatment Facility - $5 million These improvements ensure that Woods Cross City Water System can be self-supporting, should Weber Basin Water be lost. These 3 wells have a total capacity of 3,500 gpm, and the city has a total water storage of 7 million gallons. The city reviews and updates the Water System Emergency Response Plan annually to include employee training. A new Water Shortage Plan will be developed with respect to climate change in 2016. **Public Works Facility:** The city is building a new Public Works facility, utilizing current seismic building codes with a seismic rating and sustainability features. This facility is projected to cost $4 million.

Jurisdiction	Year	Activity
		Storm Water: The city has expended nearly $450,000 to install storm water infrastructure upgrades. The city has organized a Citizen Corps Council which meets monthly to discuss and promote preparedness activities. Woods Cross has been divided into Districts and Areas, with encouragement to develop Block Captains. • The city purchased UHF radios and frequencies ($4,500) for City-District and CERT District communication. • Each CERT District spent $850 for radios. The city participated in South Davis Preparedness Fair in 2011 and 2013. CERT promotional booths were set up at the Memorial Day Celebrations in 2013 -2015, Night Out With the Police 2014-2015, and preparedness fairs in 2011 and 2013. Natural hazards preparedness information was distributed to attendees at these functions. • CERT classes were conducted in the Fall of 2014, and the Spring of 2015. • CERT Training/Preparedness classes, nearly monthly since Fall 2013 • District/ Area Block Captain training for Woods Cross North District, Spring 2015 • Block Captain Training and Exercise for Area 11, June 2015 • City employee participation in the State Shake-Out, 2013-2015 • City Citizen Corp Communications check with District leaders, monthly since May 2015 The city coordinated with hazardous pipeline groups to map pipelines, and promote a media campaign on awareness and safety of pipelines in 2013.
		•

2011 Davis County Wind Event Disaster FEMA DR-4053

The strongest winds since 2000 ripped through Utah Thursday, December 1, 2011. Hurricane-force winds were widespread, with gusts that were clocked at more than 100 mph in Davis County. The cold winds pouring westward over the Wasatch Mountains flipped semis, uprooted trees, ripped up roofs and downed power lines in Weber, Davis and Salt Lake counties.

The east-to-west wind storm was caused by a cold air mass coupled with a high-pressure system in Wyoming and low pressure in southern California and Nevada. The unusual pressure imbalance set up cold winds that were channeled from the high pressure to the low.



The winds were fiercest in places where the mountain range is relatively narrow, such as Centerville, where gusts hit 102 mph. Weber and Davis counties were particularly hard hit, according to the weather service, where wind gusts above 60 mph were not uncommon.

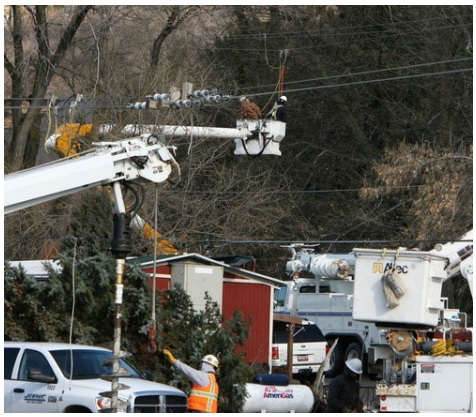
Initial estimates exceeded $20 million in damages to homes, businesses, and public infrastructure in Davis County. Preliminary damage estimates to city and county-owned buildings and other property in Davis County is easily at $3.5 million. Centerville, Farmington, Kaysville, Fruit Heights, and Bountiful all declared a disaster. Following, Davis County officials declared a disaster, requesting Federal Emergency Management Agency (FEMA) assistance. That declaration required a review by the state and a preliminary damage assessment by FEMA teams reviewed damage claims. At Farmington City Hall, the concrete tiles on the roof acted like missiles, there were 15 to 20 embedded tiles that went through shingles, wood, membranes. More than 50,000 Rocky Mountain Power customers lost power in the incident.

Government damage estimates

- Centerville: $8 million
- Farmington: $6 million
- Davis County: $3.5 million
- Bountiful: $4 million

Davis County peak wind gusts reported by the National Weather Service included: Centerville, 102 mph; West Bountiful, 92 mph; Bountiful, 78 mph; Hill Air Force Base, 69 mph; Kaysville, 65 mph.
(Source: *The Salt Lake Tribune*, December 1, 2011, KSL.com)

A FEMA Public Assistance Disaster Declaration was made February 1, 2012 and signed by President Obama.



2011 Davis County Wind Disaster FEMA DR-4053		
Jurisdiction	**Damages**	**Expenditures**
Bountiful		$1,978,318.33
Centerville		$271,265.34
Central Davis Sewer District		$32,317.31
Davis County		$236,488.27
Davis County School District		$504,116.44
Farmington		$211,970.39
Fruit Heights		$167,631.24
Kaysville		$682,224.86
North Salt Lake		$15,658.75
South Davis Fire Station 1		$18,220.36
South Davis Sewer District		$8,601.49
Utah Department of Transportation		$212,222.47
Utah Transit Authority		$260,822.54
Wasatch Integrated Waste Management District		$400,860.22
West Bountiful		$91,493.37
TOTAL		**$5,263,598.69**

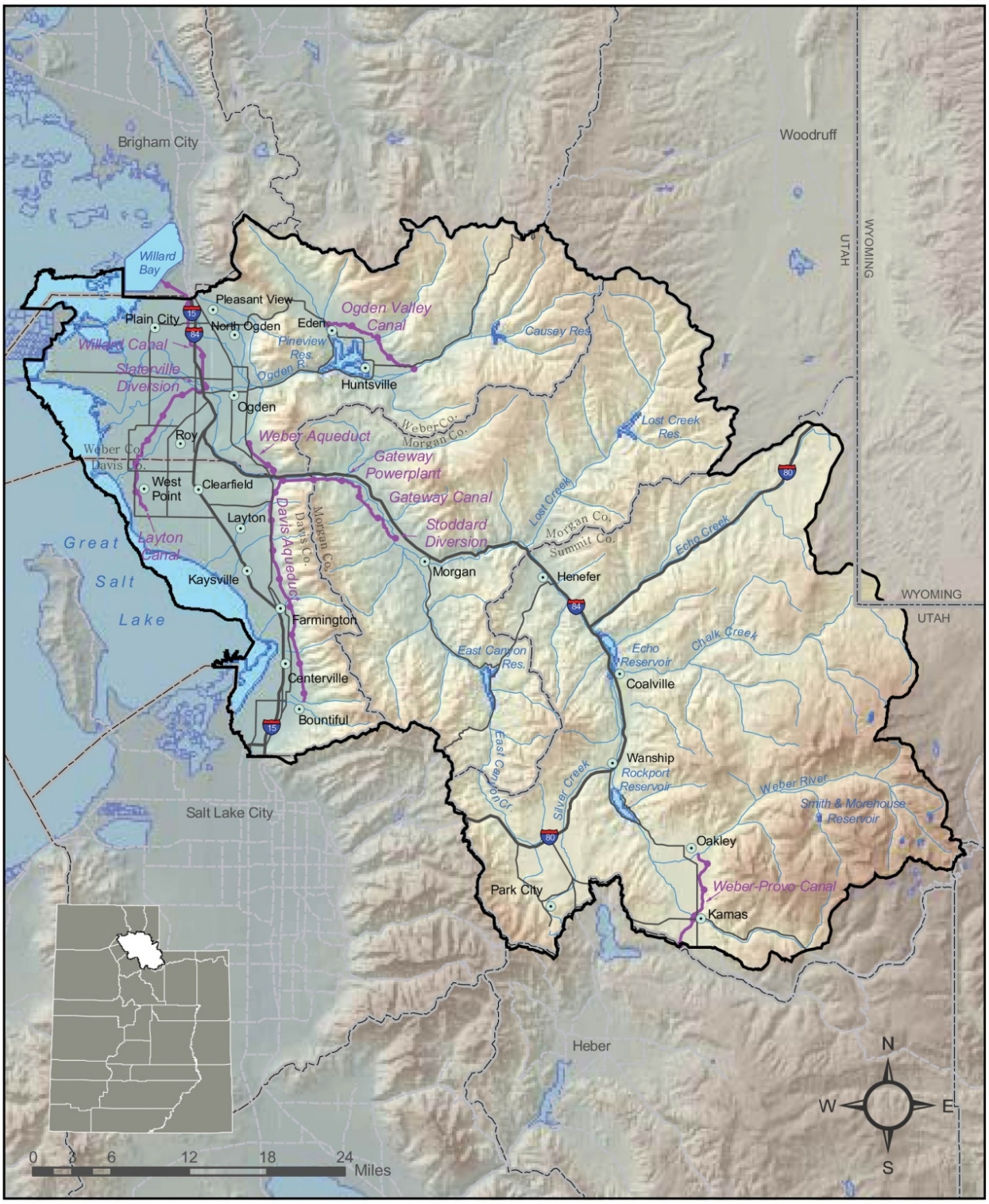
Weber Basin Water Conservancy District

The Weber Basin Water Conservancy District (WBWCD) was created on June 26,1950, by a decree of the Second District Court of Utah, under the guidelines of the Utah Water Conservancy Act. The District was formed to act as the local sponsor of the federal project and to further supply water resources to the population within its boundaries. The original project, including reservoirs, canals, irrigation and drainage systems and power plants were constructed by the Bureau of Reclamation from 1952 through 1969. The Weber Basin Water Conservancy District covers over 2,500 square miles within five counties: Davis, Weber, Morgan, Summit and a part of Box Elder.

Weber Basin delivers approximately 220,000 acre-feet of water annually: 60,000 acre-feet for municipal and industrial uses and 160,000 acre-feet for irrigation, which includes secondary pressure irrigation systems. The District operates seven large storage reservoirs which store approximately 400,000 acre-feet of the District's water. The reservoirs are: Causey, East Canyon, Lost Creek, Pineview, Smith & Morehouse, Wanship and Willard Bay. Due to the later priority of the District's water rights on the river systems, it is necessary to have storage volume equal to a two year water supply. The District operates three hydro-power generation plants that can produce up to about 8 megawatts of electricity. Also operated and maintained are over 79 miles of canals, a trans-mountain tunnel, two multi-county aqueducts, hundreds of miles of raw water and culinary pipelines, and nine major pumping stations. The District is unique for its ability to serve five classifications of water service, including agricultural water (flood and pressure), drinking water, industrial supplies, groundwater replacement and pressurized/ secondary water.

Three drinking water treatment plants and related distribution systems were also constructed by the District between 1959 to 1962. They have all undergone extensive rehabilitation and modernization projects to meet new EPA drinking water standards. The District currently provides culinary water to approximately 425,000 people in the five counties. In addition to the treatment plants, the District operates 17 deep, large capacity wells to increase supply and capacity to the District's customers. Depths are up to 1,200 feet and capacities up to 5,000 gallons per minute. Weber Basin Water acts as a wholesaler of drinking water to cities, and other districts and agencies. These entities then deliver to the tap of individual users.

Future issues for the District center around development of sufficient water supplies and facilities to meet the needs of the growing population within its boundaries. Water conservation plays an increasingly important role as new sources are likely to be difficult and expensive to develop. Water demands on the District are projected to double in the next 40 years even with the assumption that the existing per capita use will reduce significantly. These projections, along with the constant need to upgrade and rehabilitate existing infrastructure, push the financial needs projections to one half billion dollars over the next 30 years. Beyond conservation, new projects will include completion of groundwater drilling, change of use of local river supplies and probably a large regional importation project.


Brigham City
Woodruff
UTAH
WYOMING
Willard Bay
Pleasant View
Plain City
North Ogden
Eden
Ogden Valley Canal
Causey Res.
Willard Canal
Pineview Res.
Ogden R.
Statesville Diversion
Huntsville
Ogden
Roy
Weber Co.
Davis Co.
Weber Aqueduct
Morgan Co.
Lost Creek Res.
Gateway Powerplant
Gateway Canal
West Point
Clearfield
Layton
Davis Aqueduct
Stoddard Diversion
Lost Creek
Summit Co.
Echo Creek
Layton Canal
Great Salt Lake
Kaysville
Morgan
Henefer
Farmington
Chalk Creek
East Canyon Res.
Echo Reservoir
Centerville
Coalville
Bountiful
Wanship
Rockport Reservoir
Weber River
Smith & Morehouse Reservoir
Salt Lake City
Silver Creek
East Canyon Cr.
Oakley
Park City
Weber-Provo Canal
Kamas
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Mitigation Plan

The risk assessment for the WBWCD MMP has resulted in the identification of areas in the District's system which are vulnerable to damage due to natural disasters. Using the methodology described below, the District has prepared a ten year mitigation plan to implement the highest benefit natural hazard mitigation projects. Projects that the District has identified as high priority projects are listed in the table below.

Ten Year Natural Hazard Mitigation Project Plan Summary

Project Priority	Project Description	Mitigation Cost Estimate	Schedule for Design and Construction (1, 3)
1	Seismic Retrofit of the Davis South Water Treatment Plant Filter Building (2)	$1,023,000	2010 to 2012
2	Seismic Retrofit of Transformers, Switchgear and MCC's at High Priority Pump Stations and Wells (2)	$122,000	2010 to 2012
3	Seismic Retrofit of Culinary Wells	$318,000	2011 to 2014
4	Layton Canal retrofit to accommodate lateral spreading concerns (4)	$1,000,000/mile	2010 to 2012
5	Seismic Retrofit of Water Tanks	$3,380,000	2014 to 2016
6	Seismic Retrofit of Remaining Deficiencies in Water Treatment Plants	$330,000	2014 to 2016
7	Seismic Retrofit of Filter and Flocculation Basins	$3,048,000	2016 to 2020
8	Seismic Retrofit of Pump Stations	$660,000	2016 to 2020
9	Installation of Emergency Shutoff Valves in the Davis and Weber Aqueducts	To be determined	2018 to 2020
10	Perform Fault Crossing Study for Aqueducts (5)	$200,000	2012 to 2014
11	Retrofit of Replacement of Culinary Water Trunk Lines Located in Landslide Areas	To be determined	2011 to 2020
12	Conduct Emergency Repair Needs Study for Culinary and Secondary Water Lines (6)	$20,000	2012
13	Purchase of additional repair materials and emergency response training as defined by future studies	To be determined	2011 to 2020
14	Seismic Retrofit of Power Plants	$51,000	2011 to 2012
15	Landslide Retrofit of the Gateway Canal (7)	$2,200,000	2016 to 2020
16	Study Creation of additional system redundancy and disaster response resilience through construction of additional water storage tanks (8)	$100,000	2017 to 2020
17	Creation of additional system redundancy through construction of alternative water supply sources on the West Site of the Wasatch Fault System	To be determined	2020 or later

1) The District intends to pursue a number of methods for funding these projects, of which FEMA PDM funding will be an important component. Therefore the actual implementation schedule for these projects may vary and will be updated as projects are funded and completed. 2) This project has been identified by FEMA for PDM 2010 funding. 3) Costs estimates are in 2010 dollars. 4) This project will be included in a Bureau of Reclamation Funded Canal Lining Project. 5)Cost shown is estimated cost for study only. 6) Cost shown is for study

of piping repair material needs for culinary and secondary trunk lines. 7)This project was submitted for PDM funding in 2009, but not approved at that time. The project will be resubmitted in the future. 8) Cost shown is for study only.

Projects Completed 2010-2015	Total	Federal Money
Nonstructural Seismic Retrofit Project	$122,200.00	$91,650.00
11 Culinary Wells seismic Retrofit Project	$291,807.00	$208,497.25
12 MG Tank Vault Seismic Retrofit Project	$94,020.00	$70,515.00
Davis South Filter Building Seismic Retrofit	$1,054,043.55	$589,686.75
Aqueduct joint repairs	$445,954.50	
Update Communications Plan	$500.00	
Replace District Offices	$5,077,000.00	
Update security of facilities	$1,000,000	
Subtotal	**$8,085,525.05**	
Ongoing Projects		
Gateway Canal Stabilization & Lining	$100,000.00	per year
Aqueduct Condition Assessment	$200,000.00	
Replacement of Valves & Structures	$50,000.00	
Seismic Retrofit of Backwash Tanks	$150,000.00	
Security of Facilities	$200,000.00	
Subtotal	**$700,000.00**	
Long Term Projects		
Seismic Retrofit of Remaining Water Tanks	$100,000.00	
Seismic Retrofit of Flocculation/Sediment Basins	$4,000,000.00	
Seismic Retrofit of Pump Stations	$200,000.00	
New Isolation Valves on the Aqueducts	$500,000.00	
Seismic Retrofit of Aqueducts through the fault	$500,000.00	
Seismic Upgrade of Fluoride Buildings	$200,000.00	
Subtotal	**$5,500,000.00**	

Davis County Integrated Emergency Management Course; Earthquake (IEMC), June 22-25, 2015, National Emergency Training Center (NETC), Emmitsburg, MD

After Action Report – Lessons Learned
Hotwash – July 14, 2015; 8:00 to 9:00 am
Layton City Fire Department

In attendance

Ellis Bruch, Davis County's Sheriff's Office
Kevin Ward, Layton Fire Chief
Scott Maughan, Layton City Fire
Brad Wilkes, Layton City Fire
Jason Hinojosa, Layton PD
Karl Kuehn, Layton City Police Communications
Woody Woodward, Layton City
Stephen Jackson, Layton City
Gary Crane, Layton City
Kent Andersen, Layton City
Jim Mason, Layton City

Strengths:

1. It was a great opportunity to work together and build relationships with our counterparts within Davis County. It was held away from our workplace, which allowed us to stay focused without distractions for four days;
2. It provided a good focus on disaster recovery, which we had not exercised before;
3. We were able to send eleven people from Layton City, increasing the depth of understanding and experience in emergency management, EOC operation, recovery operations for each of the participants;
4. It was a successful course and exercise resulting in significant learning and setting the stage for greater collaboration and planning for Davis County and its cities in the future. Our challenge is to continue to work together with the different jurisdictions in the county.

Areas For Improvement:

1. Key cities, Farmington and Bountiful, should have been in attendance. On one hand this was a challenge, but on another it helped us realize that all entities may not be present in a real disaster, and we may need to do the best we can until they can arrive.
2. Wi-Fi connectivity at EMI was poor. We expected to see adequate Wi-Fi service at FEMA's training facility. Internet and social media should be well used during an incident when it is available. On the other hand, we can't count on it always being available in a disaster situation.
3. It would have been good to know resources available at each of the jurisdictions. This information is available on WebEOC, but connectivity was very slow or non-existent.
4. The exercise started off too slowly and did not involve many of the injects that Ellis had prepared and pre-sent. It could have been run more efficiently.

5. Ellis had sent emergency plans on a hard drive for each jurisdiction, but FEMA did not have that information available at the exercise. Participants expected this material to be available electronically.

Lessons Learned

1. Continue momentum generated by having continuing exercises with jurisdictions in Davis County. Ellis said that the county would like to schedule this same exercise in the near future and continue learning from it. The exercise can include cities that didn't attend the IEMC.
2. Train more on WebEOC and EOC Management Software with EOC participants. Get some generic WebEOC logins for people who are covering for those few who do have WebEOC accounts.
3. Explore the updated IRIS software to better track of resources. We currently use WebEOC .
4. Layton City would like to activate their EOC at least annually. The will consider doing it for each of the annual "ShakeOut" exercises in April. Davis County will consider activating their EOC for a severe snowstorm. Even though it may not be needed, it would be a time when emergency services are under some stress, and could benefit from EOC activation under those circumstances.
5. The EOC Manager needs assistance from a Support Officer. Chief Ward served as a support officer for the IEMC and it was very helpful.
6. Davis County Public Works should exercise with other Public Works departments in the County.
7. Cross train Public Works engineers in conducting emergency building inspections. Woody suggested that Engineering Departments coordinate to get additional building inspectors when there has been a lot of property damage.
8. The county should institute a County-Wide Geographical Information System (GIS). Pre-print large maps of each City for department use while conducting emergency operations. Doug Pierce recently updated the City Atlas for the Police Department. A similar document would be helpful for other departments during an emergency.
9. Involve Utah Department of Transportation (UDOT) and utility companies in City EOC exercises where appropriate.
10. After an incident, if EOC participants can't get to the Layton EOC, consider going to the jurisdiction closest to them where they can help from there.
11. A future exercise should focus on the interface between dispatch and the EOC.

Next Steps

1. Ellis will compile a more complete After Action Report/ Improvement Plan (AAR/IP) from his meetings with the other cities who attended for a review.
2. Ellis will organize a follow-up exercise involving County jurisdictions to continue the momentum.
3. Layton City will discuss lessons learned with Executive Staff and EOC participants to determine specific next steps.

Part V. 2016 MITIGATION STRATEGIES, OBJECTIVES, ACTIONS

Using the findings from the risk assessment and the capabilities assessment as a guide, several mitigation strategies and implementing actions were identified for Davis County. Each action has been formalized and placed into this Plan. These actions were identified in the planning group meetings which included input from the planning team, state and local agencies, county government, city and county residents.

Goals and objectives were developed by the above-mentioned groups with a period provided for comment and revision.

Each of the jurisdictions identified mitigation actions based on the identified goals and objectives. These actions are included in each city/district section of this Plan. The mitigation actions identify the responsible agency, the funding source, timeline, background, and their priority. Actions were selected using the information obtained from the capabilities assessment, which identified existing programs and shortfalls related to mitigation activities. The actions were prioritized based on the Social, Technical, Administrative, Political, Legal, Economic, Environmental (STAPLEE) method identified in the FEMA How-To Guides. The STAPLEE method of prioritization emphasizes the effectiveness of the actions with respect to their cost, as well as their social, technical, administrative, political, legal, environmental, and economic effects. Each action is judged and ranked against these criteria and assigned the priority of High, Medium, or Low.

The following mitigation strategies were formulated by the Davis County PDM Planning Committee. The Committee agreed to improve and expand on the strategies delineated in the 2009 Wasatch Front Regional Council (WFRC) PDM version of this Plan.

Secondary Water System Failure

Problem Identification: Davis County has several secondary water system delivery systems. The Weber Basin Aqueduct transverses the county north to south, carrying several million gallon of water each day to virtually every community. Additionally, several water impoundment ponds provide for pressurized delivery of this water. The failure of either/or the aqueduct or the impoundments could result in a catastrophic flood event.

Goal #1: Reduce the potential impact of a failure of the Weber Basin aqueduct.

Objective 1: Assess the entire length of the aqueduct for potential points of failure.

Action: The Weber Basin aqueduct is more than 50 years old, and requires regular assessment and maintenance. Weber Basin water is also planning to install emergency shutoff valves throughout the system.

Time Frame: 2018 to 2020
Funding: Weber Basin Water
Estimated Cost: To be determined
Staff: Weber Basin Water
Jurisdictions: Countywide

Earthquake

Problem Identification: Davis County is located in the heart of the Wasatch Fault between the shores of the Great Salt Lake and the foothills of the Wasatch Mountain Range. The majority of the population lives within 5 miles of the fault. The only major traffic artery runs north and south, and numerous water and petroleum pipelines either cross over or run within ½ mile of the fault. Five moderately sized petroleum refineries located in the southern end of the county are subject to severe damage from ground movement and liquefaction. A major earthquake in the area would result in hundreds of millions of dollars in damage to residential structures, industry, and of critical infrastructure, and likely some loss of life. Several public safety facilities and schools are seismically unsafe throughout the county. The Davis County Historical Courthouse in Farmington continues to house county offices and host other public events. These facilities pose a significant threat to those who regularly work and attend school in them, and are in need seismic retrofitting.

Goal #1: Provide public education on seismic hazards and mitigation.

Objective 1.1 (Priority HIGH): Conduct community preparedness fairs, community outreach events, and promote resident participation in the annual "ShakeOut" earthquake exercise.

Action: Provide earthquake public education outreach.

Time Frame: Ongoing
Funding: County and City Emergency Management
Estimated Cost: Minimal
Staff: County and City Emergency Management
Jurisdictions: Countywide

Objective 1.2 (Priority HIGH): Improve seismic resilience for public facilities including the Davis County Historical Courthouse.

Action 1: Conduct seismic reviews of the Davis County Historical Courthouse and actively seek mitigation project funding to retrofit and/or rebuild this structure.

Time Frame: 3-7 years
Funding: Mitigation grants, county funding
Estimated Cost: $12 Million
Staff: County Emergency Management/Community Development

Jurisdictions: County

Action 2: Implement structural engineering recommendations to meet seismic standards.

Time Frame: Unknown
Funding: Local, FEMA PDM, State Earthquake Program Grant
Estimated Cost: Unknown until solutions determined
Staff: County operations, County engineer, consulting engineer
Jurisdictions: Davis County/Cities

Objective 1.3 (Priority MEDIUM): Increase quality and quantity of available natural hazards data to facilitate better decision-making.

Action: Revise and update the county emergency operations plan with the updated seismic information and maps.

Time Frame: 1 year
Funding: County
Estimated Cost: Minimal
Staff: County
Jurisdictions: County and city jurisdictions

Problem Identification: Communities need to revise and update their Emergency Operations Plans (EOP) and Standard Operating Guidelines (SOG) to reflect these changes.

Goal #2 – Update and revise local jurisdictions EOPs and SOGs to enhance emergency response capabilities and critical facilities.

Time Frame: Ongoing
Funding: Local funds and EMPG funding
Estimated Cost: Minimal
Staff: City Emergency Managers/County
Jurisdictions: Davis County and local jurisdictions

Action 2: Retrofit high risk Weber Basin Water delivery system aqueduct along the east bench of the county. The Weber Basin Water Conservancy District (WBWCD) has been seismically retrofitting a large portion of their water delivery system, including; a Seismic Retrofit of Filter and Flocculation Basins and Seismic Retrofit of Pump Stations along the aqueduct along the east bench of the county. The WBWCD has received FEMA Mitigation Grant Funding for this project. Exact funding amounts are estimated to be $4 million.

Time Frame: 2016 to 2020

Funding: FEMA Mitigation Grants and WBWCD
Estimated Cost: $4 – 5 Million
Staff: WBWCD
Jurisdictions: County

Flooding

Problem Identification: FEMA has, over the past several years, updated and revised flood hazard maps throughout Davis County. As a result, an increased number of residences are currently located in flood plains. Most of these residents are not fully aware of the change in flood hazard. The County needs to reach out to citizens to provide them with this information

Goal #1: Educate citizens of Davis County about flood hazard.

Objective 1.1 (Priority HIGH): Increase the level of understanding in homeowners, city officials, permit authorities and title companies/realtors.

Action: Develop and publicize about flood hazards and the National Flood Insurance Program (NFIP) and disseminate on the County Emergency Management webpage.

Time Frame: 1 year
Funding: County
Estimated Cost: Minimal
Staff: County Emergency Management
Jurisdictions: County and city

Problem Identification: Debris basins and other flood control infrastructure require regular inspection and maintenance. Stream channels may also change with heavy flow events. Proper flood control measures should be an ongoing priority.

Goal #2: Reduce flood hazard

Objective 2.1 (Priority HIGH): Increase the capacity of streams to better handle runoff.

Action: Clean/ maintain stream channels.

Time Frame: Ongoing
Funding: County
Estimated Cost: Variable
Staff: County
Jurisdictions: County and city

Severe Weather

Problem Identification: Most presidential disaster declarations are the result to severe weather. Davis County is prone to the affects of severe weather as are many other counties in the state. These are usually thunderstorms and snowstorms. However, we are also prone to extremely severe wind events referred to as "East Winds." Historically, Davis County has experienced gusts of over 110 mph and sustained winds of 80+ mph. These can result in millions of dollars in damage. On average we experience at least one every year. Severe storms result in secondary and tertiary problems mostly dealing with power, heating and travel. Severe weather has resulted and will continue to result in serious travel problems, as well as power and heating difficulties.

Goal 1: Assist residents protect themselves from the affects of severe weather and changing global climate.

Objective 1.1 (Priority HIGH): Support programs to prepare residents and elected officials for adverse weather conditions.

Action 1: Encourage all cities to participate in the Storm Ready program.

Time Frame: 1-3 years
Funding: County and City
Estimated Cost: minimal
Staff: County/City Emergency Management
Jurisdictions: County wide

Action 2: Encourage avalanche preparedness for county backcountry users.

Time Frame: 1-6 years
Funding: County
Estimated Cost: Minimal
Staff: County Emergency Management
Jurisdictions: County wide

Problem Identification: Davis County cities near the mountain front are subject to strong easterly canyon winds. These high winds can result in serious disruption of essential public services and communications for emergency responders have been severely hampered in the past by high wind damage to communication infrastructure.

Objective 1.2 (Priority HIGH): To educate officials and the public on the impact that climate change has had on water supplies.

Action: Develop and promote an educational outreach for elected officials and the public on the impact that global climate change has had on water supplies in Davis County. Regional weather summit meeting was held in April 2016.

Timeframe: Immediate
Funding: Federal, State and Local grants
Estimated Cost: Unknown
Staff: Emergency Manager and local jurisdiction Emergency Management Directors
Jurisdictions: County wide

Goal 2: Improve emergency notification capabilities in the School District

Objective: Provide consistent and timely emergency notification to the schools in the Davis School District

Action: In order to better ensure consistent emergency communications during any kind of emergency event, including severe weather the School District has purchased an emergency alert and notification system that will be used to transmit emergency information via the internet, tablets, cell phones and radios to any of the schools in the District. The County Emergency Manager is also included in the system.

Time Frame: 2016-2017
Funding: School District Funds
Estimated Cost: $100,000
Staff: Davis School District
Jurisdictions: Countywide

Slope Failure

Problem Identification: Numerous canyons, large and small exist along the east bench of Davis County. They were formed over thousands of years by debris flows and mudslides. Now, many hundreds of homes and other structures, pipelines, power lines and roadways have been constructed on top of or through the alluvial fans produced by these events. Nature continues to construct these canyons. Landslides and debris flows will continue to occur over time, thus threatening residents and critical infrastructure.

Action 2: Continue to encourage cities to adopt a standard of requiring geo-technical studies in identified landslide and debris flow areas.

Time Frame: 1-6 years
Funding: County and city funds
Estimated Cost: Minimal

Staff: County/City Emergency Management
Jurisdictions: County wide

Problem Identification: There are a number of canyons that do not currently have debris basins constructed to contain debris flows. Others are insufficient in size. These need to be built or reconstructed in order to provide protection to residents.

Goal 2: Reduce or eliminate landslide damage due to debris flows.

Objective 2.1 (Priority MEDIUM): Reduce loss of life and damage to property by providing a means to control debris and water from debris flows.

Action 1*:* Continue to identify and re-evaluate flood hazard areas. Develop additional debris basins and retrofit others that require it.

Time Frame: 1-6 years
Funding: County/City
Estimated Cost: Unknown
Staff: County/City Public Works
Jurisdictions: County wide

Wildland Fire

Problem Identification: Wildland fire has been a continuing challenge throughout Davis County's history. There are several areas in Davis County where there is an extreme danger of wildland-urban fire. Due to increased development into wildland areas, it is likely that any fire over 100 acres in size would threaten structures. In Davis County, North Salt Lake, Bountiful, Centerville, Farmington, Fruit Heights, Kaysville, Layton, and South Weber, have been classified as "at risk" for wildland fire. These communities are actively participating in the development of Community Wildland Protection Plans (CWPP) in cooperation with the County Fire Warden and the Utah Division of Forestry Fire & State Lands. The safety of the citizens of any community is a shared responsibility between property owners, developers or homeowners associations (HOA), and local, county, state and federal governments. The primary responsibility, however, remains with the property owner and HOA level.

Goal #1: Reduce or eliminate the threat of wildland fire, and the resulting loss of property and/or life.

Objective 1.1 (Priority HIGH): Increase the level of wildfire knowledge for home and business owners by encouraging participation in The Firewise Communities Program, which provides homeowners and businesses with simple steps to reduce wildfire risk by preparing for wildland fire.

Action 1: Participate in the "Utah, Let's Do Our Part" campaign which is the result of an interagency effort to reach the public with fire prevention messages relevant to Davis County. The program targets are wildland fires; campfires, debris burning, and vehicle-caused fires. The goal of the program is to

reach specific audiences with fire prevention messages to reduce the number of human-caused fire in the County. For example, many fires are started by unattended campfires left by those out for an evening of fun in the mountains. Even on cold nights, a small breeze can cause a campfire to smolder all night, possibly resulting in a wildfire. The same problem exists with debris burning in the spring and fall.

Vehicles are often the cause of wildland fires. Drivers will pull off the side of the road into the brush to get out of traffic and the heat of the engine is enough to start a fire without the driver ever knowing it. ATVs, trucks, and other vehicles that travel cross country are another major issue as exhaust sparks, dragging metal, hot engines, brake malfunctions, and more cause wildfires. The public will see billboards, flyers, posters, PSAs, news releases, and other products with this campaign logo on them.public with fire prevention messages relevant to Davis County. The program targets

Time Frame: Immediate
Funding: County/State FFSL Grant
Estimated Cost: Unknown
Staff: County and City Fire Departments, Emergency Manager
Jurisdictions: County, North Salt Lake, Bountiful, Centerville, Farmington, Fruit Heights, Kaysville, Layton, and South Weber.

Action 2: Host an annual community Firewise day.

Time Frame: Immediate
Funding: County/FFSL grant
Estimated Cost: Minimal
Staff: County Fire Warden
Jurisdictions: Community Fire Departments

Objective 1.2 (Priority HIGH): Maintain fire breaks and provide for better access into wildland fire interface areas.

Action: Routinely maintain fire breaks and improve wildland access roads.

Time Frame: Immediate
Funding: County/FFSL Grants
Estimated Cost: Unknown
Staff: County Fire Warden/Local Jurisdiction Fire Personnel
Jurisdictions: Community Fire Departments
Objective 1.3 (Priority HIGH): Upgrade and improve local wildland fire response capabilities.

Action: Purchase new wildland fire apparatus.

Time Frame: 1-6 years

Funding: Local Fire Department Budgets/State and Federal Grants
Estimated Cost: Unknown
Staff: County/Local Fire Departments
Jurisdictions: Countywide

Problem Identification: Given that wildland fire is a hazard that can be managed through effective fuel control and the lack of defensible space in one home could threaten other homes nearby in subdivisions, ordinances requiring residents to maintain defensible space around their respective homes would greatly reduce the fire hazard in these areas. Programs could be established to assist residents in performing this requirement or to encourage rebates for property insurance.

Goal #2 – Assist homeowners to maintain defensible space around homes and businesses to more effectively mitigate the wildland fire hazard by conducting fuels reduction and chipper days.

Objective 2 (Priority HIGH): Provide coordination and support to residents and homeowners associations (HOAs) for fuels reduction and defensible space.

Action 1: Regularly conduct fuels reduction and chipper workshops.

Time Frame: Immediate
Funding: Community Fire Departments
Estimated Cost: Minimal
Staff: Emergency Manager, City/County Fire and Wildland Interface Residents
Jurisdictions: Countywide

Action 2: Educate citizens about defensible space requirements.

Time Frame: 1-5 years
Funding: Local
Estimated Cost: Minimal
Staff: Emergency Manager, City/County Fire and Wildland Interface Residents
Jurisdictions: Countywide

Part VI. 2016 CITY MITIGATION STRATEGIES, OBJECTIVES, ACTIONS

The following mitigation strategies are specific to some of the cities in Davis County. The listed city will be responsible for the specified mitigation projects.

Background Information

Bountiful City is a picturesque community nestled on the foothills of the Wasatch Range in Davis County. With a population of about 44,000, and approximately 14,000 households, Bountiful offers a variety of housing options from view on the Bountiful Bench, townhomes, to homes with access to I-15 for commuters close to Salt Lake City. The city grew rapidly during the suburb growth of the late 1940s, 1950s, and 1960s and was Davis County's largest city until 1985 when it was surpassed by Layton. Bountiful is currently Utah's 15th largest city.

Although a part of the Ogden-Clearfield Metropolitan Statistical Area, it serves as a bedroom community to Salt Lake City and the surrounding area. However, due to the very narrow entrance into Salt Lake County, roads between the counties often reach near-gridlock traffic during rush hour. The FrontRunner commuter rail has been running since April 2008, and the Legacy Parkway was opened in 2008. These were built to help alleviate the traffic load on Interstate 15 through the Bountiful area. Bountiful occupies an area of approximately 13.5 square miles. It is a gateway community to Salt Lake County for travelers going south on I-15.

Bountiful operates under a weak mayor form of government, with an elected Mayor and five Council Members. The day-to-day operations and the majority of executive authorities are delegated to a City Manager, who works hand-in-hand with the Mayor to ensure all city operations are well-run. City operations include a 24-7 police department, part-time animal services, a municipal court, water, garbage/recycling, streets, stormwater, snow removal, community development, and parks and recreation programming. Bountiful City is part of the South Davis Fire District which provides fire protection. Emergency management and pre-disaster mitigation responsibilities are coordinated by the Bountiful City Police Department.

Specific Community Hazards

- **Earthquake.** Bountiful proximity to the mountains and the Wasatch Fault puts it at high risk of earthquake damage.

- **Wildland Fire.** Much of Bountiful City is located in the foothills, increasing the risk for wildland fires.
- **Dam failure. The s**econdary water system throughout the community has small storage reservoirs.
- **Flooding.** Bountiful is located along the Wasatch Mountain Front. During the 1983 declared flooding disaster, City facilities, trails, and homes sustained significant damage.

Critical Facilities and Infrastructure

FACILITY	HAZARD/RISK	MITIGATION
Water Treatment Plant	Water contamination	Enhance security
Upper Reservoir	Water contamination, dam breach w/ flooding	Enhance security
Well	Water contamination	Enhance security
Bountiful power generation plant	Power interruption	Enhance security
Water Tanks	Water contamination, flooding from breach	Enhance security
Underground petroleum pipelines	Major Hazardous Materials release to include crude oil	Enhance security Increased protection from vehicles recently added
Irrigation Reservoirs	Water contamination, dam breach w/ flooding	Enhance security
Lakeview Hospital 630 Medical Drive	Loss of critical medical facilities	Enhance security

City Buildings and Facilities

FACILITY	HAZARD/RISK	MITIGATION
City Offices	Loss of vital city records; communication vehicles; day to day functions	TBD
City Public Works building	Damage and destruction to facilities and vehicles from earthquake	Enhance structural integrity of infrastructure
Police Department	Loss of vital police records; impact to day to day functions	TBD
Public Works Building	Loss/damage to response equipment	N/A
IT Network and Server	Loss of communications	Enhance security
EOC	Loss of operability for EOC	Equip EOC; Complete connection to fiber/analog lines
Main Generator for City Office	Loss of power for critical operations	Enhance security
South Metro Davis Fire - Station #81	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency
South Metro Davis Fire - Station #82	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency

South Metro Davis Fire - Station #83	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency
South Metro Davis Fire - Station #84	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency
South Metro Davis Fire - Station #85	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency

Stormwater Infrastructure

Multiple storm water retention basins throughout the city	Flooding	Dredge and de-silt

Main Arterial Roads

	HAZARD/RISK	MITIGATION
500 South	Destruction, evacuation and response concerns	N/A
Orchard Drive/400 East	Destruction, evacuation and response concerns	
Bountiful Blvd	Destruction, evacuation and response concerns	
500 West	Destruction, evacuation and response concerns	
South Davis Blvd	Destruction, evacuation and response concerns	

Mitigation Strategies Implemented since the 2009 Plan

Bountiful City is updating the City Emergency Operations Plan (EOP).

Planned Mitigation Strategies

Dam Failure

Problem Identification: The Millcreek City culinary water system reservoir is aging and vulnerable, and is subject to damage/failure/collapse, resulting in flooding downstream neighborhoods.

Goal: Continue to conduct and ongoing replacement program of critical infrastructure.

Objective (Priority HIGH): Enhance the resiliency of Millcreek Reservoir, part of the city culinary water system.

Action: Replace the 60+ year old 3,000,000 gallon culinary water Millcreek Reservoir.

Time Frame: 2019
Funding: City funds/State/Federal grant
Estimated Cost: $1.9 million
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Bountiful City

Flooding

Problem Identification: Bountiful City is traversed by several creeks which may be subject to flooding in severe storm events. These creeks overtopped their banks in the 1983 flood disaster, resulting in thousands of dollars in damages. Significant funding following the 1983 flooding greatly reduced flood vulnerability in those areas. Ongoing maintenance of these floodways by the city will continue to mitigate this threat.

Objective (Priority HIGH): Maintain identified flood threat areas.

Action: Annually inspect and remove debris in stream channels and debris basins.

Time Frame: Annually
Funding: City
Estimated Cost: Minimal
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Bountiful City

Earthquake

Problem Identification: Critical facilities do not meet seismic standards.

OBJECTIVE #1 (Priority MEDIUM): Retrofit facilities to seismic standards.

Action 1: Replace the Mueller Park Culinary Water Treatment Plant equipment with a new treatment system and retrofit the building to bring into compliance with current seismic code.

Time Frame: 2018
Funding: City funds/State/Federal grant
Estimated Cost: $2 million
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Bountiful City

Action 2: Construct a new 1,000,000 gallon culinary water reservoir at 1300 East 400 North, to work in tandem with two existing reservoirs increasing city water storage and earthquake survivability.

Time Frame: 2018-2019

Funding: City funds/State/Federal grant
Estimated Cost: $650,000
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Bountiful City

Action 3: Replace ten aging high pressure gas lines which serve a large portion of Bountiful City (by Questar Gas). These gas lines cross several fault traces, and are subject to failure in the event of fault movement or a reasonably expected seismic event.

Time Frame: 2016-2018
Funding: Minimal
Estimated Cost: Unknown
Staff: City/Questar Gas
Jurisdictions: Bountiful City

Action 4: Bountiful City has an ongoing, annual program of replacing aging cast iron culinary water pipe, which is very susceptible to earth movement, with flexible PVC pipe, which is better able to withstand earth movement caused by a seismic event.

Time Frame: Ongoing
Funding: City
Estimated Cost: $900,000/year
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Bountiful City

Action 5: Stoker School Demolition and Replacement. Eliminate and replace a 110 year building which is currently being used as the Bountiful campus for the University of Utah and would be subject to damage/failure/collapse in the event of a reasonably expected seismic event. The building will be replaced with a new city hall in the same location.

Time Frame: 3-4 years
Funding: Mitigation grants, Bountiful City funding
Estimated Cost: $10 Million
Staff: Bountiful City/County
Jurisdictions: Bountiful City

Wildland Fire

Problem Identification: A significant portion of Bountiful City is along the foothills creating an urban/wildland interface.

OBJECTIVE #1 (Priority MEDIUM): Fuels mitigation

Action 1: Work in tandem with homeowners to remove fuels and create fire breaks.

Time Frame: Unknown, depending on funding
Funding: Federal, State and Local
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Bountiful City

Action 2: Create a public service campaign to inform residents about fuels reduction, fire breaks, and other mitigation tactics.

Time Frame: Unknown, depending on funding
Funding: Federal, State and Local
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Bountiful City

Multi-Hazards

Problem Identification: The City does not have an emergency management plan in place and communication networks are vulnerable.

OBJECTIVE #1 (Priority HIGH): Improve communications, mitigate the impacts of and be prepared for emergency situations and hazards.

Action 1: Create an Emergency Management Plan

Time Frame: 2017
Funding: Federal and Local
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Bountiful City

Action 2: Enhance IT Network and Server Security

Time Frame: Unknown, depending on funding
Funding: Local and State
Estimated Cost: Unknown
Staff: City Administration, Public Works
Jurisdictions: Bountiful City

Background Information

Centerville City is located between Farmington and Bountiful, east of Interstate 15. The city has an estimated population of 15,33. It is located adjacent to the easternmost part of the Great Salt Lake.

Centerville operates under a weak mayor form of government, with an elected Mayor and five Council Members. The day-to-day operations and the majority of executive authorities are delegated to a City Manager, who works closely with the Mayor to ensure all city operations are well-run. City operations include a full time Police, Fire, and Public Works Departments. Emergency management and pre-disaster mitigation responsibilities are coordinated by the Centerville City Manager.

Specific Community Hazards

- **Wildland Fire.** A significant portion of Centerville City is along the foothills creating an urban / wildland interface.
- **Flooding.** Centerville is traversed by several creeks which may be subject to flooding in severe storm events and spring runoff

Wildland Fire

Problem Identification: A significant portion of Centerville City is along the foothills creating an urban / wildland interface. Prevent Wildfires from coming into the city.

OBJECTIVE (Priority MEDIUM): Fuels mitigation

Action 1: Work with homeowners to remove fuels and create defensible spaces and maintain fire break roads.

Time Frame: Ongoing
Funding: Federal, State and Local
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineering, Etc.
Jurisdiction: Centerville City

Action 2: Create a public service campaign to inform residents about fuels reduction, fire breaks, defensible spaces and other mitigation tactics.

Time Frame: Estimated completing will be the fall of 2017.
Funding: Federal, State and Local
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineering, etc.
Jurisdiction: Centerville City

Action 3: Participate in the CWFP- Community Wildfire Protection Plan

Time Frame: Documentation of man hours and community service will be done annually.
Funding: Federal, State, Local, citizen in-kind participation.
Estimated Cost: Unknown
Staff: City Administration, Public Works, Centerville community involvement, State workers
Jurisdiction: Centerville City

Flooding

Problem Identification: Centerville is traversed by several creeks which may be subject to flooding in severe storm events and spring runoff. Significant funding towards a debris flow basin in Deuel Creek area has greatly reduced flood vulnerability in this area. Ongoing work on upsizing water coverts are taking place under Frontage Road extending under the Freeway and also in the area of Bernard Creek.

OBJECTIVE (Priority HIGH): Maintain identified flood threat areas.

Action 1: Continue upsizing covert's in flood threat areas.

Time Frame: 2019
Funding: City
Estimated Cost: $400,000
Staff: City Administration, Public Works, Engineering, etc.
Jurisdiction: Centerville City

Centerville Mitigation Projects 2016-2022

- Centerville City has just recently doubled the drainage fees in order to pay for repairs and upgrades to our drainage systems
- South Davis Metro Fire will tear down and build a new fire station in Centerville
- Additional repairs and improvements on the firebreak road
- Implementing a Wildland / Urban Fire Protection Plan

- Centerville has developed a 45 year master plan to up-grade the water system. Work is currently in progress to make improvements in the system to keep up with this plan
- Davis County has plans to put an open creek into a culvert along Porter Lane.

Background Information

Clearfield was one of the last communities to be settled in the northern part of Davis County (1877). Hunters and Native American Warriors knew this land before the first white man settled here. They referred to it as the land of wind and sand. But it was the roar of the train's engine that first awakened the area in 1869 and stirred the sleeping Sand Ridge, which it was once known as until the name was later changed to Clearfield in order to attract agricultural settlers

Clearfield City has a total land area of 7.8 square miles, and a population of 30,112 as of the 2010 Census, making it the third largest city in Davis County, behind Layton and Bountiful. Clearfield City has an average elevation of 4,327 feet above sea level. The lowest point within the boundaries of the city is 4,314 feet at the intersection of 1000 West and Antelope Drive on the city's western edge and the highest is 4,711 feet at a point that is within the city's northeast corner, but physically located on Hill Air Force Base property along Constitution Way in their housing area.

The city is located in the north central portion of Davis County. The county is surrounded by the Great Salt Lake to the west and the steep Wasatch mountain range on the east, although neither of these notable natural landmarks is physically within the city boundaries. Directly encircling Clearfield are the cities/areas of Sunset City to the north, Clinton City to the northwest, Syracuse City and West Point City to the west, Layton City to the south and east, and Hill Air Force Base military installation to the northeast.

There are no major lakes or rivers within the city. There are a few small ponds, mostly at public parks or on privately owned property. The only significant waterway in the city is the Weber and Davis Canal along the east and northeast edge of the city that extends both north and south of the city boundaries. The Clearfield Canal Trail parallels the canal for a portion of its trip through Clearfield.

Specific Community Hazards

- **Earthquake.** Clearfield is in the portion of Davis County where it is near the low lying areas of the Great Salt Lake where the water table is near the surface and would be susceptible to liquefaction in addition to shaking.

Earthquake

Problem Identification: Clearfield is in the portion of Davis County where it is near the low-lying areas of the Great Salt Lake where the water table is near the surface and would be susceptible to liquefaction in addition to shaking. Liquefaction is a loss of strength in some saturated granular soil, which can result in slope failure or substantial settlement of structures. The majority of habitable land in the City is either moderately or highly susceptible to liquefaction. Most of this land is either covered with single or two story residential structures, manufacturing and business buildings that would likely suffer minor to moderate damage due to liquefaction. However, many underground utilities could be severely damaged. Summer flash flooding can cause flooding problems in Clearfield City.

Objective #1 (Priority HIGH): Identify areas prone to liquefaction.

Action: Numerical modeling studies will be performed to model the behavior of embankments underlain by liquefiable soils and treated soils. This objective will utilize the geomechanicalmodeling program FLAC 3.4 (Itasca Consulting Group 1997). The FLAC model will be used to perform parametric studies of the seismic performance of embankments subjected to a suite of different earthquake ground motions. The parametric studies will be used to determine the influence of several design and remediation factors on computed deformations. These included: 1. static factor of safety of the embankment; 2. Thickness of the liquefiable layer; 3.Embankment geometry; 4. Depth to the groundwater table; 5. Extent of ground treatment by soil densification; and 5. Ground motion characteristics. The results of the numerical analyses will be used to develop an improved seismic design procedure that incorporates all of the parametric study data, and includes data incorporated from the literature review. Design recommendations will also be developed that highlight the usage of a simple design chart and more importantly, the assumptions and limitations of using the chart for design purposes.

Time Frame: 2020
Funding: City funds/State/Federal grant
Estimated Cost: $250,000
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Clearfield City

OBJECTIVE #2 (Priority MEDIUM): Educate general public about earthquakes and the need to secure the contents of their homes and offices..

Action: Hold an Emergency Preparedness Fair to educate public on the need to secure the contents of their homes and offices.

Time Frame: 2019
Funding: City funds
Estimated Cost: $1,500
Staff: City Administration, Public Works, Health Department, etc.
Jurisdictions: Clearfield City

Background Information

Clinton is a city in Davis County, Utah, United States. It is part of the Ogden–Clearfield, Utah Metropolitan Statistical Area. The area, then part of Layton, was settled in the 1870's by James Hill and his family. Early settlers used it to graze their animals but, even though the land was fertile, culinary water had to be hauled in from the Weber River. The area was commonly called The Range, Sand Ridge, The Basin and The Summit. The first school was built in 1885 just south of the cemetery. Clinton would not become an official town until 1936, and its growth was relatively small until the 1960's.The population was 20,426 at the 2010 census, up from 12,585 at the 2000 census. Clinton grew rapidly during the 1990s and continues to see rapid growth, with an estimated population of 21,104 in 2014.

Clinton is located in northern Davis County, bordered by Sunset to the east, Clearfield to the southeast, and West Point to the southwest. The northern border of Clinton is the Weber County line, with the city of Hooper to the northwest and Roy to the north and northeast. According to the United States Census Bureau, Clinton has a total area of 5.8 square miles, all of it land

Specific Community Hazards

- **Earthquake.** Clinton proximity to the mountains and the Wasatch Fault puts it at high risk of earthquake damage.
- **Wildland Fire.** Clinton City has a walking/running/biking trail on the old Denver Rio Grande western Rail road track system. There is approximately 6,000' to 8,000' of trail that is covered with an abundance of natural fuels.
- **Flooding.** Clinton is susceptible to flooding from storm events and runoff.

Planned Mitigation Strategies

Earthquake

Action 1: Clinton City has an ongoing program of replacing aging cast iron culinary water pipe, which is very susceptible to earth movement, with flexible PVC pipe, which is better able to withstand earth movement caused by a seismic event.

Time Frame: Ongoing
Funding: City
Estimated Cost: $3 to 5 million
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Clinton City

Action 2: Clinton City is adding a new culinary water reservoir and deep well at 2200 N 730 W. This reservoir and deep well will be within city limits. The city's main culinary water system is currently stored on Hill Air Force Base. This will also give us a secondary culinary water supply in the event that the main culinary water reservoirs or piping fail. This will increase city water storage and earthquake survivability. The land for this project has been purchased already by the city.

Time Frame: By 2021
Funding: City
Estimated Cost: $4 million
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Clinton City

Action 3: Clinton City is adding a 1,200 sq ft addition to the Public works building. This addition will meet current seismographic code standards.
Time Frame: 2016-2017
Funding: City
Estimated Cost: $250,000
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Clinton City

Wild fire fuel mitigation

Clinton City has a walking/running/biking trail on the old Denver Rio Grande western Rail road track system. There is approximately 6,000' to 8,000' of trail that is covered with an abundance of natural fuels.

Action 1: Create fire breaks and reduce fuel loads in these areas.

Time Frame: Unknown, depending on funding
Funding: City
Estimated Cost: $80,000
Staff: City Administration, Public Works, Fire Department etc.
Jurisdictions: Clinton City

Flooding

Action 1: Adding a 5 acre foot storm water detention basin at 1300 N 2700 W. This addition will help manage storm water runoff to prevent flooding in a Residential area of the city.
Time Frame: 2016-2017
Funding: City
Estimated Cost: $230,000
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Clinton City

Multi-Hazards

Problem Identification: Update emergency management plan in place and improve communication networks that are vulnerable. Improve communications, mitigate the impacts of and be prepared for emergency situations and hazards.

Action 1: Update an Emergency Management Plan

Time Frame: 2017
Funding: Local
Estimated Cost: Unknown
Staff: All Departments
Jurisdictions: Clinton City

Action 2: Enhance IT Network and Server Security

Time Frame: Unknown, depending on funding
Funding: Local
Estimated Cost: Unknown
Staff: City Administration
Jurisdictions: Clinton City

Action 3: Enhance Multi-hazard outreach program through city website, social media, and community training.

Time Frame: ongoing

Funding: Local
Estimated Cost: Unknown
Staff: All Departments
Jurisdictions: Clinton City

Background Information

Farmington City is a picturesque community nestled on the foothills of the Wasatch Range in Davis County. With a population of about 22,500, and approximately 7,000 households, Farmington serves as the county seat and offers a variety of entertainment to include Utah's largest amusement park (Lagoon), Legacy Fair Grounds, Station Park Shopping Center, and various outdoor recreation opportunities to include nearly two-hundred miles of walking and hiking trails. Housing options include farming estates, dense residential communities, care of the aged centers, townhomes and homes with access to Interstate 15, Legacy Highway, and Highway 89 for commuters close to Ogden (to the north) and Salt Lake City (to the south). Farmington was settled in 1847 and remained a bedroom community regardless of being the county seat and location of Utah's largest amusement park. This changed in 2011 when commercial and residential development exploded and continues to expand at the time of this report. Farmington was recently ranked #14 of "Best Places to Live" in a nationwide probe performed by Money Magazine.

Although a part of the Ogden-Clearfield Metropolitan Statistical Area, Farmington serves as a bedroom community to both Ogden City and Salt Lake City. However, due to the very narrow entrance into Salt Lake County, roads between the counties often reach near-gridlock traffic during rush hour. The FrontRunner commuter rail has been running since April 2008, and the Legacy Parkway was opened in 2008. These were built to help alleviate the traffic load on Interstate 15 through the Farmington area. Farmington City occupies an area of approximately 10 square miles; however, provides critical services for surrounding areas of unincorporated Davis County. Farmington is a gateway community to both North and South Davis County and acts as a main arterial pathway for ground and rail transportation.

Farmington operates under a weak mayor form of government, with an elected Mayor and five Council Members. The day-to-day operations and the majority of executive authorities are delegated to a City Manager, who works hand-in-hand with the Mayor to ensure all city operations are well-run. City operations include a 24-7 police department, 24-7 fire and ambulance department, water, garbage/recycling, streets, stormwater, snow removal, community development, parks and recreation

programming. Emergency management and pre-disaster mitigation responsibilities are coordinated by the City Manager.

Specific Community Hazards

- **Earthquake.** Farmington proximity to the mountains and the Wasatch Fault puts it at high risk of earthquake damage.
- **Wildland Fire.** Much of Farmington City is located against the foothills, increasing the risk (HIGH) for wildland fires. Farmington also provides initial fire and ambulance response to emergencies within and above Farmington Canyon areas that encompass over 30 structures.
- **Dam failure.** Primary and secondary water systems throughout the community utilize multiple storage reservoirs. Certain components of this delivery and storage systems pose a high failure risk in the event of a seismic incident.
- **Flooding.** Farmington is located along the Wasatch Mountain Front. During 1983, city infrastructure, homes, and trails sustained significant damage from mud slides and flooding.
- **Chemical Release** Potential crude oil release, ultra-high volume (52 gallons per second at 200 psi) within the center of Farmington City – Station Park and Legacy Center area. Interstate and heavy rail also passes through Farmington with countless quantities hazardous materials.
- **Critical Roads.** Critical Roadways for lifeline infrastructure. A seismic event could separate access routes between east Farmington and west Farmington due to failure of overpasses
- **Windstorm.** Sever downslope winds form Wasatch Mountain Range
- **Land Subsidence.** Several structures in the city have experienced various degree of settlement and require further understanding / mitigation solutions.
- **Multi-Hazards.** The City does not have a detailed emergency management plan in place and communication networks are vulnerable.

Critical Facilities and Infrastructure

FACILITY	HAZARD/RISK	MITIGATION
Well / Water Treatment Plants	Water contamination	Enhance security
Upper Reservoirs	Water contamination, dam breach w/ flooding	Enhance security
Well	Water contamination	Enhance security
Underground petroleum pipelines	Major Hazardous Materials release to include crude oil within critical city infrastructure and commerce area of town.	Enhance security Increased protection from new and ongoing construction
Irrigation Reservoirs	Water contamination, dam breach w/ flooding	Enhance security
Power & Gas Utilities	Complete loss of utilities	Enhance security
Critical Roadway & Bridges	Loss of emergency access / city	Enhance security

	split into two by I-15, Legacy Hwy and Hwy 89.	

City Buildings and Facilities

FACILITY	HAZARD/RISK	MITIGATION
City Offices	Loss of vital city records; communication vehicles; day to day functions	TBD
City Public Works building	Damage and destruction to facilities and vehicles from earthquake	Enhance structural integrity of infrastructure
Police Department	Loss of vital police records; impact to day to day functions	TBD
Public Works Building	Loss/damage to response equipment	TBD
IT Network and Server	Loss of communications	Enhance security
EOC	Loss of operability for EOC	Equip EOC; Complete connection to fiber/analog lines
Main Generator for City Office	Loss of power for critical operations	Enhance security
Farmington Fire Station #71	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency / perform study
Farmington Fire Apparatus Storage BLD (West Side) #72	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency / perform study
Well Houses	Loss of municipal water supply	Enhance security

Stormwater Infrastructure

Multiple storm water retention basins throughout the city	Flooding	Dredge and de-silt

Main Arterial Roads

	HAZARD/RISK	MITIGATION
Main Street (North to South)	Destruction, evacuation and response concerns	N/A
Sheppard Lane (West to East)	Destruction, evacuation and response concerns	
200 East (North to South)	Destruction, evacuation and response concerns	
Park Lane (West to East)	Destruction, evacuation and response concerns	
Clark Lane / State Street (East to West)	Destruction, evacuation and response concerns	
Glovers Lane & 1525 West	Destruction, evacuation and response concerns	

Mitigation Strategies Implemented since the 2009 Plan

Farmington City is updating the City Emergency Operations Plan (EOP).

Planned Mitigation Strategies

Earthquake

Problem Identification: Critical facilities do not meet seismic standards.

OBJECTIVE (Priority HIGH): Retrofit facilities to seismic standards.

Action 1: Retrofit, modify and/or Replace the Farmington City Fire Station #71 building to bring into compliance with current seismic code.

Time Frame: 2020
Funding: City funds/State/Federal grant
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Farmington City

Action 2: Identify / pre-plan entire culinary water delivery network and reservoirs city-wide to determine earthquake survivability and modify accordingly.

Time Frame: 2018-2019
Funding: City funds/State/Federal grant
Estimated Cost: $500,000
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Farmington City

Action 3: Replace multiple aging high pressure gas lines which serve a large portion of Farmington City (by Questar Gas). These gas lines cross several fault traces, and are subject to failure in the event of fault movement or a reasonably expected seismic event.

Time Frame: 2016-2018
Funding: Minimal
Estimated Cost: Unknown
Staff: City/Questar Gas
Jurisdictions: Farmington City

Action 4: Farmington City has an ongoing, annual program of replacing aging cast iron culinary water pipe, which is very susceptible to earth movement, with flexible PVC pipe, which is better able to withstand earth movement caused by a seismic event.

Time Frame: Ongoing
Funding: City
Estimated Cost: $900,000/year
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Farmington City

Dam Failure

Problem Identification: Multiple water containment systems located throughout Farmington are aging and subject to various stages of decay. Based on assessment findings, these containment vessels will require different levels of repair and possible replacement.

Goal: Continue to conduct and ongoing replacement program of critical infrastructure.

Objective (Priority HIGH): Enhance the resiliency of Farmington city culinary water system.

Action: Repair and/or Replace various culinary water containment reservoirs.
Time Frame: 2019
Funding: City funds/State/Federal grant
Estimated Cost: $ Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Farmington City

Wildland Fire

Problem Identification: A significant portion of Farmington City is along the foothills with a significant history of urban/wildland interface fires.

OBJECTIVE (Priority HIGH): Fuels mitigation

Action 1: Work in tandem with homeowners and government programs, via public education campaigns; such as, FireWise to educate and remove fuels to better facilitate defensible spaces.

Time Frame: Unknown, depending on funding
Funding: Federal, State and Local
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Farmington City

Action 2: Continue to utilize state and federal resources such as: Federal Excess Personal Property (FEPP) programs to help provide adequate equipment and assets to mitigate wildland / interface fires.
Time Frame: Unknown, depending on funding
Funding: Federal, State and Local
Estimated Cost: Unknown

Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Farmington City

Chemical Release

Problem Identification: Potential ultra high volume crude oil release (52 gallons per second at 200 PSI) within the center of Farmington City – Station Park and Legacy Center area.
OBJECTIVE (Priority MEDIUM): Continue working with pipeline vendors, ensuring that adequate training for all personnel and specialized equipment remains available.

Action: Ongoing / Proper maintenance and training

Time frame: Annually
Funding: Farmington City & County Health Department
Estimated Cost: $5,000
Staff: Farmington City & County Health Department
Jurisdiction: Farmington City & Davis County Health Department

Critical Roads

Problem Identification: Critical Roadways for lifeline infrastructure
OBJECTIVE (Priority Medium) Provide unrestricted access or critical roadways for all life line infrastructure
Action: Identify & map life line infrastructure
Time Frame: 2018-2019
Funding: City Budget
Estimated Costs: $10,000
Staff: Public Works, Engineering, Community Development
Jurisdiction: Farmington City

Windstorm

Problem Identification: Sever downslope winds form Wasatch Mountain Range

OBJECTIVE (Priority MEDIUM) Structural building integrity

Action: Review proper building and development codes

Time Frame: 2019

Estimated cost: $2,500
Staff: Community Development, Building Department
Jurisdiction: Farmington City

Land Subsidence

Problem Identification: Several homes in the city have experienced substantial settlement

OBJECTIVE (Priority MEDIUM): Conduct an analysis of why this is occurring and seek to discover mitigation solutions.

Action: Continue with residential inquiries, monitoring and evaluations of existing established benchmarks and boring when indicated.

Time Frame: 2018-2020
Funding: City Budget
Estimated Cost: Unknown
Staff: City Staff, Consultants
Jurisdiction: Farmington City

Multi-Hazards

Problem Identification: The City does not have a detailed emergency management plan in place and communication networks are vulnerable.

OBJECTIVE (Priority HIGH): Improve communications, mitigate the impacts of and be prepared for emergency situations and hazards.

Action 1: Create a detailed Emergency Management Plan

Time Frame: 2018
Funding: Federal and Local
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Farmington City

Action 2: Enhance IT Network and Server Security

Time Frame: Unknown, depending on funding
Funding: Local and State
Estimated Cost: Unknown
Staff: City Administration, Public Works

Fruit Heights Background Information

Fruit Heights City is located between Kaysville on the west and Farmington on the south. The community is located on the foothills of the Wasatch Range in Davis County. With a population of about 5,000, and approximately 1,500 households, Fruit Heights is one of the more affluent communities in the state. The city grew rapidly during the 1970-1980's, but has now nearly reached the "build out" stage with few open areas available for development.

Fruit Heights was originally known as Mountain Road. It was the first road between Salt Lake City and Ogden City. For nearly 50 years, Kaysville folks came to the Mountain Road, first to get their mail from Pony Express riders and later from stage coach drivers. Early pioneer families settled along the Old Mountain Road around 1850.

John Bair had his own saw mill, located about where the Rock Loft is now. The mill furnished most of the wood for the early homes. Over the years settlers changed the area to beautiful farms and orchards. Water was very scarce. Ditches had to be dug. Some families were able to get water from springs in the mountains, but many had to use water from Haight's Creek, Baer Creek and irrigation ditches. It was used for culinary purposes, farm animals and irrigation. This situation continued until 1939.

It was then the people voted to incorporate and become a town, and what was known as the area along the "Old Mountain Road" was named Fruit Heights, because of the fruit industry.

Fruit Heights operates under a weak mayor form of government, with an elected Mayor and five Council Members. The day-to-day operations and the majority of executive authorities are delegated to a City Manager, who works closely with the Mayor to ensure all city operations are well-run. City operations include a full time Public Works Department. Fruit Heights City contracts with Kaysville for Fire and Emergency Medical Services (EMS) and with the Davis County Sheriff's Office for law enforcement and paramedic response. Emergency management and pre-disaster mitigation responsibilities are coordinated by the Fruit Heights City Manager.

Specific Community Hazards

- **Earthquake.** Fruit Heights proximity to the mountains and the Wasatch Fault puts it at high risk of earthquake damage.
- **Wildland Fire.** Much of Fruit Heights City is located in the foothills, increasing the risk for wildland fires.
- **Dam failure. The s**econdary water system throughout the community has small storage reservoirs.
- **Flooding.** Fruit Heights is located along the Wasatch Mountain Front. During the 1983 declared flooding disaster, City facilities, trails, and homes sustained significant damage.

Critical Facilities and Infrastructure

FACILITY	HAZARD/RISK	MITIGATION
Culinary water storage tanks	The city has 2 water storage tanks that may experience water contamination, flooding, and failure due to earthquake	Enhance security, and upgrade water distribution system

City Buildings and Facilities

FACILITY	HAZARD/RISK	MITIGATION
City Offices/EOC	Loss of vital city records; communication vehicles; day to day functions. Loss of operability for EOC	Provide for city office/EOC survivability following an earthquake
Public Works Building	Loss/damage to response equipment	N/A
Main Generator for City Office	Loss of power for critical operations	Enhance security

Stormwater Infrastructure

Stormwater detention basins	Flooding: excessive rainfall overfilling banks	Downstream protection of property

Main Arterial Roads

	HAZARD/RISK	MITIGATION
Mountain Road	Destruction, evacuation and response concerns	N/A
Nicholls Road	Destruction, evacuation and response concerns	
Green Road	Destruction, evacuation and response concerns	
400 North	Destruction, evacuation and response concerns	
Highway 89	Destruction, evacuation and response concerns	

Planned Mitigation Strategies

Earthquake

Problem Identification: Critical facilities do not meet seismic standards.

OBJECTIVE #1 (Priority MEDIUM): Retrofit waterlines and storm drain infrastructure to meet seismic standards.

Action 1: Replace culinary water line (Asbestos Cement) and upsize Mountain Road and Nicholls Road to 1000 South Mountain Road to bring into compliance with current seismic code.

Time Frame: 2018
Funding: City funds/State/Federal grant
Estimated Cost: $420,000
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Fruit Heights City

Action 2: Loop the 1800 East to Eastoaks Drive water line increasing city water earthquake survivability.

Time Frame: 2018-2019
Funding: City funds/State/Federal grant
Estimated Cost: $59,000
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Fruit Heights City

Action 3: Install storm drain and detention basin below Eastoaks Drive to bring into compliance with current seismic code

Time Frame: 2018-2020
Funding: City funds/State/Federal grant
Estimated Cost: $189,000
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Fruit Heights City

Action 4: Install and line the storm drain pipe underneath Green Road to bring into compliance with current seismic code

Time Frame: 2016-2017
Funding: City funds/State/Federal grant
Estimated Cost: $120,000
Staff: City Administration, Public Works, Engineer, etc.

Jurisdictions: Fruit Heights City

Action 5: Install a drain pipe in an open ditch along Mahogany Drive to bring into compliance with current seismic code

Time Frame: 2018-2020
Funding: City funds/State/Federal grant
Estimated Cost: $35,000
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Fruit Heights City

Action 6: Upgrade and install a storm drain along South Mountain Road to bring into compliance with current seismic code

Time Frame: 2018-2020
Funding: City funds/State/Federal grant
Estimated Cost: $180,000
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Fruit Heights City

Multi-Hazards

Problem Identification: The city Emergency Operations Plan (EOP) is overdue for a update and revision.

OBJECTIVE #1 (Priority HIGH): Improve communications, mitigate the impacts of and be prepared for emergency situations and hazards.

Action 1: Update the Emergency Operations Plan (EOP)

Time Frame: 2017
Funding: Federal and Local
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Fruit Heights City

Action 2: Enhance IT Network and Server Security

Time Frame: Unknown, depending on funding
Funding: Local and State
Estimated Cost: Unknown
Staff: City Administration, Public Works
Jurisdictions: Fruit Heights City

Background Information

Shortly after Mormon pioneers arrived in 1847, the Kaysville area, originally known as "Kay's Creek", or Kay's Ward, was settled by Hector Haight in 1850 as a farming community. He had been sent north to find feed for the stock and soon thereafter constructed a cabin and brought his family to settle the area. Farmington, Utah, also claims Hector Haight as its original settler. Two miles north of Haight's original settlement, Samuel Holmes built a cabin in 1849 and was soon joined by other settlers from Salt Lake, namely Edward Phillips, John Green, and William Kay. In 1868 Kaysville became the first city incorporated in Davis County. Kaysville has a total area of 10.5 square miles. The city has a population of approximately 31,000 residents.

Kaysville operates under a weak mayor form of government, with an elected Mayor and five Council Members. The day-to-day operations and the majority of executive authorities are delegated to a City Manager, who works closely with the Mayor to ensure all city operations are well-run. City operations include a full time Police, Fire, and Public Works Departments. Emergency management and pre-disaster mitigation responsibilities are coordinated by the Kaysville City Manager.

Specific Community Hazards

- **Earthquake.** Kaysville proximity to the mountains and the Wasatch Fault puts it at high risk of earthquake damage.
- **Wildland Fire.** Much of Kaysville City is located in the foothills, increasing the risk for wildland fires.
- **Dam failure. The s**econdary water system throughout the community has small storage reservoirs.
- **Flooding.** Kaysville is located along the Wasatch Mountain Front. During the 1983 declared flooding disaster, City facilities, trails, and homes sustained significant damage.

Critical Facilities and Infrastructure

FACILITY	HAZARD/RISK	MITIGATION
Culinary water storage tanks and secondary water reservoirs	The city has culinary water storage tanks and secondary water storage reservoirs that may experience water contamination, flooding, and failure due to earthquake	Enhance security, and upgrade water distribution system
Main Substation	Loss of power following earthquake	Upgrade infrastructure to current

		seismic standards
West Substation	Loss of power following earthquake	Upgrade infrastructure to current seismic standards
Burton Substation	Loss of power following earthquake	Upgrade infrastructure to current seismic standards
Schick Substation	Loss of power following earthquake	Upgrade infrastructure to current seismic standards

City Buildings and Facilities

FACILITY	HAZARD/RISK	MITIGATION
City Offices/EOC	Loss of vital city records; communication vehicles; day to day functions. Loss of operability for EOC	Provide for city office/EOC survivability following an earthquake
Public Works Building	Loss/damage to response equipment	N/A
Kaysville City Power Department	Disruption in electrical service to residents following earthquakes	Upgrade infrastructure to current seismic standards
Main Generator for City Office	Loss of power for critical operations	Enhance security

Stormwater Infrastructure

Stormwater detention basins	Flooding: excessive rainfall overfilling banks	Downstream protection of property

Main Arterial Roads

	HAZARD/RISK	MITIGATION
Main Street	Destruction, evacuation and response concerns	N/A
200 North	Destruction, evacuation and response concerns	
Angel Street	Destruction, evacuation and response concerns	
Crestwood Drive	Destruction, evacuation and response concerns	
Highway 89	Destruction, evacuation and response concerns	
Interstate 15	Destruction, evacuation and response concerns	

Planned Mitigation Strategies

Earthquake

Problem Identification: Critical facilities do not meet seismic standards.

OBJECTIVE #1 (Priority MEDIUM): Retrofit waterlines and storm drain infrastructure to meet seismic standards.

Action 1: Mutton Hollow water line was upgraded in 2016 to add redundancy to the system and better fire flow

Time Frame: 2016
Funding: City funds
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Kaysville City

Action 2: Design and upgrade culinary water storage tanks for some time over the next 5 to 10 years, and add a second pump house in the next 1-3 years that will equalize the water in the tanks.

Time Frame: 2017-2027
Funding: City funds/State/Federal grant
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Kaysville City

Action 3: The City performs continuous maintenance and repair to keep the system in good working order for both fire flow and earthquake resistance.

Time Frame: 2016-2021
Funding: City funds
Estimated Cost: $10,000/year
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Kaysville City

Action 4: The City is collaborating with the Utah State University experimental facility to upgrade their ponds to better facilitate storm drain function.

Time Frame: 2017-2019
Funding: City funds/Utah State University
Estimated Cost: Minimal
Staff: City Administration, Public Works, Engineer, USU, etc.
Jurisdictions: Kaysville City

Action 5: Fill open ditch with a storm drain pipe along Angel Street.

Time Frame: 2017-2018
Funding: City funds
Estimated Cost: Unknown

Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Kaysville City

Action 6: Reconstruct water and flood control channel through Barnes Park.

Time Frame: 2014-2015
Funding: City funds
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Kaysville City

Action 7: Storm water retention pond construction on Nature Conservancy land.

Time Frame: 2017-2018
Funding: City funds
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Kaysville City

Action 8: Storm water retention pond construction on 200 North and Wellington.

Time Frame: 2018-2019
Funding: City funds
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Kaysville City

Action 9: Storm drain upsize and replacement on 100 North.

Time Frame: 2015-2016
Funding: City funds
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Kaysville City

Action 10: Storm drain upsize and replacement on 600 East to include new boxes and pipe replacement.

Time Frame: 2015-2016
Funding: City funds
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Kaysville City

Wildland Fire

Problem Identification: A significant portion of Kaysville City is considered to be in the Urban-Wildland Fire Interface.

OBJECTIVE #1 (Priority HIGH): Decrease wildfire hazard in the Urban-Wildland Fire Interface area of the city due to fireworks use.

Action 1: Developed and supported a permanent firework ordinance to restrict use and the Urban-Wildland Fire Interface through City Council adoption.

Time Frame: 2016
Funding: Local
Estimated Cost: Minimal labor costs
Staff: Fire Department, Parks Department
Jurisdictions: Kaysville City

Action 2: Complete and adopt Community Wildfire protection Plan

Time Frame: 2017-2018
Funding: USFS
Estimated Costs: Minimal
Staff: Fire Department
Jurisdictions: Kaysville City/County Fire Marshall

Multi-Hazards

Problem Identification: The city Emergency Operations Plan (EOP) is overdue for a update and revision.

OBJECTIVE #1 (Priority HIGH): Improve communications, mitigate the impacts of and be prepared for emergency situations and hazards.

Action 1: Update the Emergency Operations Plan (EOP)

Time Frame: 2017
Funding: Federal and Local
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Kaysville City
Action 2: Enhance IT Network and Server Security

Time Frame: Unknown, depending on funding
Funding: Local and State
Estimated Cost: Unknown
Staff: City Administration, Public Works
Jurisdictions: Kaysville City

Action 3: Kaysville City owns and maintains its own power supply system for city residents. The city performs an annual ongoing system-wide inspection, which includes: Pole inspection, line clearance, tree trimming, voltage upgrades as required, and replacement of poles/equipment on voltage upgrade as needed. All of the above will help prevent loss of power/system damage, enhance reliability from all types of natural hazards.

Time Frame: 2016-2021
Funding: City funds
Estimated Cost: $15,000/year
Staff: City Administration, Public Works, Engineer, Kaysville Power, etc.
Jurisdictions: Kaysville City

Background Information

Layton City is located in Davis County, 25 miles north of Salt Lake City. Layton City has a current estimated population of 74,000 (2016) making it the largest city in Davis County and 9th most populous in the State of Utah. It is located adjacent to Hill Air Force Base to the north, Syracuse to the west, Kaysville to the south, Clearfield to the west/northwest, South Weber to the northeast and Uintah/Wasatch/Cache National Forest to the east. The City covers approximately 24 square miles.

Layton City continues to experience substantial residential growth in both the single family and multi-family housing market and even more significantly in the retail market. Layton City is home to Weber State University Davis

Layton City is the economic hub of the county with a large regional mall, numerous hotels, restaurants, large conference center, and several large business parks. The City is bisected by I-15 and very active rail lines, including the UTA Front Runner Commuter line. The Union Pacific line handles a large amount of hazardous materials transportation on a daily basis.

Layton City operates with a Council-Manager form of government. Major city departments include Police, Fire, Public Works, Parks, Legal, Finance/Management services, and Community Development. Emergency management functions are coordinated through the Fire Department with various assigned roles relating to NIMS training, emergency operations plan maintenance, citizen outreach, continuity of operations, and LEPC/State DEM involvement.

Specific Community Hazards

- **Earthquake.** Layton City's proximity to the mountains and the Wasatch Fault puts it at high risk of earthquake damage.
- **Wildland Fire.** Layton City is located in the Wasatch Front, increasing the risk for large wildland urban interface fires. Within the City are several trail systems, such as the Kays Creek Trail and Bonneville Shoreline Trail, increasing the wildfire potential.
- **Dam failure.** Layton City has three reservoirs with various dam failure potential.
- **Flooding.** The potential for flooding is mostly related to dam breach, however the west areas of the city could have flooding due to proximity to the Great Salt Lake. Additionally, there is the potential for flooding related to debris flows post any significant wildfire.
- **Landslide.** There are portions of Layton City deemed 'sensitive lands' and the City has experienced destructive landslide in the past decades.

Critical Facilities and Infrastructure

FACILITY	HAZARD/RISK	MITIGATION
Weber Basin Water Treatment Plant SR193 & HWY89	Water contamination,	Enhance security
Hobbs Reservoir 2360 E. Canyon View	Water contamination, dam breach w/ flooding	Enhance security
Sandridge well 3050 N. Dump Rd	Water contamination	Enhance security
Power plant substation 3050 N. Dump Rd	Power interruption	Enhance security
Fairfield Well Dump Rd below golf course	Water contamination	Enhance security
HAFB runway SR193/Fort Ln.	Flight interruption	Enhance security
Power plant substation Fort Ln. & 1000 N.	Power interruption	Enhance security
Fort Lane Well 1550 N. Fort Ln.	Water contamination	Enhance security
City Shop Well 1925 N. Fort Ln.	Water contamination	Enhance security
Water Tank Oak Hills & HWY89	Water contamination, flooding from breach	Enhance security
Underground petroleum pipeline valve Tanglewood & HWY89	Major Hazardous Materials release to include crude oil	Enhance security Increased protection from vehicles recently added

Holmes Reservoir 2800 E. Gentile Rd	Water contamination, dam breach w/ flooding	Enhance security
Adams Reservoir 1500 E. 900 N.	Water contamination, dam breach w/ flooding	Enhance security
Questar Natural Gas substation 900 S. Main St.	Hazardous materials release	Enhance security
Power plant substation 600 N. Sugar St.	Power interruption	Enhance security
Power plant substation 3100 W. 1000 N.	Power interruption	Enhance security
Water pump station 2100 W. Weaver Ln.	Water contamination	Enhance security
Davis Hospital 1600 W. Antelope	Loss of critical medical facilities	Enhance security
Laytona Well 2050 N. 400 W.	Water contamination	Enhance security
Green Leaf water pump & well 1000 N. at RR tracks (2200 W.)	Water contamination	Enhance security

City Buildings and Facilities

FACILITY	HAZARD/RISK	MITIGATION
City Offices	Loss of vital city records; day to day functions	Enhance seismic resiliency as needed
Police Department	Loss of vital police records; impact to day to day functions	Enhance seismic resiliency as needed
Public Works Building	Loss/damage to response equipment	Enhance seismic resiliency as needed
IT Network and Server	Loss of communications	Enhance security
EOC (Located in Police Department)	Loss of operability for EOC	Ensure communication improvements are made as required
Main Generator for City Office	Loss of power for critical operations	Enhance security
Fire Station 51 (Alternate EOC)	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency as needed
Fire Station 52	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency as needed
Fire Station 53	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency as needed (seismic retrofit was done in 2006 with PDMG)
Parks Building	Loss/damage to potential response equipment	

Storm water Infrastructure

Multiple storm water retention basins throughout the city	Flooding	Dredge and de-silt

Main Arterial & Major Roads

	HAZARD/RISK	MITIGATION
Highway 193	Destruction, evacuation and response concerns	N/A
Antelope Drive	Destruction, evacuation and response concerns	
Main Street	Destruction, evacuation and response concerns	
Hill Field Road	Destruction, evacuation and response concerns	
Highway 89	Destruction, evacuation and response concerns	
Oak Hills/Gentile	Destruction, evacuation and response concerns	
Interstate 15	Destruction, evacuation and response concerns	
Fairfield Rd	Destruction, evacuation and response concerns	
2200 W.	Destruction, evacuation and response concerns	
Fort Lane Rd	Destruction, evacuation and response concerns	
Church St.	Destruction, evacuation and response concerns	
Layton Parkway	Destruction, evacuation and response concerns	
Gordon Avenue	Destruction, evacuation and response concerns	
Cherry Lane	Destruction, evacuation and response concerns	

Mitigation Strategies Implemented since the 2009 Plan

Layton City has updated the Emergency Operations Plan (EOP) and City Continuity of Operations Plan (COOP) but both are in need of revision.

Planned Mitigation Strategies

Wildland Fire

Problem Identification: A significant portion of Layton City is considered to be in the wildland urban interface.

OBJECTIVE #1 (Priority HIGH): Fuels mitigation on public land (City & Federal)

Action 1: Work in Parks Department to accomplish fuel reduction in city trails, most significantly on the Kay Creek Trail.

Time Frame: 2017
Funding: Local
Estimated Cost: Minimal labor costs
Staff: Fire Department, Parks Department
Jurisdictions: Layton City

Action 2: Work with the United States Forest Service to improve fuel reduction along the Bonneville Shoreline Trail.

Time Frame: 2017
Funding: USFS
Estimated Costs: Minimal. Work will be performed by the Weber Basin Hand Crew as part of their annual assignments and training
Staff: Fire Department
Jurisdictions: US Forest Service/Layton City border areas

OBJECTIVE #2 (Priority MEDIUM): Fuels mitigation/reduction on private land

Action 1: Work with private landowners on fuel reduction programs and education

Time Frame: 2017
Funding: Local (with possible State grant funds). Otherwise costs will be for the Wildland Fire Mitigation & Suppression city assessment per SB122 according to the UWRAP (Utah Wildfire Risk Assessment Portal)
Estimated Cost: Minimal labor costs
Staff: Fire Department, Parks Department
Jurisdictions: Layton City

Action 2: Implement the "Ready, Set, Go!" wildland urban interface education program for citizens in accordance with the adopted "Community Wildfire Protection Plan" (See Attached)

Time Frame: 2017-2018
Funding: Federal, State and Local
Estimated Cost: Unknown
Staff: Fire Department
Jurisdictions: Layton City

Multi-Hazards

Problem Identification: The Layton City *Continuity of Operations Plan (COOP)* and *Emergency Operations Plan* are in need of review and revision.

OBJECTIVE #1 (Priority HIGH): Review and update the *Layton City Continuity of Operations Plan (COOP)*

Action 1: Have each City department review their individual COOP and make revisions as needed.

OBJECTIVE #2 (Priority HIGH): Review and update the Layton City *Emergency Operations Plan*

Action 2*:* Have each City Department review and revise their individual department plan and their respective roles and assignments within each assigned ESF.

Action 3: Fire Department will coordinate the development of a Layton City employee *Emergency Response Handbook* with action guides for various types of emergencies for use by office staff as a quick reference.

North Salt Lake

Background Information

North Salt Lake is located in southern Davis County; it is bordered to the north by Woods Cross, to the northeast by Bountiful, and to the south by Salt Lake City. North Salt Lake has a total area of 8.6 square miles. The city has approximately 16,500 residents. North Salt Lake took its name from the name of the small post office at the railroad tracks. The old Utah Highway Patrol weigh station was purchased and used as the first town hall.

North Salt Lake operates under a weak mayor form of government, with an elected Mayor and five Council Members. The day-to-day operations and the majority of executive authorities are delegated to a City Manager, who works closely with the Mayor to ensure all city operations are well-run. City operations include a full time Police, Fire, and Public Works Departments. Emergency management and pre-disaster mitigation responsibilities are coordinated by the North Salt Lake City Manager.

North Salt Lake Mitigation Projects

- North Salt Lake planning: Continue to develop the City's Master Plan.
- Continue to work with the State on hillside development planning.
- Continue to work with the Fire Service on our Wildfire Plan.
- Continue to provide Emergency Preparedness education and support to our Community.

- Continued monitoring of existing landslide areas and control nearby development.

Specific Community Hazards

- **Earthquake.** North Salt Lake's proximity to the mountains and the Wasatch Fault puts it at high risk of earthquake damage.
- **Wildland Fire.** Much of North Salt Lake City is located in the foothills, increasing the risk for wildland fires.
- **Dam failure. The s**econdary water system throughout the community has small storage reservoirs.
- **Flooding.** North Salt Lake is located along the Wasatch Mountain Front. During the 1983 declared flooding disaster, City facilities, trails, and homes sustained significant damage.

Critical Facilities and Infrastructure

FACILITY	HAZARD/RISK	MITIGATION
Culinary water storage tanks and secondary water reservoirs	The city has culinary water storage tanks and secondary water storage reservoirs that may experience water contamination, flooding, and failure due to earthquake	Enhance security, and upgrade water distribution system
Water System		Upgrade infrastructure to current seismic standards
Storm Water System		Upgrade infrastructure to current seismic standards
		Upgrade infrastructure to current seismic standards
		Upgrade infrastructure to current seismic standards

City Buildings and Facilities

FACILITY	HAZARD/RISK	MITIGATION
City Offices/EOC	Loss of vital city records; communication vehicles; day to day functions. Loss of operability for EOC	Provide for city office/EOC survivability following an earthquake
Public Works Building	Loss/damage to response equipment	N/A
South Metro Davis Fire - Station #81	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency
South Metro Davis Fire - Station #82	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency
South Metro Davis Fire - Station #83	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency

South Metro Davis Fire - Station #84	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency
South Metro Davis Fire - Station #85	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency

Stormwater Infrastructure

Stormwater detention basins	Flooding: excessive rainfall overfilling banks	Downstream protection of property

Main Arterial Roads

	HAZARD/RISK	MITIGATION
Main Street	Destruction, evacuation and response concerns	N/A
Highway 89	Destruction, evacuation and response concerns	
Orchard Drive	Destruction, evacuation and response concerns	
Redwood Road	Destruction, evacuation and response concerns	
Eaglewood Drive	Destruction, evacuation and response concerns	
Interstate 15	Destruction, evacuation and response concerns	
Bountiful Boulevard	Destruction, evacuation and response concerns	

Planned Mitigation Strategies

Earthquake

Problem Identification: Critical facilities do not meet seismic standards.

OBJECTIVE #1 (Priority MEDIUM): Retrofit waterlines and storm drain infrastructure to meet seismic standards.

Action 1: Upgrade existing roads and utilities infrastructure where growth has exceeded capacity.

Time Frame: 2016-2021
Funding: City funds
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: North Salt Lake City

Action 2: Design and upgrade culinary water storage tanks for some time over the next 5 to 10 years, and add a second pump house in the next 1-3 years that will equalize the water in the tanks.

Time Frame: 2017-2027
Funding: City funds/State/Federal grant
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: North Salt Lake City

Action 3: The City performs continuous maintenance and repair to keep the system in good working order for both fire flow and earthquake resistance.

Time Frame: 2016-2021
Funding: City funds
Estimated Cost: $10,000/year
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: North Salt Lake City

Action 4: The City is collaborating with the Utah State University experimental facility to upgrade their ponds to better facilitate storm drain function.

Time Frame: 2017-2019
Funding: City funds/Utah State University
Estimated Cost: Minimal
Staff: City Administration, Public Works, Engineer, USU, etc.
Jurisdictions: North Salt Lake City

Action 5: Fill open ditch with a storm drain pipe along Angel Street.

Time Frame: 2017-2018
Funding: City funds
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: North Salt Lake City

Action 6: Reconstruct water and flood control channel through Barnes Park.

Time Frame: 2014-2015
Funding: City funds
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: North Salt Lake City

Action 7: Storm water retention pond construction on Nature Conservancy land.

Time Frame: 2017-2018
Funding: City funds
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: North Salt Lake City

Action 8: Storm water retention pond construction on 200 North and Wellington.

Time Frame: 2018-2019
Funding: City funds
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: North Salt Lake City

Action 9: Storm drain upsize and replacement on 100 North.

Time Frame: 2015-2016
Funding: City funds
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: North Salt Lake City

Action 10: Storm drain upsize and replacement on 600 East to include new boxes and pipe replacement.

Time Frame: 2015-2016
Funding: City funds
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: North Salt Lake City

Wildland Fire

Problem Identification: A significant portion of North Salt Lake City is considered to be in the Urban-Wildland Fire Interface.

OBJECTIVE #1 (Priority HIGH): Decrease wildfire hazard in the Urban-Wildland Fire Interface area of the city due to fireworks use.

Action 1: Developed and supported a permanent firework ordinance to restrict use and the Urban-Wildland Fire Interface through City Council adoption.

Time Frame: 2016
Funding: Local
Estimated Cost: Minimal labor costs
Staff: Fire Department, Parks Department
Jurisdictions: North Salt Lake City

Action 2: Complete and adopt Community Wildfire protection Plan

Time Frame: 2017-2018
Funding: USFS
Estimated Costs: Minimal
Staff: Fire Department
Jurisdictions: North Salt Lake City/County Fire Marshall

Multi-Hazards

Problem Identification: The city Emergency Operations Plan (EOP) is overdue for a update and revision.

OBJECTIVE #1 (Priority HIGH): Improve communications, mitigate the impacts of and be prepared for emergency situations and hazards.

Action 1: Update the Emergency Operations Plan (EOP)

Time Frame: 2017
Funding: Federal and Local
Estimated Cost: Unknown
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: North Salt Lake City
Action 2: Enhance IT Network and Server Security

Time Frame: Unknown, depending on funding
Funding: Local and State
Estimated Cost: Unknown
Staff: City Administration, Public Works
Jurisdictions: North Salt Lake City

Action 3: North Salt Lake City owns and maintains its own power supply system for city residents. The city performs an annual ongoing system-wide inspection, which includes: Pole inspection, line clearance, tree trimming, voltage upgrades as required, and replacement of poles/equipment on voltage upgrade as needed. All of the above will help prevent loss of power/system damage, enhance reliability from all types of natural hazards.

Time Frame: 2016-2021
Funding: City funds
Estimated Cost: $15,000/year
Staff: City Administration, Public Works, Engineer, North Salt Lake Power, etc.
Jurisdictions: North Salt Lake City

Background Information

The town of South Weber was originally incorporated in 1938 and on March 16, 1971 it became a Third Class City. South Weber City is located in northeast Davis County at the mouth of Weber Canyon, bounded by the Weber River on the north and Layton City on the south. US Highway 89 and Interstate 84 are the two major transportation corridors that pass through the City. The 2010 census determined a population of 6,051 persons.

South Weber operates under a council-manager form of government, with an elected Mayor and five Council Members. The day-to-day operations and the majority of executive authorities are delegated to a City Manager, who works hand-in-hand with the Mayor to ensure all city operations are well-run. City operations include a municipal court, water, streets, storm water, sanitary sewer, snow removal, community development, parks and recreation programming, and a volunteer Fire Department. South Weber contracts for garbage services, animal control services, and law enforcement services.

Specific Community Hazards

- **Earthquake.** South Weber's proximity to the mountains and the Wasatch Fault puts it at high risk of earthquake damage.
- **Wildland Fire.** The southern and eastern city boundaries are located on the foothills, and are subject to increased risk of wildland fires.
- **Dam failure.** The City is at the mouth of Weber Canyon which contains several dams including, Echo, Rockport and East Canyon.
- **Flooding.** South Weber's northern boundary is located along the Weber River.
- **High Winds.** South Weber is at the mouth of Weber Canyon, which produces consistent high winds.

Critical Facilities and Infrastructure

FACILITY	HAZARD/RISK	MITIGATION
Water Tanks	No culinary water	Shut off valve(s)
Pump Stations	No culinary water	Back-up generator
Major sewer trunk lines	Backup/flooding/health	
Culinary water well	No culinary water	Back-up generator
Sewer lift station (serves 4 homes)	Backup/flooding/health	

City Buildings and Facilities

FACILITY	HAZARD/RISK	MITIGATION
City Offices	Loss of vital city records; communication; vehicles; day to day functions	TBD
Public Works Building	Loss/damage to response equipment/supplies/materials	TBD
Fire Station	Loss/damage to response equipment	TBD
IT Network and Server	Loss of communications	Enhance security
EOC	Loss of operability for EOC	TBD
Main Generator for City Office	Loss of power for critical operations	TBD
Family Activity Center	Loss of day to day functions	TBD

Stormwater Infrastructure

Detention basins	Flooding	Dredge & de-silt/ clean outlet control structures

Main Arterial Roads

	HAZARD/RISK	MITIGATION
South Weber Dr.	Destruction, evacuation and response concerns	Redundancy in connecting street network
Interstate 84/ U.S. 89	Destruction, evacuation and response concerns	Redundancy in connecting street network
475 East	Destruction, evacuation and response concerns	Redundancy in connecting street network
1900 East	Destruction, evacuation and response concerns	Redundancy in connecting street network
2100 East	Destruction, evacuation and response concerns	Redundancy in connecting street network
Deer Run Drive	Destruction, evacuation and response concerns	Redundancy in connecting street network

Mitigation Strategies Implemented since the 2009 Plan

South Weber City is updating the City Emergency Operations Plan (EOP).
Replaced old cast iron and led-joint pipe in water system.

Planned Mitigation Strategies

Identify the most productive use of funding to implement the highest number of projects.

Dam Failure

Problem Identification: If the East Canyon Dam were to break, it may cause flooding in South Weber. The dam is located approximately 28 miles upstream as a feeder into the Weber River. The likelihood that flood waters would overtop the existing banks of the river by the time it reached South Weber is very low. However, the mitigation is the same as for Flooding below because the source of the flooding in both scenarios is the Weber River.

Objective (Priority MEDIUM): Prevent flooding along the south side of I-84 (in the lower lying areas) from the Stake & Parson Companies Gravel Pit west until the Riverdale City boundary.

Action: Build a berm around the Staker & Parsons Co. gravel pit at an elevation higher than the banks of the river adjacent to the Weber River in that area.

Time Frame: Unknown, depending on funding
Funding: City, State, Federal grant, possibly private collaboration
Estimated Cost: $300,000 to $600,000
Staff: City Engineer, Public Works, Private Contractor
Jurisdiction: South Weber

Flooding

Problem Identification: If the south bank of the Weber River were to rupture at a location adjacent to the Staker & Parson Companies Gravel Pit, it would fill the pit with water. Once the pit was full, the river would flow out of the pit area and run along the south side of I-84 rather than back into the existing river channel. This is due to the elevation of the river channel being higher than the lowest elevations around the pit at that location. The flood waters would run in the lowest lying areas along I-84 (which is higher in elevation than the adjacent property on the south) until it got to Riverdale City and/or a location where it would run back into the existing river channel. This scenario could happen due to an earthquake or high flood waters in the river itself which exceeded the river bank at that location.

Objective (Priority HIGH): Prevent flooding along the south side of I-84 (in the lower lying areas) from the Stake & Parson Companies Gravel Pit west until the Riverdale City boundary.

Action: Build a berm around the Staker & Parsons Co. gravel pit at an elevation higher than the banks of the river adjacent to the Weber River in that area.

Time Frame: Unknown, depending on funding
Funding: City, State, Federal grants, possibly private collaboration
Estimated Cost: $300,000 to $600,000
Staff: City Engineer, Public Works, Private Contractor
Jurisdiction: South Weber

Earthquake

Problem Identification: South Weber's proximity to the mountains and the Wasatch Fault puts it at high risk of earthquake damage. The amount of damage, and what infrastructure or facilities would be damaged would depend on the magnitude of the earthquake. As mentioned, there is some potential for flooding from the Weber River due to an earthquake. A second likely risk is damage to the City's culinary water system. Damage to other utility lines (petroleum, gas, communication, power, irrigation), roads and homes is also likely to occur in varying degrees due to the magnitude of the earthquake.

Objective (Priority MEDIUM): Protect the City water system where feasible.

Action #1: Replace the waterline at the East Bench Reservoir to Cornia Dr. This line is cast iron and more susceptible to rupture than other lines in the system.

Time Frame: 2018-2019
Funding: City
Estimated Cost: $220,000
Staff: City Engineer, Public Works, Private Contractor
Jurisdiction: South Weber

Action #2: Install high-flow emergency shut-off valves on the outflow lines from all of the city culinary water reservoirs. This would prevent potential (local) flooding at the reservoir sites as well as retain the stored culinary water for use once the damaged lines in the system could be repaired.

Time Frame: 2018
Funding: City
Estimated Cost: $80,000
Staff: City Engineer, Public Works, Private Contractor
Jurisdiction: South Weber

Wildland Fire

Problem Identification: A portion of South Weber City is along the foothills creating an urban/wildland interface.

OBJECTIVE #1 (Priority MEDIUM): Fuels mitigation.

Action: Work in tandem with homeowners to remove fuels and create fire breaks.

Time Frame: Unknown, depending on funding
Funding: City and private property owners
Estimated Cost: Minimal
Staff: Fire Department, Public Works, City Administration
Jurisdiction: South Weber

High Winds

Problem Identification: The City is at the mouth of Weber Canyon which produces continual moderate winds, but has the potential at times of very high winds. High winds from the east are also possible in general along the whole mountainside area.

OBJECTIVE #1 (Priority MEDIUM): To secure critical infrastructure.

Action: Put emergency backup generator at Church St. pump station.

Time Frame: 2017-2018
Funding: City
Estimated Cost: $98,125
Staff: City Engineer, Public Works
Jurisdiction: South Weber

OBJECTIVE #2 (Priority MEDIUM): To minimize debris and potential compromised access for emergency vehicles due to fallen trees across streets.

Action: Work in tandem with homeowners to trim or remove tall trees that are susceptible to falling over and causing damage to homes, other facilities or across streets.

Time Frame: Unknown, depending on funding
Funding: City and private property owners
Estimated Cost: Minimal
Staff: Public Works
Jurisdiction: South Weber

Background Information

Sunset is a city in Davis County, Utah, United States. It is part of the Ogden–Clearfield, Utah Metropolitan Statistical Area. The population was 5,122 at the 2010 census. Sunset emerged as a distinct place in 1916. Sunset is located in northern Davis County. It is bordered by Hill Air Force Base to the east, Clearfield to the south, Clinton to the west, and Roy in Weber County to the north.

According to the United States Census Bureau, the city of Sunset has a total area of 1.3 square miles, all of it land.

Specific Community Hazards

- **Earthquake.** Sunset's proximity to the Wasatch Fault puts it at high risk of earthquake damage.
- **Flooding.** Sunset is susceptible to flooding from runoff and storm events.

Earthquake

Problem Identification: Public Works Shop may not meet seismic standards. Due to age of structure.

Objective #1(Priority Medium)

Action 1: Build a new Public Works Shop

Time Frame: 2023-2029
Funding: City funds/State/Federal/UDOT
Estimated Cost: $1.5 million
Staff: City Administration: Public Works: Engineer:
Jurisdictions: Sunset City Corp

Problem Identification: Fire Station may not meet seismic standards. Due to age of structure

Objective: #2 (priority Medium)

Action 1: Build a new Fire Station structure

Time Frame: 2023-2029
Funding: City funds/State/Federal/UDOT
Estimated Cost: $1.5 million
Staff: City Administration: Public Works: Engineer: Fire Dept.
Jurisdictions: Sunset City Corp

Flooding

Problem Identification: 450 W from 2137 N to 2300 N these properties are lower than the roadway. During periods of heavy rains the water will go over the curb and sidewalk towards the homes.

Objective: (Priority high): Install Storm Water catch basins to catch the water flow before it has a chance to accumulate to the point of overflow.

Action 1: Engineer the new catch basins to ensure water is taken care of.

Time Frame: FY 2017
Funding: City Funds
Estimated Cost: $100,000
Staff: Public Works: Engineering
Jurisdictions: Sunset City

SYRACUSE
EST. CITY 1935

Background Information

Syracuse City is located 30 miles north of Salt Lake City, UT. The city footprint covers 8.7 sq. miles.

Since 2006 the city's population has more than doubled with a current population of 27,969. Syracuse has many young working families as well as older native residents. The commercial base continues to develop, with interest in a new sixty-acre industrial park.

Due to the growth in Davis County, one new highway project (State Highway 193), has recently been completed, and another (the West Davis Corridor) is in the planning process with the Utah Department of Transportation and Syracuse.

Syracuse City proper has all of the amenities of a suburban community, including: City Hall, Syracuse Justice Court, Syracuse Public Safety Department, six elementary grade schools, two Jr. High (secondary) Schools, and Syracuse High School. Syracuse City also offers gas stations, grocery stores, restaurants, office buildings, medical and dental practices, childcare facilities, and various other types of businesses.

Syracuse City is also home to the North Davis Sewer District which processes sewer for over 200,000 people in Davis County. The sewer district and public utilities like culinary water, natural gas, and electricity distribution, are considered as critical infrastructure within the community.
If impacted by disaster, the loss of this infrastructure would result in significant economic impact, and potentially the loss of life.

Syracuse operates under a Mayor/Council form of government, with an elected Mayor and five Council Members. The day-to-day operations and the majority of executive authorities are delegated to a City Manager, who works closely with the Mayor to ensure a continuous performance of all city operations.
City operations include 24-7 police, fire, and public works departments, a municipal court, water, streets, stormwater evacuation, snow removal, community development, and parks and recreation programming. Emergency management and pre-disaster mitigation responsibilities are coordinated by the Syracuse City Manager.

Specific Community Hazards

- **Earthquake.** Syracuse proximity to the Wasatch Fault puts it at high risk of earthquake damage.
- **Wind Event.** Syracuse City is west of the Wasatch Mountain Range where several downslope and canyon wind events have potential for property damage.
- **Flooding.** Syracuse is located west of the Wasatch Mountain Front, and just East of the Eastern shore of the Great Salt Lake. Flooding from heavy rain that overwhelms storm drainage systems and impacts sewer and water infrastructure is a potential hazard, as well as flooding from rising lake levels or seiche event cause by earthquake.

Critical Facilities and Infrastructure

FACILITY	HAZARD/RISK	MITIGATION
Streets / Transportation	Earthquake	Regular Maintenance
Culinary Water System	Earthquake	Planned Upgrades
Sanitary Sewer	Earthquake	Regular Maintenance

Electrical Grid – (Rocky Mountain Power)	Earthquake / Wind	Back-up Generators for critical infrastructure
Natural Gas Grid – (Questar Gas)	Earthquake / Flood	Explore Alternative Fuel Sources for critical infrastructure

City Buildings and Facilities

FACILITY	HAZARD/RISK	MITIGATION
City Offices	Loss of vital city records; communication vehicles; day to day functions	Explore Back-up of records Off-site
Police Department	Loss of vital police records; impact to day to day functions	Explore Satellite Station Feasibility/Need
Fire Department	Reduced Ability to Respond	Explore Satellite Station Feasibility/Need
Public Works Building	Loss/damage to response equipment	N/A
Community Center	Loss of Sheltering Ability and Volunteer Response	Explore Alternate Sheltering options
IT Network and Server	Loss of communications	Enhance security
EOC (Fire Station)	Loss of operability for EOC	Equip secondary location for use as EOC

Stormwater Infrastructure

Storm Water Retention Basins	Flooding	Dredge and de-silt as needed

Main Arterial Roads

	HAZARD/RISK	MITIGATION
Antelope Drive	Destruction, evacuation and response concerns	State Highway
Highway 193	Destruction, evacuation and response concerns	State Highway
Bluff Road	Destruction, evacuation and response concerns	Maintain
700 South	Destruction, evacuation and response concerns	Maintain
2700 South (Gordon)	Destruction, evacuation and response concerns	Maintain
3700 South (Gentile)	Destruction, evacuation and response concerns	Maintain
1000 West	Destruction, evacuation and response concerns	Maintain
2000 West	Destruction, evacuation and response concerns	State/City Maintain
3000 West	Destruction, evacuation and response concerns	Maintain

Mitigation Strategies Implemented since 2012

- Syracuse has updated the City Emergency Operations Plan (EOP), and created an Emergency Preparedness Committee that meets monthly.
- Syracuse has installed back-up generators for all public buildings, including Police, Fire, Public Works, Community Center (shelter), and Administration. This will enable efforts to maintain services during long-term power outages or other infrastructure emergencies.

- Syracuse City Public works has less than 10 percent of the culinary water grid with outdated concrete/tile culinary water line remaining in need of upgrade.

Planned Mitigation Strategies

Flooding

Problem Identification: Syracuse City is established in western Davis County near the Bluff of the Great Salt Lake which may be subject to flooding in severe storm events or earthquake-caused wave event. Upstream drainage has potential to exceed capacity, resulting in thousands of dollars in damages. Ongoing maintenance of these drainage canals and pipelines by the city will continue to mitigate this threat.

Objective (Priority Medium): Upgrade and maintain drainage systems.

Action 1: Annually inspect and remove debris in stream channels and detention basins and storm drains.

Time Frame: Annually
Funding: City
Estimated Cost: Minimal
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Syracuse City

Action 2: Storm Water Master Plan includes design to connect and activate the 4000 West Outfall Project (60-inch diameter storm-water pipeline on city's South side) that terminates along the Bluff into the Great Salt Lake.

Time Frame: 2020
Funding: City
Estimated Cost: $300,000

Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Syracuse City

Earthquake

Problem Identification: Critical facilities may not meet seismic standards. Due to geography, liquefaction may occur.

OBJECTIVE (Priority MEDIUM): Retrofit facilities to seismic standards.
Action 1: Retrofit existing water storage facilities to bring into compliance with current seismic code.

Time Frame: 2026
Funding: City funds/State/Federal grant
Estimated Cost: $2 million
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Syracuse City

Action 2: Construct a new 6,000,000-gallon culinary water reservoir at a location East of the city, to work in tandem with existing reservoir increasing city water storage and earthquake survivability.

Time Frame: 2026
Funding: City funds/State/Federal grant
Estimated Cost: $21 Million
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Syracuse City

Action 3: Complete Culinary Water System Master Plan

Time Frame: 2017
Funding: Minimal
Estimated Cost: Unknown
Staff: Public Works, Engineer, etc.
Jurisdictions: Syracuse City

Action 4: Syracuse City has an ongoing, annual program of replacing 80 miles of aging cast iron sewer pipe, which is very susceptible to earth movement, with PVC pipe, which is better able to withstand earth movement caused by a seismic event.

Time Frame: Ongoing
Funding: City
Estimated Cost: $250,000 / mile

Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Syracuse City

High Wind Event

Problem Identification: Syracuse City is down-slope of the Wasatch Mountain Range where seasonally strong winds have caused damage to structures and the urban forest.

OBJECTIVE (Priority MEDIUM): Building Code Enforcement
Action 1: Work in tandem with project developers and homeowners to follow standardized codes and maintain structural integrity of commercial and residential buildings.

Time Frame: Ongoing
Funding: City
Estimated Cost: Minimal
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Syracuse City

Action 2: Create a public service campaign to inform residents about tree species and varieties that are more likely to endure high wind events without failure, causing damage to utilities, landscape and buildings.

Time Frame: Ongoing
Funding: City and Local Volunteer
Estimated Cost: Minimal
Staff: City Administration, Code Enforcement, Volunteer Committee, etc.
Jurisdictions: Syracuse City

Multi-Hazards

Problem Identification: As Syracuse City grows, there is a need to add a staff member as a dedicated Emergency Manager to oversee preparedness, mitigation, response and recovery activities for the commercial district and residents.

OBJECTIVE (Priority Medium): Improve communications, mitigate the impacts of and be prepared for emergency situations and hazards.

Action 1: Create a full-time Emergency Manager position.

Time Frame: 2021

Funding: City
Estimated Cost: $40,000
Staff: City Administration
Jurisdictions: Syracuse City

Background Information

West Bountiful was first located in 1848 when pioneers made their way into the territory. It was incorporated as a town on January 28, 1949. The City is located about eight miles north of Salt Lake City and twenty-nine miles south of Ogden.

West Bountiful is a City of the fifth class and operates under a six-council member form of government, with an elected Mayor and five Council Members. The day-to-day operations are delegated to a City Administrator, who works hand-in-hand with the Mayor to ensure all city operations are well-run. City operations include a 24-7 police department, water, garbage/recycling, streets, storm water, snow removal, community development, and an Arts Council. West Bountiful City is part of the South Davis Fire District which provides fire protection. Emergency management and pre-disaster mitigation responsibilities are coordinated by the West Bountiful City Police Department in partnership with local citizens that are appointed to the Emergency Preparedness Advisory Committee (EmPAC). Sanitary Sewer services are provided by the South Davis Sewer District. Animal Care and Control services are provided by Davis County.

The 5300 residents enjoy a quiet, rural, equestrian life style. Many opportunities for cultural events are provided through a monthly concert series and arts displays. Major events include 4th of July celebration, Founders' Day celebration, and special activities for Halloween, Easter and Christmas. The City benefits from a vibrant commercial district along 500 West between 400 North and 500 South, with a variety of goods and services from restaurants and deli's to home improvement and savings club businesses.

The FrontRunner commuter rail has been running since April 2008, and the Legacy Parkway was opened in 2008. These were built to help alleviate the traffic load on Interstate 15 through the West Bountiful area. West Bountiful is a gateway community to Salt Lake County for travelers going south on I-15 and Legacy Parkway.

Specific Community Hazards

- **Earthquake.** West Bountifuls' proximity to the mountains and the Wasatch Fault puts it at high risk of earthquake damage.
- **Flooding.** West Bountiful is located along the Wasatch Mountain Front. City facilities, trails, and homes sustained significant damage during the 1983 flooding disaster.
- **High Winds.** West Bountiful is subject to high winds. December, 2011 West Bountiful was subjected to extreme winds that caused significant damage to houses, trees, and other infrastructure.

Critical Facilities and Infrastructure

FACILITY	HAZARD/RISK	MITIGATION
500 South Water Tank	Water contamination, flooding, tank failure	New main line connection into tank. New main line from tank into West Bountiful
400 North Water Tank	Water contamination, flooding, tank failure	New main line from tank into West Bountiful
Bountiful Water Connection	Line Failure	

City Buildings and Facilities

FACILITY	HAZARD/RISK	MITIGATION
City Offices	Loss of vital city records; communication vehicles; day to day functions	Transfer paper records to digital and secondary back up off site. Update heavy equipment.
Police Department	Loss of vital police records; impact to day to day functions	Update servers and security.
Public Works Building	Loss/damage to response equipment	Developing plans to construct a new maintenance yard.
IT Network and Server	Loss of communications, Cyber Attacks	Enhance security, Contract with professional IT Services, new servers.
EOC	Loss of operability for EOC	Equip EOC; Preplanned secondary EOC and mobile EOC Trailer with equipment
Main Generator for City Office	Loss of power for critical operations	Enhance security and maintenance.
South Metro Davis Fire - Station #81	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency
South Metro Davis Fire - Station #82	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency
South Metro Davis Fire - Station #83	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency
South Metro Davis Fire - Station #84	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency

South Metro Davis Fire - Station #85	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency

Stormwater Infrastructure

Storm Water Ditches	Flooding	Dredge and de-silt
Storm Water Lines	Flooding	New lines in many areas of city

Main Arterial Roads

	HAZARD/RISK	MITIGATION
500 South	Destruction, evacuation and response concerns	N/A
400 North	Destruction, evacuation and response concerns	New road from 800 West to 1100 West
1100 West	Destruction, evacuation and response concerns	Proper maintenance, chip seal etc
800 West	Destruction, evacuation and response concerns	New areas a road and proper maintenance.
Pages Lane	Destruction, evacuation and response concerns	New road, curb and gutter, and below ground infrastructure

Mitigation Strategies Implemented since the 2009 Plan

West Bountiful City is updating the City Emergency Operations Plan (EOP).
West Bountiful City created the Emergency Preparedness Advisory Committee (EmPAC).
West Bountiful City assigned the city's emergency planning to the police department.
West Bountiful City purchased a mobile trailer that was converted into a mobile command trailer.
West Bountiful City purchased new vehicle and handheld police radios to replace outdated equipment and making bringing the radios into compliance with projected UCA changes.
West Bountiful City has purchased secondary radios for police, public works, and CERT.
West Bountiful City has started to store water and food supplies for city incident command.
West Bountiful City increased emergency preparedness training, eg. Spontaneous Volunteer Management.
West Bountiful City takes part in emergency drills, eg. The Utah Great Shake Out.
West Bountiful's CERT works in conjunction with the city government and has a representative on the EmPAC board.
West Bountiful City purchased a new backhoe and loader that will be used in the event of a disaster.

Planned Mitigation Strategies

Holly Frontier Refinery

Problem Identification: Fire, Explosion, Chemical Leak.

Goal: Continue a good working relationship with Holly to include quality communication and collaboration on projects that affect the city.

Objective (Priority HIGH): Mitigate potential fire and explosion damage.

Action: Replace main waterline on 500 South to improve water flow to refinery in the event of fire or explosion

Time Frame: Compete by October, 2016
Funding: Holly Refining
Estimated Cost: $500,000
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: West Bountiful City

Flooding

Problem Identification: West Bountiful City is traversed by several canals which may be subject to flooding in severe storm events. These canals overtopped their banks in the 1983 flood disaster, resulting in thousands of dollars in damages. Significant funding following the 1983 flooding greatly reduced flood vulnerability in those areas. Ongoing maintenance of these floodways by the county will continue to mitigate this threat.

Objective (Priority HIGH): Maintain identified flood threat areas.

Action: Annually inspect and remove debris in stream channels and debris basins.

Time Frame: Annually
Funding: City
Estimated Cost: Minimal
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: West Bountiful City

Earthquake

Problem Identification: Critical facilities do not meet seismic standards. Water tanks supplying water to city.

OBJECTIVE (Priority High): Replace main water line from 500 South water tank to city. Replace aging waterlines supplying water to the city. Replace Questar gas lines that supply gas to the city.

Action 1: Replace main water line from 500 South water tank to city

Time Frame: Completed 2016
Funding: City funds/Holly Refinery
Estimated Cost: $1million
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: West Bountiful City

Action 2: Replace aging high pressure gas lines which serve a large portion of West Bountiful City (by Questar Gas). These gas lines cross several fault traces, and are subject to failure in the event of fault movement or a reasonably expected seismic event.

Time Frame: Ongoing
Funding: Minimal
Estimated Cost: Unknown
Staff: City/Questar Gas
Jurisdictions: West Bountiful City

Action 3: West Bountiful City has an ongoing, annual program of replacing aging cast iron culinary water pipe, which is very susceptible to earth movement, with flexible PVC pipe, which is better able to withstand earth movement caused by a seismic event.

Time Frame: Ongoing
Funding: City
Estimated Cost: $500,00/year
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Bountiful City

Multi-Hazards

Problem Identification: West Bountiful City's emergency operations plan is in the process of being updated.

OBJECTIVE #1 (Priority HIGH): Improve communications, mitigate the impacts of and be prepared for emergency situations and hazards.

Action 1: Update Emergency Operations Plan

Time Frame: 2017
Funding: Federal and Local
Estimated Cost: Unknown
Staff: City Administration, Police, Public Works, Engineer, EmPAC, etc.

Jurisdictions: West Bountiful City

Action 2: Enhance IT Network and Server Security

Time Frame: Unknown, depending on funding
Funding: Local and State
Estimated Cost: Unknown
Staff: City Administration, Police Department
Jurisdictions: West Bountiful City

Background Information

West Point is a city in Davis County, Utah, United States. It is part of the Ogden–Clearfield, Utah Metropolitan Statistical Area. The population was 9,511 at the 2010 census, up from 6,033 at the 2000 census. The estimated population in 2014 was 10,204. The city has experienced quick growth centered primarily around single-family residential construction.

West Point is located along the eastern shoreline of the Great Salt Lake, and an extensive network of wetlands is strung along the western boundaries. These areas are essential to migrating birds. The cities of Clinton and Hooper are located to the north, Clearfield is to the east, and the city of Syracuse is to the south.

Specific Community Hazards

- **Earthquake.** West Point's proximity to the Wasatch Fault puts it at high risk of earthquake damage.
- **Flooding.** West Point is susceptible to flooding from runoff and storm events.

Planned Mitigation Strategies

Earthquake

OBJECTIVE #1 Enforce Building Codes

Problem Identification: Building codes are being updated regularly, and sometimes it takes a while for the City to update the codes.

Objective (Priority High): Make sure the City is up-to-date with building codes.

Action: Adopt and enforce updated building code provisions to reduce earthquake damage risk.

Time Frame: 2017
Funding: City
Estimated Cost: Staff time
Staff: City Inspector, Administration
Jurisdictions: West Point City

OBJECTIVE #2 Seismic Hazards

Problem Identification: West Point City has the potential to become vulnerable to Seismic Hazards.

Objective (Priority High): Know what locations within the City are most vulnerable to seismic events.

Action: Use GIS to map hazard areas, at-risk structures, and associated hazards to assess high-risk areas, and then offer the mapping online for residents and design professionals.

Time Frame: Unknown
Funding: Unknown
Estimated Cost: Unknown
Staff: Public Works Department, City Engineer
Jurisdictions: West Point City

OBJECTIVE #3 Earthquake Risk Awareness

Problem Identification: Many West Point City residents have not been in an earthquake, so they may not know what to do when one comes.

Objective (Priority High): Have an educated citizenry when it comes to earthquake protocol.

Action: Develop an outreach program about earthquake risk and mitigation activities in homes schools, and businesses, and educate homeowners on safety techniques to follow during and after an earthquake.

Time Frame: Continuing
Funding: City
Estimated Cost: Staff time
Staff: Administration
Jurisdictions: West Point City

Flooding

Problem Identification: The City has many Sewer and Storm Drain Manholes that often get filled with debris which could potentially cause flooding.

Objective (Priority Medium): Maintain Sewer and Strom Drain Manholes.

Action: Annually inspect and remove debris in City Sewer and Storm Drain Manholes.
Time Frame: Annually
Funding: City
Estimated Cost: Staff Labor + Repairs as needed
Staff: Public Works Department
Jurisdictions: West Point City

Multi-Hazards

Objective #1 Water Contamination

Problem Identification: West Point City has had traces of Chloroform in the water in recent months and the Chlorine residuals are perpetually low.

Objective (Priority High): Maintain the City Water to State Standards.
Action: Add Chlorine Booster to the Water System.
Time Frame: 2017
Funding: City
Estimated Cost: $30,000
Staff: Public Works Department, City Engineer
Jurisdictions: West Point City

Objective #2 Emergency Medical Preparedness

Problem Identification: West Point City does not have any Automated External Defibrillators (AEDs) in the City.

Objective (Priority High): Have AEDs available in case of emergency.
Action: Acquire seven AEDs, one for each park, the Municipal Building, the Public Works Building, and two portables for the Public Works Director and the Recreation Director.
Time Frame: 2017
Funding: Unknown
Estimated Cost: $14,000
Staff: Public Works Department
Jurisdictions: West Point City

Objective #3 Emergency Management Plan

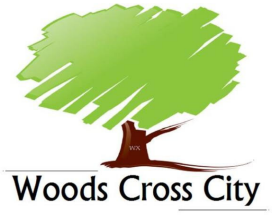
Problem Identification: The City has not adopted an emergency management plan.

Objective (Priority High): Improve communications, mitigate the impacts of and be prepared for emergency situations and hazards.
Action: Finalize and adopt an Emergency Management Plan.
Time Frame: 2017
Funding: Local
Estimated Cost: Staff Time
Staff: City Administration
Jurisdictions: West Point City

Objective #4 Fire Hydrant Flushing

Problem Identification: The City has many fire hydrants that could potentially get clogged or not have enough water pressure.

Objective (Priority Medium): Maintain City fire hydrants.
Action: Annually inspect all City fire hydrants to ensure proper water pressure.
Time Frame: Annually
Funding: City
Estimated Cost: Staff Labor + Repairs as needed
Staff: Public Works Department
Jurisdictions: West Point City



Background Information

Woods Cross City is a community located in Davis County along the valley of the Wasatch Range. With a population of about 10,000 and approximately 2,800 households, Woods Cross offers a variety of housing options commercial and industrial businesses with access to I-15 and Legacy Parkway for commuters close to Salt Lake City.

Although a part of the Ogden-Clearfield Metropolitan Statistical Area, it serves as a bedroom community to Salt Alake City and the surrounding area. However, due to the very narrow entrance into Salt Lake County, roads between the foothills and wetlands often reach near-gridlock traffic during rush hour. The FrontRunner commuter rail has been running since April 2008, and the Legacy Parkway was opened in 2008. These facilities have helped alleviate the traffic load on Interstate 15 through the South Davis County Area. Woods Cross occupies an area of approximately six square miles.

Woods Cross City operates with an elected Mayor and five Council Members. The day-do-day operations and the majority of executive authorities are delegated to a City Administrator, who works hand-in-hand with the Mayor and Council ensure all city operations are well-run. City operations include a 24-7 police department, a municipal court, water, garbage/recycling, street, stormwater, snow removal, community development, and parks facilities. Woods Cross City is part of the South Davis Fire District which provides fire protection. Emergency management and pre-disaster mitigation responsibilities are coordinated by the City Administrator.

Specific Community Hazards

- **Earthquake:** Woods Cross City's proximity to the Wasatch Fault puts it at a high risk of earthquake damage.
- **Railways:** Two major railroad tracks and an industrial rail track cross through the community.
- **Chemical Release:** Three petroleum facilities reside within Woods Cross City and others in very close proximity make probability of explosions or air contamination.
- **Pipeline:** Woods Cross City has 12 pressure petroleum pipelines that run through the city in roughly one mile wide corridor which encompass the majority of the City.
- **Flooding:** Woods Cross City is located along the eastern edge of the Great Salt Lake wetlands thus making the ground water suitable to many locations.
- **Volunteers:** Activate and establish ongoing training and programs for public to be involved.
- **Wildland Fire:** Western portion of Woods Cross City borders a nature preserve scenic by way and trail which has a potential for wildfires.
- **Windstorm:** Woods Cross City lies on the western edge of the Wasatch from which have severe down slope wind events.
- **Land Subsidence:** Homes in a specific geographical area is experience substantial settlement issues after many years of being constructed.

Critical Facilities and Infrastructure

FACILITY	HAZARD/RISK	MITIGATION
Wells #3, #4 & #5	Water contamination Low water level Power loss	Proper source protection SCADA Monitoring Standby generators
Storage reservoirs	Water Contamination Earthquake	Proper security control Design & constructed for earth quake
Treatment Plant	Earthquake Power loss	Designed & constructed for earthquake Standby generator

City Buildings and Facilities

FACILITY	HAZARD/RISK	MITIGATION
City Offices	Loss of vital city records; communication vehicles; day to day functions	Backup of vital records and storage
Police Department	Loss of vital police records; impact to day to day functions	Backup of vital records and storage
Public Works Building	Loss/damage to response equipment	Relocate and construct new facility to meet earthquake standards
IT Network and Server	Loss of communication	Enhance security
EOC	Loss of operability for EOC	Complete connection to fiber/analog lines: develop second EOC location

Standby Generator for City Office and Water system facilities	Loss of power for critical operations	Enhance security; proper maintenance of generators
South Metro Davis Fire - Station #81	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency
South Metro Davis Fire - Station #82	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency
South Metro Davis Fire - Station #83	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency
South Metro Davis Fire - Station #84	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency
South Metro Davis Fire - Station #85	Loss/damage to response apparatus/personnel	Enhance structural earthquake resiliency

Stormwater Infrastructure

1500 South & 1950 South Detention basins	Flooding: excessive rainfall overfilling banks	Downstream protection of property

Critical Arterial Roads

	HAZARD/RISK	MITIGATION
1500 South	Destruction, evacuation and response concerns, bridge collapse, train derailment	UDOT rebuilt I-15 bridge in 2014
800 West	Destruction, evacuation and response concerns	
1100 West	Destruction, evacuation and response concerns, train derailment	
Redwood Road	Destruction, evacuation and response concerns	
2600 South	Destruction, evacuation and response concerns, train derailment, bridge collapse	UDOT rebuilt I-15 bridge in 2014

Community

Various Community Preparedness Events	CERT Classes, CERT Training Meetings	Organization of Citizen Corp Council, District Area Leadership Block Captain training
Community Involvement Volunteers	Lack of trained manpower	Encourage community support Increase training opportunities

Mitigation Strategies Implemented since the 2009 Plan

Woods Cross City has updated the City Emergency Operations Plan (EOP)

Drinking Water Well drilled and equipped with standby power - $1.5 million
3.1 million gallon reservoir designed and constructed for earthquake resilience -
$3 million
2,000 gpm Water Treatment Facility$5 million
Upgrade to radio system with additional frequencies for city to district's communication -$5,000
Air monitoring equipment set up within the City - Business paid approximately $100,000 to Health Department for implementation
Woods Cross Public Works Mutual Aid Agreements – UTWARN and UPWEMA

Planned Mitigation Strategies

Flooding

Problem Identification: Basement flooding

OBJECTIVE (Priority HIGH): Determine elevations of high water elevations. Establish benchmarks for surveyor to utility

Action: Set lowest dwellable elevation and benchmarks

Time Frame: 2016
Funding: City budget
Estimated Cost: $10,000
Staff: City Administration, Public Works, Engineer, etc.
Jurisdictions: Woods Cross City

Earthquake

Problem Identification: Public Works facility does not meet seismic standards.

OBJECTIVE #1 (Priority HIGH): Retrofit facilities to seismic standards.

Action 1: Construct a new Public Works Facility

Time Frame: 2017-2018
Funding: Municipal bonding/utility fees
Estimated Cost: $6.5 million
Staff: City Administrator, Public Works
Jurisdictions: Woods Cross City

Action 2: Replace Aging Waterlines

Time Frame: Annually
Funding: Utility fees

Estimated Cost: $300,000 yearly
Staff: Public Works & Engineering
Jurisdictions: Woods Cross City

Railways

Problem Identification: Hazmat spill

OBJECTIVE (Priority MEDIUM): Train on hazardous material response

Action: First response training
Time Frame: Annually
Funding: Grants
Estimated Cost:
Staff: South Davis Metro Fire
Jurisdiction: South Davis Metro Fire

Chemical Release

Problem Identification: Air Quality form chemical/petroleum releases

OBJECTIVE (Priority MEDIUM): Educate the public and maintain existing monitoring equipment installed

Action 1: Proper maintenance and training

Time frame: Annually
Funding: Business and County Health Department
Estimated Cost: $5,000
Staff: County Health Department
Jurisdiction: Davis County Health Department

Action 2: Public notification

Time Frame: Annually
Funding: Business
Estimated Cost: $500
Staff: Air Quality Committee
Jurisdiction: Woods Cross City

Pipeline

Problem Identification: Petroleum pipelines that impact the community

OBJECTIVE 1 (Priority LOW): Support improvements to infrastructure

Action 1: Educate community of pipeline awareness

Time Frame: Annually
Funding: Pipeline owners/City budget
Estimated Cost: $250.00
Staff: Pipeline owners/City Staff
Jurisdictions: Pipeline owners/Woods Cross City

Volunteers

Problem Identification: Programs & training for community volunteers

OBJECTIVE (Priority HGH): Establish a spontaneous volunteer management team

Action 1: Train specific individuals for the City sponsored Volunteer Management Team

Time Frame: 2017 City 2019 Districts
Funding: City Budget
Estimated Cost: $1,000
Staff: Woods Cross Citizen Corp Council
Jurisdiction: Woods Cross City

Action 2: Meetings and training to maintain a Citizen Emergency Response Team

Time Frame: Annually
Funding: City Budget
Estimated Cost: $1,000
Staff: Woods Cross Citizen Corp Council
Jurisdiction: Woods Cross City

Critical Roads

Problem Identification: Critical Roadways for life line infrastructure
OBJECTIVE: Provide unrestricted access or critical roadways for all life line infrastructure
Action: Identify & map life line infrastructure
Time Frame: 2017-20149
Funding: City Budget
Estimated Costs: $10,000
Staff: Public Works, Engineering, Community Development
Jurisdiction: Woods Cross City

Wildland Fire

Problem Identification: Wildland fire

OBJECTIVE #1 (Priority LOW) Fuel mitigation

Action 1: Maintain a reduction of fuel along trail system

Time Frame: Annually
Funding: City Budget
Estimated Cost: $5,000
Staff: Public properties staff
Jurisdiction: Woods Cross City

Action 2: Participate with South Davis Metro Fire District on a Community Wildfire Protection Plan

Time Frame: 2017
Funding: Woods Cross City, South Davis Metro Fire District
Estimated Costs: $10,000
Staff: City Administration, City Citizen Corp Council, Fire District
Jurisdiction: Woods Cross City, South Davis Metro Fire District

Windstorm

Problem Identification: Sever downslope winds form Wasatch Mountain Range

OBJECTIVE#1 (Priority LOW) Structural building integrity

Action 1: Review proper building and development codes

Time Frame: 2018
Estimated cost: $2,500
Staff: Community Development, Building Department
Jurisdiction: Woods Cross City

Land Subsidence

Problem Identification: Several homes in the city have experienced substantial settlement

OBJECTIVE (Priority MEDIUM): Conduct an analysis of why this is occurring and seek to discover mitigation solutions.

Action: Continue with residential inquiries, monitoring and evaluations of existing established benchmarks and boring

Time Frame: 2016-2018

Funding: City Budget
Estimated Cost: $50,000
Staff: City Staff, Consultants
Jurisdiction: Woods Cross City

Multi Hazards

Problem Identification: Lack of electronic storage and communication equipment that is vulnerable

OBJECTIVE (Priority MEDIUM): Improve storage capacity and duplicate critical communication as needed for operations

Action 1: Develop team to access the need and determine critical components

Time Frame: 2018
Funding: City Budget
Estimated Cost: $1,000
Staff: City Personnel
Jurisdiction: Woods Cross City

Action 2: Enhance the storage and communication equipment

Time Frame: 2019
Funding: City Budget
Estimated Cost: $10,000
Staff: City Administration & personnel
Jurisdiction: Woods Cross City

Part VII. DAVIS COUNTY GEOGRAPHIC SETTING

County	**306,479**
Bountiful	42,552
Centerville	15,335
Clearfield	30,112
Clinton	20,426
Farmington	18,275
Kaysville	4,987
Kaysville	27,300
Layton	67,311

North Salt Lake	16,322
South Weber	6,051
Sunset	5,122
Syracuse	24,331
West Bountiful	5,265
West Point	9,511
Woods Cross	9,761
Unincorporated	3,818

Local Population Data 2010 (Source: factfinder.census.gov)

A. Geographic and Physiographic Background

Davis County is located in northern Utah with an area of approximately 633 square miles. Two thirds of the county is covered by the Great Salt Lake, allowing for only 233 square miles of usable land, much of which is National Forest. The Great Salt Lake is the largest water body within the state and was named due to its' high salt content. The elevation ranges from 4,200 feet at the Great Salt Lake to 9,547 feet at Francis Peak. Davis County is bordered by Morgan County to the east, Weber County and the Weber River to the northeast, Tooele County to the west, and Salt Lake County to the south (Davis County 2003).

B. Geology

Davis County is comprised of the Wasatch Mountain Range. The Wasatch Mountain Range runs north-south and is the eastern border of the valley region of the Great Basin, which is part of the much larger Basin and Range Province.

The geology of this area is a product of Miocene Epoch faulting and folding followed by a period of upheaval. The upheaval raised the valley 3,000 to 5,000 feet in a dome like manner during the Tertiary Period. This disturbance of the valley floor created a tension and a build-up of stress. To accommodate for the change, "block-faulting" occurred that allowed for the uplift of the mountain ranges and depression of the valley floor. This depression extends to the lowest portion of the Wasatch Front Region: the Great Salt Lake. Erosion is now the main geologic process of this area.

The Wasatch Range is comprised of mainly tertiary lake deposits and tertiary and quaternary volcanic rocks as well as younger Precambrian sedimentary rocks. To the north of Salt Lake City on the Wasatch

Front, the hardest, highly altered metamorphosed rocks of schist and gneiss are found and date back about 2.6 billion years. Paleozoic marine sedimentary rocks surround the Precambrian areas of the Range. The Paleozoic sedimentary rocks have a very weak make-up and, in conjunction with Utah's heavy precipitation during the winter and summer months, many landslides, avalanches, debris flows, and rockfalls occur.

C. Climate

Northern Utah has a cold desert climate. Utah has hot dry summers and cold winters. However, Utah's climate is variable, wet in some areas of the state and dry in others. This variability is a function of latitude, elevation, topography, and distance from moisture sources. The Davis County region's climate borders a semi-arid, mid-latitude steppe climate that occurs along the perimeter of the Great Basin Desert, and a humid continental climate found at slightly higher elevations in the Rocky Mountain foothills (Critchfield, 1974).

Northern Utah has four seasons, low annual precipitation, convective and frontal storms, dry summers, low humidity, and large annual and diurnal temperature extremes. The Wasatch Mountain Range brings most of the precipitation to the valley floor. The winter months bring heavy snow accumulation over the mountains that are favorable for winter sport activities.

Spring runoff is at its peak from April through June and can cause flooding along the lower streams. Flash flooding from summer thunderstorms affects smaller more localized areas in the county from summer thunderstorms.

The average annual precipitation in the Wasatch Mountain Range can be more than 40 inches. The average annual precipitation at the Salt Lake International Airport is 15.3 inches, with an average of 58.9 inches of snowfall. Utah is the second driest state in the nation.

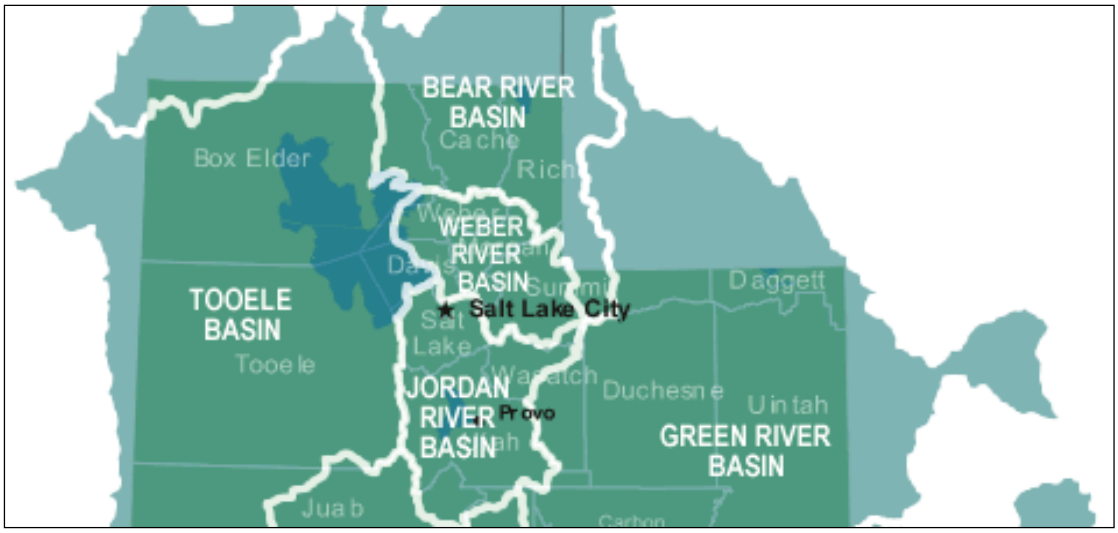
The surrounding mountain ranges act as a barrier to the cold continental arctic masses. This also insulates the area during the day and cools the area rapidly at night. On clear nights, the colder air accumulates on the valley floor, while the foothills and benches remain relatively warm.

During the fall and winter months, smoke, haze, and fog can accumulate in the lower levels of stagnant air over the valley floor and can last for several weeks at a time. This is caused by areas of sinking air or high-pressure anticyclones settling over the Great Basin.

Average wind speeds are usually light to moderate, usually below 20 miles per hour. Strong winds can occur in Davis County, mainly in canyon mouths along the western slopes of the Wasatch Mountains. Tornadoes have occurred in this region but are uncommon. Severe hailstorms have also occurred in the region during the spring and summer months.

D. Major Rivers

Most of Davis County's water is from Wasatch Range snowmelt that occurs during the spring and summer. Larger drainages or river basins are formed from the mountain ravines or depressions that merge into perennial rivers and then meet forming the larger drainages. Davis County has a short stretch of the Weber River Basin.



Map 4-2. Area Drainage Basins (Source: USGS 2006)

Agricultural irrigation is the primary use of developed water in Utah, but municipal, industrial, environmental and recreational uses are increasing and this competition will reform the way water is utilized. With the growing population, agricultural land has decreased, with residential and commercial development on the rise. According to the Utah Water Plan, the Weber River Basins is projected to lose a significant amount of agricultural lands over the next few decades.

E. Water and Drought

Utah is the second driest state in the nation and ranks second in per capita water use of public supplies. According to the Utah Division of Water Resources, Utah experienced drought conditions from 1999 to 2004, and from 2014 to 2015 on a statewide level. Decreased flow from major rivers has led to a decline in most of the reservoir levels and in the Great Salt Lake. The 2015 water year was one of the driest ever recorded (Utah Division of Water Resources 2015).

F. Development Trends

Davis County will continue to grow. Despite nationwide trends, Utah continues to develop. In general, the “developable” areas are in the western portion of the county bounded by the Great Salt Lake. See Table 4-3 (next page) for projected population and household growth in Davis County.

Davis County is part of the area known as the Urban Core of the Wasatch Front, in conjunction with Salt Lake, and Weber Counties. Over the past several decades, a great deal of growth has occurred in these three counties. Davis County's residential growth will continue to infill previous agricultural and industrial fringe. Some of the residential growth is occurring on more sensitive lands such as hillsides and low lying areas towards the Great Salt Lake, and in northern Davis County. The opening of the Legacy Parkway in 2008 provided a much needed alternate north/south transportation expressway through the county. The planned North Davis Highway will further facilitate transportation from Weber, through Davis, to Salt Lake County.

Population growth in the county is attributed primarily to residents having children. Some residential growth is attributed to in-migration due to the area's strong job market. Nationally, growth is occurring in the west and in the south.

2000 Population	**2014 Population (Estimate)**	**2020 Population**	**2030 Population**	**% Growth 2000-2030**
240,204	329,692	369,467	390,159	62.4%
2000 Households	**2014 Households (Estimate)**	**2020 Households**	**2030 Households**	**% Growth 2000-2030**
71,698	103,628	122,029	135,759	89.3%
2000 Household Size	**2014 Household Size (Estimate)**	**2020 Household Size**	**2030 Household Size**	**Change 2000-2030**
3.30	3.25	2.98	2.82	-0.48
2001 Employment	**2010 Employment (Estimate)**	**2020 Employment**	**2030 Employment**	**% Growth 2000-2030**
125,330	169,750	200,044	209,651	67.3%

Population and Household Projected Trends (www.census.gov) Accessed November 2015

Davis County's population is projected to continue to increase exponentially. This will result in housing cost increases greater than the rate of inflation. Higher population densities are projected to be concentrated in currently developed areas with recent development occurring at lower densities in the outlying areas.

A large commercial development has occurred at the Station Park project in Farmington. In Clinton a large commercial development area has experienced major growth at 2000 W. and 1800 N.

G. Development Constraints/Opportunities

Influences on development are many and interrelated. A few are geographic, historic layout, transportation, household size, technology, employment trends and public policy. Development influences can encourage and/or discourage growth. For example, floodplains, wetlands, slopes and faults, sensitive species and transportation influences both attract and detract development.

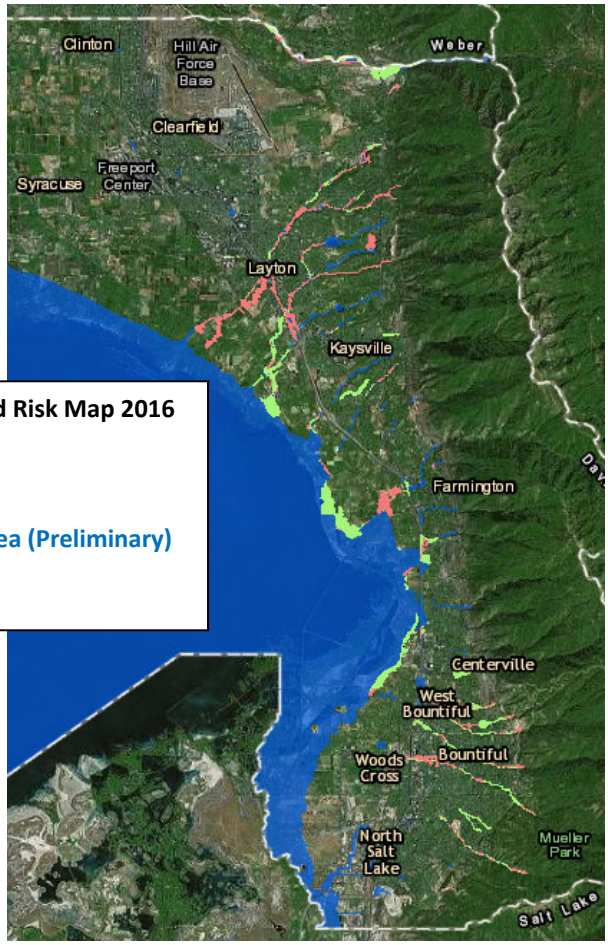
H. Geographic

Geographic constraints on the urban area have created a linear region in Davis County that stretches more than 15 miles north to south, from Sunset on the north and south to North Salt Lake. At its widest, the Davis County is only 15 miles wide. This unique geographic layout has resulted in the development of a transportation system that is focused on the north-south movement of goods and people.

I. Floodplains

There are a number of identified floodplains in Davis County that pose challenges, command respect and generate appeal for development. Davis County is bisected by the Weber River and numerous streams, which emanate from the mountains and flow westward into the Great Salt Lake. In Davis County, several small creeks, such as Kays, Farmington, Davis, Deuel, North Canyon and others flow from the mountains into the lake. There are other streams too numerous to mention here, but some flow through open channels while sections of others are piped underground. While development is challenged by the floodplain, it is also attracted to it.

J. National Flood Insurance Program Participation



Davis County Utah Flood Risk Map 2016

Floodplain Increase
Floodplain Decrease
Special Flood Hazard Area (Preliminary)

Source: www.arcgis.com

The National Flood Insurance Program was created in 1968 by the Federal Emergency Management Agency (FEMA) to provide homeowners living in the 100-year floodplain an opportunity to purchase flood insurance for their home. In order for individuals to be eligible to purchase flood insurance, their community needs to participate in the National Flood Insurance Program (NFIP). Assistance for community participation in the NFIP is provided by the State Floodplain Manager at DEM. There is also limited funding for flood mitigation projects for communities participating in the NFIP.

National Flood Insurance Program (NFIP) Participation							
Community Name	**CID**	**County**	**Date of Entry**	**Current Effective Map**	**Policies**	**Total Claims**	**Repetitive Loss**
Davis County	490038#	Davis	03/01/82	06/18/07	16	19	No
Bountiful	490039#	Davis	08/29/78	06/18/07	56	34	No
Centerville	490040#	Davis	03/01/82	06/18/07	35	10	No
Clearfield	490041#	Davis	02/20/79	06/18/07(M	15	0	No
Clinton	490042#	Davis	06/18/07	(NSFHA)	8	3	No
Farmington	490044#	Davis	08/17/81	06/18/07	46	10	No
Fruit Heights	490046#	Davis	08/17/81	06/18/07	12	2	No
Kaysville	490045#	Davis	03/01/82	06/18/07	35	6	No
Layton	490047#	Davis	12/01/82	06/18/07	65	14	No
North Salt Lake	490048#	Davis	08/29/78	06/18/07(M)	47	2	No

South Weber	490049#	Davis	09/12/78	06/18/07	11	1	No
Sunset	490050#	Davis	11/21/78	06/18/07(M)	3	0	No
Syracuse	490051#	Davis	06/18/07	(NSFHA)	17	1	No
West Bountiful	490052#	Davis	08/03/81	06/18/07	13	4	No
West Point	490053#	Davis	06/18/07	05/13/10	2	0	No
Woods Cross	490054#	Davis	09/29/78	06/18/07(M)	4	32	No

Davis County and all jurisdictions participate in the National Flood Insurance Program (NFIP). Davis County joined in March 1982 and the cities joined on the dates as indicated on the chart above. All jurisdictions are in the Regular Program with their current effective maps dated from 2007. FEMA has recently completed a remapping of Davis County and the cities. Specific new map dates are not available, but will likely be 2015 or later. Currently, Davis County has a total of 385 flood insurance policies, and has had a total of 138 claims since entering the NFIP. Each jurisdiction strives to follow the requirements of the NFIP, and utilize permitting for development in the floodplains. Centerville, Bountiful and West Bountiful all participate in the Community Rating System (CRS). Their status is 7, 9, and 9 respectively. Additionally, Davis County does not have any repetitive loss structures within its boundaries. The County is supporting the mitigation efforts of entities like the Weber Basin Water Conservancy District and surrounding jurisdictions to help reduce the impact from hazards including flooding.

K. Wetlands

Wetlands are those areas that are inundated or saturated with surface or groundwater at a frequency and duration sufficient to normally support a prevalence of vegetation typically adapted for life in saturated soil conditions. The greatest and most significant complex of wetlands in the intermountain area can be found adjacent to and surrounding the Great Salt Lake. These wetlands provide important habitat to resident wildlife and are also an internationally significant habitat. As many as one million migratory shorebirds and waterfowl utilize the Great Salt Lake wetlands during annual migrations across North America. A majority of these wetlands are found on the east side of the lake. The east side of the lake is where the lake receives most of the fresh water and also where development pressures are occurring. Numerous rivers and streams flow into the lake, supplying this area with the fresh water needed to support wetlands plant and animal life. Wetlands can also be found adjacent to the streams, particularly in areas where the streams flow through relatively flat topography or low-lying areas.

Wetlands can be categorized according to their quality and type. Jurisdictional wetlands are those wetlands that are within the extent of the U.S. Army Corps of Engineers (USACE) regulatory overview. For an area to be identified as a jurisdictional wetland, the area must exhibit positive indicators of wetland hydrology, hydrophytic vegetation and hydric soils. If wetlands provide a particularly rich habitat for a variety of wildlife species, it is usually considered to be of high quality, or have a high functional value. Also, wetlands can be classified according to their type, including marsh, wet meadow, riparian scrub, playa/mudflat and open water.

L. Farmlands

Over the past several years, many acres of farmland in the area have been developed. There is a limited amount of prime/unique farmland and farmland of statewide importance in western Davis County. Historically, development followed farmland in an agrarian economy.

Farmlands of statewide importance are not as good as prime farmlands, but are nevertheless important to the agricultural base of the area. These farmlands have more limitations than prime farmlands, such as steeper slope, high water table and alkali problems. However, these lands can be made just as productive as the prime farmlands with proper management of the land. If farmlands of the type described above are located within incorporated city limits, it is presumed they will be eventually developed into urban type land uses. Currently, a majority of the acreage of these farmlands is being used to grow winter (dry farm) wheat and alfalfa.

M. Slopes and Faults

The steep slopes of the Wasatch Mountain Range were created by the Wasatch Fault, which runs the entire length of the urbanized areas. The Wasatch Fault and other faults in the area highlight the potential for earthquakes in the area and the need to consider their possible impact on infrastructure. As development continues to creep higher on the foothills of the Wasatch Mountains, slope stability, erosion and drainage problems will present engineering challenges in development design. Development is usually attracted more to the views of slopes and faults than repelled by the higher risk of soil instability.

N. Open Space

Open Space is a large influence to residential and commercial development. Generally, people are attracted to open space. The Wasatch-Cache National Forest comprises the eastern portion of Davis County and includes a relatively large amount of open space. The urbanized area is fortunate to have exceptional public access to this open space to the east of the valley. Francis Peak is a notable Wasatch Range peak just east of Davis County. Numerous nationally recognized winter and summer recreation areas for skiers, hikers and rock climbers are in close proximity. As a consequence, hundreds of thousands of people visit the public lands in the foothills and mountains of the Wasatch annually.

Other open space features in Davis County includes, Antelope Island in the Great Salt Lake and the Farmington Bay Bird Refuge; which is a fresh water bay created by a dike of the Great Salt Lake. Over the past several years, population growth in the urbanized areas has impacted the open space resources of the Wasatch Range in a variety of ways. Two of these ways are mentioned here. First, there are many more people visiting the popular places in the adjacent mountains. This has jeopardized the environmental quality of the mountains by degrading surface and ground water quality. The Wasatch Range is the major source of water for the adjacent urbanized areas, and water quality degradation can have far-reaching effects.

Secondly, many access points or trail heads to the canyon and other mountain destinations located on public lands that were commonly used in the past have been closed off to the public by private developments. The effect of this is that much of the public open space becomes inaccessible and the opportunity to visit these popular places becomes lost. Remaining access to non-private lands is channeled through an ever-decreasing number of public access points.

Not only can open space resources be found in the mountains of the Wasatch, but private and public open space is also found in the valleys in the form of farms, developed and natural parks, golf courses, water features and vacant land. In many instances, these resources may receive more intensive use than those found in the adjacent mountains. Recently, because of the rapid growth in the area, citizens as well as state and local political leaders have become concerned about the relatively rapid loss of private open space resources, such as farmland and vacant land. Urban growth has put considerable pressure on the farmlands that can still be found in, or adjacent to, the urbanized areas. Some individuals and lawmakers value farmlands and would like to see some of them preserved for future generations. Management and development of open space has many questions – how, where, and to what degree will these lands be preserved?

Some agricultural lands are receiving state designation as farmland preserves through the use of conservation easements and favorable tax treatments. These designations assist farmers in preserving their lands for future agricultural use and provide aesthetically pleasing open space today. However, as development pressure and property values increase, it may become increasingly difficult to keep many agricultural lands in agriculture preserves. Policy decisions relative to open space will affect land use and development patterns, and, as a consequence, will also affect long range plans for the region's transportation systems.

O. Hazardous Waste Sites

Davis County has a few hazardous waste sites, or contaminant sources. Most of these sources are near Hill Air Force Base or in close proximity to industrial areas. Construction through potential contaminant sources may add health and safety concerns and affect construction budget expenditures. The impact of these sites on transportation facilities will need to be addressed during the design and construction phase of each highway or transit project.

There are potentially five types of contaminant sources: underground storage tanks, Title 3 sites, Toxic Release Inventory (TRI) 1990 sites, Resource Conservation and Recovery Act (RCRA) sites and Comprehensive Environmental Response Compensation and Liability Act (CERCLA) sites.

The Comprehensive Environmental Response, Compensation and Liability Inventory System (CERCLIS) database documents hazardous waste sites where a release or potential threatened release, has been investigated. These sites are further defined as a location that has been reported to the Environmental Protection Agency and where it is probable that some environmentally hazardous materials are present.

Also, the State of Utah Division of Solid and Hazardous Waste maintains databases for underground storage tank facilities, Leaking Underground Storage Tank (LUST) sites, and RCRA facilities.

P. Sensitive Species

Sensitive species are plants and animals, which are considered threatened or endangered relative to extinction. There are currently 21 species in the Wasatch Front Urban Area that fall into the sensitive species category. The most notable of these are the peregrine falcon, bald eagle, and Ute ladies tresses which are all on the federal list of endangered and threatened species. Both peregrine falcon and bald eagle sightings have been reported over the past few years on a fairly regular basis. Some examples of other less notable sensitive species, which are known to inhabit certain areas of Davis County, include the spotted frog, least chub, western burrowing owl, ferruginous hawk, white faced ibis, Bonneville cutthroat trout, pocket gopher, and others. The likelihood of these and other sensitive species being present in the region will depend on whether or not suitable habitats exist.

Q. Ground Water

Much of the water flowing in streams and interfluvial areas seeps into the ground. The foothills and the base of the mountains are the locations where much of this water seeps into the ground. These locations are referred to as aquifer recharge areas. Water is stored in aquifers of various types. A considerable amount of the Wasatch Front Region's water resources comes from these aquifers, which can be tapped through wells or natural artesian springs. Davis County receives only about 15 inches of precipitation a year, yet the benches and mountaintops can annually receive 60 to 100 inches of precipitation. This contrast in precipitation can be a challenge in determining best development. Past and present human activities have affected these ground water resources in certain locations. If precautions are not taken, harmful substances found in landfills and mine tailings can be leached by rain and snow and find its way into the ground water resources. One example of this situation includes the plume of contaminated groundwater slowly moving westward near Sunset, caused by the inappropriate disposal of solvents and other chemicals for decades at Hill Air Force Base.

R. Historical Development Layout

Historically, development has occurred according to the "Plat of Zion." Davis County has street layouts based on the "Plat of Zion", implemented by Brigham Young when the Mormon Pioneers permanently settled the area beginning in1847. This concept is based on a grid of 10-acre blocks with wide streets. While the concept is apparent in central city areas, the suburbs deviate. Historically, the street network and connecting highways served the local areas. Intercity travel was via the Bamberger Railroad, which ran passenger service from Salt Lake City to Ogden from 1891 to 1952. In the 1950's, the federal government instituted the Interstate Highway System. Interstate 15 linked Salt Lake City, Ogden and Provo together with points north and south while Interstate 80 linked the area with points east and west.

Development has also followed along Interstate 15, Highway 89, and major collectors. Interstate 15 continues north through Davis County joining Interstate 84 in Weber County. Other major north-south arteries in Davis County include U.S. Highway 89 and the Legacy Parkway. The North Davis Highway in western Davis County will serve as a major traffic collector for that area. The historic development has followed the geographic constraints particularly in transportation.

S. Transportation

Large employment centers, such as Hill Air Force Base will need to be served with an improved transportation system. In 2014, the Utah Transit Authority (UTA) implemented a shuttle bus program between the Clearfield Front Runner Station and Hill Air Force Base. This shuttle service has not had a high level of ridership.

The Wasatch Front Regional Council completed a Comprehensive Transportation Plan (RTP) in 2015. The transportation projects included in the 2015-2040 RTP are planned to meet the travel needs and improve quality of life within the Wasatch Front for the next 30 years. WFRC developed project lists with residents, local government stakeholders, and partner agencies by collecting project ideas and testing them against the RTP Goals. To be implemented, the region will need both existing and additional transportation revenues, which are outlined in the phasing and financial assumptions.

In addition to regional road, transit, and bicycle improvements, the 2015-2040 RTP also recommends general policy for transportation systems, enhancements, regional freight movement, safety, preservation and maintenance, and homeland security. The Plan conforms to federal air quality standards, meaning that the vehicle emissions estimated for the year 2040 are within the limits identified in the State Implementation Plan (SIP). Click here for the Plan's air quality conformity analysis. The plan includes interactive maps containing all of the highway, transit, and bike projects proposed for the 2015-2040 RTP. (Source: Regional Transportation Plan 2015-2040 Wasatch Front Regional Council 2015)
The growth and distribution of population and employment in Davis County will have a significant impact on the transportation demands in the next 25 years. Transportation accessibility is one of the major, if not the most important determining factor, where people live and work. To a large extent, people will live and work where transportation exists. Future development patterns will influence and be influenced by transportation. It is better planning to first conceptually plan for major transportation requirements.

A significant portion of the population growth is expected to occur in western and southwestern sections of Davis County. Anticipated growth will increase the need for north-south travel in the Region, which is being addressed in part by the ongoing reconstruction of I-15, the Legacy Parkway, and the North Davis Highway. Finally, travel in Davis County will increasingly be affected by the population and employment growth in the Farmington/Layton urban area.

Air quality is an influence on transportation. Greater awareness and concern for the air quality has resulted in tighter air quality standards and decreased transportation emissions. As Davis County continues to grow, the interrelationships among development and transportation will continue to increase.

These interrelationships have significant impact on the transportation facilities now and in the future. Davis County's transportation system will need to improve east/west capacity to serve employment centers in suburban locations, such as Clearfield City's Freeport Center. Travel demand will continue to grow in direct proportion to projected population increases. The population and employment growth in Davis County will increasingly affect travel demand in the urbanized area.

The growth and distribution of the Wasatch Front population and employment will continue to have a significant impact on the transportation needs of the future. Increases in regional population and employment translate into a growing demand for travel. In addition, the number of miles driven continues to increase. The amount and distribution of growth provide insights into the type, size and location of new transportation facilities required to meet present and future travel demand, including new highway projects, transit improvements, and transportation facilities for bicycles and pedestrians.

T. Household Size

Even with relatively large families, Utah is following the national downward trend in household size. As the population ages, birthrates fall and the household size decreases. There are areas in the region that will experience a slowing of population growth due to falling household sizes, while others will increase due to neighborhood recycling, where young families with children move into a neighborhood as the aging population dies. Overall, Davis County's population continues to grow and there doesn't appear that this growth will slow down in the foreseeable future.

U. Technology

As technology develops, its influence on community development touches every aspect dramatically. Technological influences are significant. This report will only very briefly mention a few. Technology advances in communications have made it possible for telecommuting, reduced the requirement of a daily commute to a workplace; increased availability of reliable public transportation has changed where people live and work; advances in agriculture have allowed more food to be produced on less land; and technological advances allow developments on marginal sites.

V. Reclamation of Industrial Land

Much public and private land will remain undeveloped because of specific environmental constraints, such as steep slopes, prime wetlands, or hazardous substances. However, other environmentally challenging properties are now developable due to advances in technology. Some areas historically used for industrial or mining activity are planned to be reclaimed for other uses.

W. Employment Trends

In the past 30 years, Davis County's economy has diversified, resulting in more widespread development. The county's economy was once heavily dependent on a limited number of industrial sectors, primarily Hill Air Force Base, and Freeport Center.

No longer dependent on a limited number of sectors, the County's economy is now based on the service sector and other industries, such as health care, education, and local government. Agriculture continues to decline in importance in Davis County as agricultural lands are developed for urban expansion. The distribution of commercial and industrial development will remain much as it is today. Davis County experienced minimal employment changes, up or down, during the past decade. Overall, large employment gains are occurring in suburban areas.

X. Public Policy

Under Utah State law, local cities and counties are responsible for setting land use policy in their areas. Projections for the Wasatch Urban Area Long Range Transportation Plan: 2007-2030 is based on individual city and county land use assumptions. A majority of the region is expected to be developed for residential uses. These local master plans call for relatively low-density residential and non-residential development patterns, with some pockets of denser activity. Large areas of industrial/warehouse development are planned around Hill Air Force Base. High-density office and commercial developments are focused mainly in the Station Park Development, near the Clearfield and Layton Frontrunner Stations with smaller commercial areas located in the Redwood Road area in North Salt Lake. Additional smaller nodes of commercial and retail development are dispersed throughout urban and rural portions of the County.

The Utah Quality Growth Act of 1999 created the Utah Quality Growth Commission to address the challenges and opportunities that growth brings to Utah. In addition, several public and private partnership planning efforts involved in smart growth initiatives have developed land use alternatives and growth scenarios. Envision Utah's outreach presentations provided local public officials and the general public the opportunity to examine the future consequences of various land use decisions. The growth scenarios ranged from the status quo land use planning to a demonstration of much greater density. These planning exercises and demonstrations proved beneficial in educating participants about development options and their anticipated consequences.

A significant portion of Davis County is currently zoned for low-density residential development. Additional commercial land use nodes are dispersed throughout southern Davis County to serve adjoining residential communities. An extension of the existing transportation network will provide needed highway and transit service to newly developed land. As land use changes, so will the type and size of facilities needed to meet increased travel demand.

Future land use characteristics of the Davis County urban area will play a key role in determining future development trends. Large portions of north Davis County is currently zoned for low-density residential development. Industrial land uses are located at the Falcon Hill development on Hill Air Force Base, and Clearfield's Freeport Center.

Areas for commercial land uses include linear concentrations along major arterial roads including Hill Field Road near the Layton Hills Mall, State Street (Layton and Clearfield) and Main Street (Kaysville, Clearfield and Sunset). Additional commercial nodes are dispersed throughout the Urbanized Area to serve adjoining residential communities.

Public policy is the greatest contributing factor in development. This report has briefly mentioned the general development trends in the region and county as well as the contributing and limiting influences on development. Ultimately, the many development constraints and influences are measured, weighed, compared, and balanced in public policy.

Development public policy is articulated in Master Plans (sometimes referred to as General Plans, Land Use Management Codes, and other planning documents). Master Plans and Land Use Management Codes are formally adopted by city or county councils whereas other planning documents may not receive formal adoption. All Region counties continue to update their Master Plans and Land Use Management Codes. The counties have cooperated in producing the Wasatch Front Regional Open Space Plan. This Plan gives each county guidelines for preserving and developing open space. Davis County has been supportive of Envision Utah. Envision Utah is partially State supported to advocate smart growth. Envision Utah defines "smart growth" as growth that requires minimal infrastructure and maximizes environmental and human benefits.

Part VIII. Capabilities Assessment

This assessment analyzes current capacity to mitigate the effects of natural hazards and emphasizes the positive capabilities that should be continued. Davis County has elected to conduct a hazard and capabilities analysis.

The following areas were assessed to determine mitigation capabilities:

1. *Staff and Organization*
2. *Technical*
3. *Fiscal*
4. *Policies and Programs*
5. *Legal Authority*
6. *Political Willpower*

A. Staff and Organization

The assessment found that Davis County has the capability to undertake and complete a limited level of natural hazards mitigation projects. Davis County and its cities are already protecting citizens from natural hazards under one if not several departments within their governmental structure.

City and County Elected Officials

The Davis County Commission consists three members. Each of the fifteen cities has a mayor and a city council, consisting of five members, which governs the municipality. The elected officials have the responsibility of adopting mitigation policies. Cities and counties receive their legal authority to govern from the State of Utah.

Davis County General Capabilities

Listed below is a general organizational list of county/city governmental administrative areas involved in pre-disaster mitigation:

- Elected officials
- City Managers
- County and City Attorneys
- County Assessors
- County Clerks
- Human Services/Personnel Directors
- County and City Treasurers/ Finance
- Public Works Departments
- County Health Department
- Police and Fire Departments
- Davis County Emergency Management
- Special Improvement Districts

Emergency Management

Davis County has a an emergency management director, organized under the sheriff's office. The emergency management director is responsible for natural and man-made hazard mitigation, preparedness, and response and recovery operations.

Local Emergency Planning Committee (LEPC)

The mission of LEPC is to coordinate emergency preparedness for hazardous materials between all public and private emergency task disciplines. Many LEPC's have expanded their mandated hazardous materials function to include all hazards. The Davis County LEPC is comprised of elected officials; law enforcement, emergency management, firefighting, emergency medical services, health, local environmental, hospital and transportation personnel; broadcast and print media; community groups; and owners and operators of hazardous chemical facilities that are required by federal law to have hazardous chemical emergency planning. Davis County has an active LEPC.

Fire/Emergency Medical Services

Most of the cities in Davis County have fire departments. Following a national trend, there are two multi-jurisdiction fire districts in Davis County that were formed with the goal to better provide fire and emergency medical services.

Public Works

Divisions within public works often include streets, engineering, water, power, wastewater and sanitation. The Davis County public works department has undertaken a number of mitigation projects in the county. Several municipal public works departments have also participated in hazard mitigation primarily in the form of storm water and watershed management projects.

Health Care

Davis County's 2 hospitals and the county health department provide medical emergency preparedness and response. Davis County Health organizes, coordinate and direct emergency medical and health services. The health department assesses health hazards caused by damage to sewer, water, food supplies or other environmental systems. It also provide safety information, assess disaster related mental health needs and services, and provide crisis counseling for emergency workers. Short of a pandemic disease outbreak, the health department will likely continue to adequately staff, train and fund its mission.

School District

The Davis School District has more than 70,000 students in 90 schools. District administrators work closely with local public safety officials including law enforcement, fire emergency medical services, and public health to help to ensure that schools are well prepared for any kind of emergency.

Special Service Districts

For the purposes of this Plan, Special Service Districts (SSD) are defined as quasi-governmental agencies having taxing authority, providing a specific public service that may include; public transportation, fire, water, wastewater and sewer. These SSD's work closely with local public safety officials to ensure that these Districts are well prepared for any kind of emergency. In many cases, the districts participate in the county or city emergency preparedness committee for emergency coordination, planning and response.

Technical Capability

Throughout the plan update process, Davis County staff consulted with and utilized the technical expertise from a wide variety of resources listed below:

Jurisdiction Technical Expertise
Davis County and all of the cities either employ or contract with planners, emergency managers, building inspectors, housing specialists and engineers on staff.

Geographic Information Systems (GIS)
Davis County has experienced GIS staff capable of providing important data to this planning process. GIS is a geo-referenced set of hardware and software tools that are used to collect, manage and analyze spatial data. (GIS capabilities are often found in other departments such as public works or information technology.) GIS is most beneficial when data from all departments and planning jurisdictions is inputted for analysis.

Public Safety Communications (PSC)
Public safety communications networks assure emergency communications through radio, microwave, telephone, satellite, internet, e-mail, fax and amateur radio. One of the most beneficial capabilities of PSC is providing cross communication between equipment and frequencies. PSC coordinates dissemination of emergency information to the media, the public and emergency personnel; activates internal information systems; acts as a liaison to elected officials; assists in the provision of emergency information and document the impact.

Public Works
Public works departments generally provide engineering, transportation, GIS, water, wastewater, sanitation (in some cases electric power) expertise and capability. As a team, public works personnel identify critical infrastructure and plan and prepare for emergency mitigation.

Other Technical Capabilities

Utah Division of Emergency Management (Utah DEM)
Utah DEM assists Davis County in providing information on preparing for and responding to emergencies. DEM serves as the liaison between local, state and federal emergency assistance. DEM also educates the public about earthquakes, hazardous materials, floods, communications, leadership, information technology, funding, coordination and supplies.

Utah State University(USU) Cooperative Extension
The USU Extension Service assisted with family and community data in putting research-based knowledge to work. Many of the programs and informational courses improve pre-disaster mitigation.

University of Utah

The University of Utah was utilized as a technical resource for academic mitigation research and demographic data.

Fiscal Capability

Davis County has limited fiscal capabilities to implement mitigation strategies. Davis County is one of the top five counties in the state in budgeted expenditures and population. Davis County and most of its jurisdictions have provided some level of matching funds for federal grants in the past.

Utah State Code; Section 17-50-501 classifies counties into six categories based on population. The State of Utah grants graduated autonomy to counties according to class size. Davis County is a Class 2 county with an estimated 2014 population of over 330,000 residents (USCB 2015 Quick Facts).

Policies and Programs

Connecting local land use management with natural hazard planning is an effective way to mitigate a community's risk. Many communities have plans, ordinances, agreements, maps, training, warning systems, etc. in place that help them to become more disaster resistant. One of the goals of this Plan is for communities to coordinate existing activities so that individual objectives become part of an overall plan of action.

Land Use Management Tools

<u>Ordinances</u>

- **Zoning ordinances** designate the use of land and structures for the purpose of protecting the health, safety and welfare of residents and businesses. A zoning ordinance divides all land within a jurisdiction into zones or related uses. The zoning ordinance is comprised of two parts; the text and maps. Specific zones are usually created for residential, commercial, industrial and government uses. The map defines the boundaries of these zones and the text provides the regulations for uses that are permitted to exist in each of the zones.

- **Subdivision ordinances** regulate all divisions and improvements of property including the division of land involving the dedications of new or changes of existing streets/roads.

- **Design controls** regulate building and landscaping. Such controls can be tailored to require that new developments meet the specific needs of the area. For example, requiring flame resistant roofs in urban-rural wildland fire interface zones or requiring that trees and vegetation are planted on steep slopes to help mitigate landslide hazards.

- **Floodplain ordinances** prevent building in special flood hazard areas and provide flood loss reduction measures to new and existing development. Floodplain management ordinances help to provide insurance to homes and businesses through the National Flood Insurance Program (NFIP). The NFIP's

Community Rating System was implemented to encourage cities to manage floodplain activities that exceed the minimum NFIP standards. A community participating in the system will receive reductions in insurance premiums.

- **National Flood Insurance Program Participation** The National Flood Insurance Program was created in 1968 by the Federal Emergency Management Agency (FEMA) to provide homeowners living in the 100-year floodplain an opportunity to purchase flood insurance for their home. In order for individuals to be eligible to purchase flood insurance, their community needs to participate in the National Flood Insurance Program (NFIP). Assistance for community participation in the NFIP is provided by the State Floodplain Manager at DEM. There is also limited funding for flood mitigation projects for communities participating in the NFIP. Davis County and all the cities participate in the NFIP and comply with the minimum standards required by FEMA to be considered participating jurisdictions.

- **Building codes** require certain standards of practice.

Easements

Easements can be a cost effective way to control development in hazard prone areas. Various land trusts can help secure easements that can then be conserved or preserved.

Planning

- **General plans** serve as a guide for decision-making on rezoning and other planning proposals and as the goals and policies of municipalities attempting to guide land use in local jurisdictions. Each plan is recommended to include land use, transportation, environment, public service and facilities, rehabilitation, redevelopment, conservation, and economics. Also recommended are implementing recommendations including the use of zoning ordinances, subdivision ordinances, capital improvement plans, and other suitable actions that the municipality deems appropriate. General plans articulate the jurisdiction's vision while land use management codes implement that vision. General plans and land use management codes are being consulted, reviewed, and changed as necessary.

- **Emergency Operations Plans (EOPs)** identify specific emergency actions undertaken by a jurisdiction to protect lives and property immediately before, during, and following an emergency. The Davis County Emergency Operations Plan EOP was reviewed as part of this planning process.

- **Floodplain Management Plans** identify steps and implementation strategies to effectively deal with floodplains. FEMA uses a scoring system is used to rate communities. Those with higher scores will receive higher discounts (in 5% increments) on flood insurance.

- **Stormwater Management Plans** identify water policies for an entire watershed. Such policies can include: preservation of habitats, water quality and supply, open space development, land preservation, pollution prevention and construction regulations.

- **Environmental reviews** explain how development affects the land and its resources.

- **Capital Improvement Plans**. Cities plan for costs related to infrastructure, public facilities, and public safety. These plans identify projects, prioritize them and identify ways of funding them. Such plans can include disaster reduction costs or mitigation measures in flood-prone areas or retrofitting buildings for seismic strengthening.

The jurisdictions that make up this Region have incorporated various mitigation measures. The following tables identify, by county, existing land use ordinances, management practices and plans currently in place.

DAVIS COUNTY														
	Bountiful	Centerville	Clearfield	Clinton	Farmington	Kaysville	Kaysville	Layton	North Salt Lake	South Weber	Syracuse	West Bountiful	Woods Cross	Unincorporated County
Avalanches	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Earthquakes, Faults, Geologic Hazards	Y	Y	N	Y	Y	Y	Y	Y	N	N	N	N	N	Y
Floodplains	Y	Y	Y	n/a	Y	Y	Y	Y	Y	Y	N	Y	Y	Y
Foothills & Canyons	Y	Y	N	n/a	Y	Y	Y	Y	N	Y	N	N		Y
Groundwater	Y	Y	N	Y	Y	N	Y	Y	Y	N	N	N	Y	Y
Habitat	N	N	N	N	N	N	N	Y	N	N	N	N	N	N
Lakes, Streams, Riparian	Y	Y	N	N	Y	N	N	Y	N	Y	N	Y	N	Y
Landslides	Y	Y	N	n/a	Y	Y	Y	Y	Y	Y	N	N	n/a	Y
Mountains & Forest Zones	Y	N	N	n/a	N	N		N	N	N	N	N	n/a	Y
Pollution & Air Quality (General Plan)	N	N	N	N	N	N	N	Y	N	N	N	Y	Y	Y
Prime Agricultural Lands	N	N	N	Y	Y	N	Y	Y	N	N	N	N	N	Y
Ridgelines	Y	N	N	n/a	N	N	N	N	N	N	N	N	n/a	N
Steep Slopes	Y	Y	N	N	Y	Y	Y	Y	Y	Y	N	N	n/a	Y
Watersheds	Y	N	N	N	Y	Y	Y	Y	N	N	N	Y	Y	Y
Wetlands (Army Corps)	N	Y	N	Y	Y	Y	Y	Y	N	Y	N	N	N	Y
Wild Land Fire	Y	N	N	N	Y	N	Y	Y	N	N	N	N	N	Y

Sensitive Lands	Y	Y	N	N	Y	Y	Y	Y	Y	Y	N	Y	N	Y

Table 5-2. Natural Hazard & Environmental Quality Ordinances, Davis County

DAVIS COUNTY														
	Bountiful	**Centerville**	**Clearfield**	**Clinton**	**Farmington**	**Kaysville**	**Kaysville**	**Layton**	**North Salt Lake**	**South Weber**	**Syracuse**	**West Bountiful**	**Woods Cross**	**Unincorporated County**
Emergency	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Stormwater	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Growth	Y	Y	N	N	-	N	-	Y	N	-	-	N	Y	N
Community	9	9	N	N	N	N	N	N	N	N	N	9	N	N
General Plan Land Use Update	2008	2008	2008	2006	1998	2008	2008	2008	2001	2008	2006	2007	2006	2006
2015-2040 Regional Transportation	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015
General Plan Housing Update	2008	2008	2008	1984	1998	2008	2008	2008	2001	2008	2006	2007	2004	2006

Table 5-3. Natural Hazard and Environmental Planning, **Davis County** *Sunset, West Point - unable to obtain information

Building Codes

International and national building codes have been adopted by all jurisdictions in the county. These codes are constantly in review for reasonable preparedness for disasters. Locally, building officials lobby for additions or exceptions to international and/or national building codes according to local conditions. Most insurance policies rely on the international and national building code standards for assurance.

The Insurance Services Office, Inc. manages the Building Code Effectiveness Grading Schedule (BCEGS). This program was implemented in 1995 and assesses the building codes in effect in a particular community as well as how well the community enforces its building codes. The BCEGS program assigns each municipality a BCEGS grade of 1 to 10 with 1 showing exemplary commitment to building code enforcement. Insurance Services Inc. (ISO) developed advisory rating credits that apply to ranges of BCEGS classifications 1-3, 4-7, 8-9, 10. ISO gives insurers BCEGS classifications, BCEGS advisory credits, and related underwriting information.

Communities with effective, well-enforced building codes should sustain less damage in the event of a natural disaster, and insurance rates can reflect that. The prospect of lessening natural hazard related damage and ultimately lowering insurance costs provides an incentive for communities to enforce their building codes rigorously. FEMA also uses these scores in their competitive grant programs, giving a higher ranking to those projects with lower scores. The following table highlights the BCEGS scores for Davis County jurisdictions.

DAVIS COUNTY	BCEGS Classification		Date
	Residential	Commercial	
Bountiful	3	3	2006
Centerville	3	3	2004
Clearfield	3	3	2004
Clinton	4	2	2005
Davis County	4	4	2006
Farmington	3	3	2005
Fruit Heights	3	4	2006
Kaysville	3	2	2004
Layton	3	3	2004
North Salt Lake	4	4	2003
South Weber	4	4	2004
Syracuse	4	3	2006
West Bountiful	99	99	2006
West Point	99	99	2003
Woods Cross	99	99	2006

Table 5-12. Building Code Effectiveness Grading Reports, Davis County

Legal Authority

Local governments play an essential role in implementing effective mitigation. Each local government will review all present or potential damages, losses, and related impacts associated with natural hazards to determine the need or requirement for mitigation action and planning. In Davis County the local executive responsible for carrying out plans and policies are the county commissioners and for local jurisdictions it is the city mayors/city managers. Local governments must be prepared to participate in the post-disaster Hazard Mitigation Team process and the pre-mitigation planning as outlined in this document. The cities and counties of Utah have the authority, through policing, to protect the health, welfare, and safety of their residents.

Political Willpower

Davis County region public officials have shown support for pre-disaster planning in the following ways:

Community Development Documents

Elected officials have adopted updated community development documents to reduce the risk of emergencies and disasters. Each county and most cities have updated Emergency Operation Plans, Land Use Management Codes, International Building Codes, and General Plans that include pre-disaster planning. In addition, there is support from residents. Davis County recently adopted an Open Space Plan. In the Davis County Open Space Plan, property with higher probability for natural hazards is recommended for open space or lower intensity uses.

Emergency Planning Training Courses

Davis County's residents have supported emergency planning training sponsored by Utah DEM and local governments such as: CERT (Community Emergency Response Team), Local Emergency Planning Committees (LEPC), Hazardous Materials (HAZMAT), Site Plans and Ordinances, Real Estate Requirements, and Hazard Mitigation.

Part IX. Risk Assessment

A. Hazard Identification

The first step in risk assessment is identifying the hazards that could affect Davis County. Hazard identification addresses the geographic extent, the intensity/magnitude of a hazard and the probability of its occurrence. Hazard identification was initiated through an extensive process that utilized the following:

- Core Planning Team
- Local Working Group
- Subject Matter Experts
- Community and Public individuals
- Elected Officials
- City and County Agencies
- Utah Division of Emergency Management
- Utah Geological Survey
- Utah Automated Geographic Reference Center

The natural hazards in Table 7-1 (next page) below have the potential of impacting Davis County. The identification process for Davis County utilized those natural hazards that consistently impacted the county prior to and during the planning process based on history of occurrences, future probability, and risk. Table 7-2 identifies those natural hazards for easy reference.

Davis County created maps that identified the location of critical facilities and the municipalities affected by each identified hazard. Initial data from this study was also used to determine hazards that presented the greatest risk to the county. The geographic extent of each hazard is identified through maps. County hazard intensity/magnitude and probability profiles are also outlined.

Davis County conducted and updated risk assessment analyses for each identified hazard.

Hazard	How Identified	Why Identified
Earthquake	Review of County Emergency Operations Plan Review of past disaster declarations Input from City and County Emergency Operations Managers, USGS, UGS, Utah DEM, and community members	Utah has a 1/5 chance, of experiencing a large earthquake within the next fifty years. Numerous faults throughout Utah including the Intermountain Seismic Zone. Yearly, Utah averages approximately 13 earthquakes having a magnitude 3.0 or greater. Earthquakes can create fire, flooding, hazardous materials incident, transportation, and communication limitations. The Wasatch Front has recorded large earthquakes in the past and can be expected to experience large earthquakes in the future.
Landslide	Input from City and County Emergency Operations Managers, USGS, UGS, NCDC, Utah DEM, and community members	Have caused damage in the past to residential and commercial infrastructure. Can be life threatening. Generally occur in known historic locations therefore risks exist throughout much of the Davis County. To increase community awareness.
Wildland Fire	Review of County Emergency Operations Plan Review of Community Wildland Protection Plans (CWPP) Input from County Emergency Managers, Utah DEM, Utah FFSL, Utah FS, NWS, FEMA, and local community members	Serious threat to life and property. Increasing threat due to urban growth in WUI areas. Secondary threat associated with flooding, drought, and earthquake. Much of the mountain front portion of Davis County is at risk. Additional funding and resources offered by local and state agencies to reduce risk. To increase community awareness.
Problem Soils	Review of County Emergency Operations Plan Input from community members, Utah, DEM, and UGS Researched historical data	Related to subsequent effects from earthquakes. Have affected infrastructure and local economy in the past.
Dam Failure	Review of County Emergency Operations Plan Input from community members, Utah DWS, Dam Safety Section, Utah DEM Review of inundation maps	Can cause serious damage to life and property and have subsequent effects such as flooding, fire, debris flow, etc. Davis County has several irrigation reservoirs. Threat to downhill communities. Subsequent effects include flooding, and debris flows. To increase community awareness. To incorporate mitigation measures into existing plans to help serve local residents.
Flood	Review of past disaster declarations Input from City and County Emergency Operations Managers, Utah DWS, UGS, Utah Army Corps of Engineers, Utah DEM, and community members	Several incidents have caused severe damage and loss of life. Many of the rivers and streams are located near neighborhoods. Many neighborhoods are located on floodplains, alluvial fans. Topography and climate lead to cloudburst storms and heavy precipitation can result in flash flooding throughout Davis County.

	Review of Flood Insurance Studies, Floodplain maps, and Flood Insurance Rate Maps	
Severe Weather	Review of County Emergency Operations Plan Review of past disaster declarations Input from City and County Emergency Managers, Utah Avalanche, Forecast Center, Utah Department of Transportation, and community members	Damage to communities, homes, infrastructure, roads, and residents. Can cause property damage and loss of life. Results in economic loss. Lightning is number one cause of natural hazard death in Utah. Can be costly to recover from.

Table 7-1. Local Hazards Identification

The hazard identification process was aided through the use of FEMA How to Guidance documents, FEMA 386-1,2,3,7 FEMA Post Disaster Hazard Mitigation Planning Guidance DAP-12, Disaster Mitigation Act of 2000, 44 CFR Parts 201 and 206, Interim Final Rule, and FEMA Region VIII Crosswalk. The risk assessment process also utilized assistance from local Davis County GIS using the best available data.

Davis County Natural Hazards	
Earthquake	X
Landslide	X
Wildland Fire	X
Problem Soils	
Dam Failure	X
Flood	X
Drought	X
Severe Weather	X

B. Hazard Profile

This section describes the causes and characteristics of each identified hazard, including its *severity* or *magnitude* (as it relates to the percentage of the jurisdiction that can be affected), *probability*, conditions that make the area prone to the hazard, hazard history, and maps of the hazard's geographic location or extent. The hazards were profiled based on history of occurrence, local input, county emergency operations plans, and county master or general plans, scientific reports, historical evidence, and hazard analysis plans. A risk assessment "Hazard Profile" table was created that highlights the above mentioned materials in each of the county portions of the plan introducing each identified hazard. The probability of a hazard event was determined through the amount of risk to the county. The probability or likelihood of an occurrence is categorized into four categories: Highly Likely, Likely, Possible, and Unlikely.

In determining hazard magnitude a scale was used to identify the level of damage on a countywide basis from Catastrophic to Negligible. (See table below)

	Jurisdiction Affected	**Risk**
Catastrophic	More than 50%	Extreme or High
Critical	25-50 %	Moderate
Limited	10-25%	Moderate
Negligible	Less than 10%	Low

Hazard Profile

The probability of a hazard event was determined through the amount of risk to the county. The probability or likelihood of an occurrence is categorized into four categories: Highly Likely, Likely, Possible, and Unlikely.

The geographical extent or location of the community that would be affected has been identified in the mapping portion of each county where geographic data was available. Hazard histories are provided for each county. These histories were taken from the Spatial Hazard Events and Losses Database for the United States (SHELDUS). Histories for each county were condensed into charts, tables and graphs in each county hazard profile section.

Maps were created using GIS software to identify the location and extent of each identified hazard area. Hazard maps were created for every identified natural hazard within the county. The following risk assessment maps were created for Davis County:

Dam/Reservoir Sites	*Liquefaction Potential*
Earthquake Epicenters and Fault Zones	*Problem Soils*
Flood Zones	*Wildfire*
Ground-shaking Potential	*Combined Structural Hazards*
Landslide Susceptibility	*Severe Weather*

C. Vulnerability Analysis

The vulnerability analysis is based on asset identification and potential loss estimates for those jurisdictions located within identified hazard areas.

Asset Identification

The vulnerability analysis combines the data from each of the hazard profiles and merges it with community asset information to analyze and quantify potential damages from future hazard events. The asset inventory identifies buildings, roads, and critical facilities that can be damaged or affected by the hazard events. Critical facilities are of particular concern because of the essential products and services to the general public they provide. These critical facilities can also fulfill important public safety, emergency response, and/or disaster recovery functions. The critical facilities identified in this plan include hospitals, police and fire stations, schools, communication facilities, utility companies, water and wastewater treatment plants. In order to assess where and to what extent the identified hazards will affect the assets of each county, the locations of assets were identified and overlaid with the mapped hazards using GIS software.

Potential Loss Estimates

Potential dollar loss estimates were identified using this same method; therefore estimates were completed for existing infrastructure only. When data permitted, structure, content, and function of the identified vulnerable infrastructure was incorporated into the vulnerability assessments. Describing the vulnerability in terms of dollar losses provides the community and the state with a common framework in which to measure the effects of hazards on assets. Future planned development was not analyzed due to the lack of data available in GIS format.

The core planning team and local planning team members estimated potential losses for the identified hazards by using the methodology explained in the FEMA document titled, Understanding Your Risks: Identifying Hazards and Estimating Losses, Utah DEM historical data and GIS data.

The information sources used to complete the vulnerability assessment portion of this Plan include; Utah DEM, County GIS department, county Assessor's Office, HAZUS-MH data, and the Utah Automated Geographic Reference Center (AGRC). This data was compiled into GIS layers that were used as overlays to identify critical facilities, municipalities, roads, and residents. The assets that have been identified are based on the best available data during the development of this Plan in GIS form.

D. Methodology

Geographic Information System (GIS) software was used as the basic analysis tool to complete the hazard analysis for the Davis County Natural Hazards Pre-Disaster Mitigation Plan. For most hazards a comparison was made between digital hazard data and Transportation Analysis Zone (TAZ) demographic information.

Statewide digital data was obtained from Utah Automated Geographic Reference Center (AGRC) for problem soils only. The vulnerability assessment for the county estimates the number of homes, business, infrastructure and population vulnerable to each hazard and assigns a replacement dollar value to residential structures and infrastructure in each hazard area. All the analysis takes place within the spatial context of a GIS. With the information available in spatial form, it is a simple task to overlay the natural hazards with census data to extract the desired information.

The methodology used to determine vulnerability for all hazards was identical. The number of households and population vulnerable to each hazard was determined using WFRC Transportation Analysis Zone (TAZ) data and Block Data from the 2010 Census data. The Block Data from the 2010 Census database, or TAZ data, was intersected with each of the mapped hazard layers in order to determine the number and location of residential housing units and population at risk from hazards. The methodology used assumes an even distribution of residential housing units and population across each census block. Point data from HAZUS MH was used to determine the number of businesses, and the annual sales of each business in each hazard area.

The number of acres for all hazards was determined for each city and the unincorporated county. Once an acre total was identified it was overlaid on the Census Block data or TAZ data to determine the total number of homes impacted. The number of homes impacted was then multiplied by the average housing value to determine the total value of potential loss. 2010 average house values from the U.S. Census Bureau were used for Davis County. Content values are not included, which would raise the potential loss numbers for housing by approximately 50%.

In addition to the above methodology, earthquake was profiled using HAZUS-MH, which is shorthand for Hazards United States - Multihazards.

The HAZUS-MH Earthquake Model is designed to produce loss estimates for use by federal, state, regional and local governments in planning for earthquake risk mitigation, emergency preparedness, response and recovery. The methodology deals with nearly all aspects of the built environment and a wide range of different types of losses.

Extensive national databases are embedded within HAZUS-MH, containing information such as demographic aspects of the population in a study region, square footage for different occupancies of buildings, and numbers and locations of bridges. Embedded parameters have been included as needed. Using this information, users can carry out general loss estimates for a region. The HAZUS-MH methodology and software are flexible enough that locally developed inventories and other data that more accurately reflect the local environment can be substituted, resulting in increased accuracy. TAZ data from 2010 was aggregated to census blocks to update population data within HAZUS-MH.

Uncertainties are inherent in any loss estimation methodology. They arise in part from incomplete scientific knowledge concerning earthquakes and their effects upon buildings and facilities. They also result from the approximations and simplifications that are necessary for comprehensive analyses. Incomplete or inaccurate inventories of the built environment, demographics and economic parameters add to the uncertainty. These factors can result in a range of uncertainty in loss estimates produced by the HAZUS-MH Earthquake Model, possibly at best a factor of two or more.

The methodology has been tested against the judgment of experts and, to the extent possible, against records from several past earthquakes. However, limited and incomplete data about actual earthquake damage precludes complete calibration of the methodology. Nevertheless, when used with embedded inventories and parameters, the HAZUS-MH Earthquake Model has provided a credible estimate of such aggregated losses as the total cost of damage and numbers of casualties. The Earthquake Model has done less well in estimating more detailed results - such as the number of buildings or bridges experiencing different degrees of damage.

Such results depend heavily upon accurate inventories. The Earthquake Model assumes the same soil condition for all locations, and this has proved satisfactory for estimating regional losses. Of course, the geographic distribution of damage may be influenced markedly by local soil conditions. In the few instances where the Earthquake Model has been partially tested using actual inventories of structures plus correct soils maps, it has performed reasonably well.

The HAZUS Model estimates building losses, numbers of shelters required for displaced households, amounts of debris generated, and numbers of casualties. A HAZUS report was completed for each of the counties covered in this Plan.

The potential impact of natural hazards on transportation and utilities was determined in a similar method as described above. Roads and utilities were overlaid on the hazard areas and the impacted utility and road segments were inventoried. Once the length of vulnerable infrastructure was determined it was multiplied by cost estimate information from HAZUS-MH.

In addition to the linear features, point data for critical facilities, dams, care facilities, schools, power generation facilities and substations were analyzed to determine if the feature was within a hazard area.

Limited availability of digital data presented a problem in completing the vulnerability assessment. Potential loss numbers were only determined for earthquakes, flood, landslides, dam failure, problem soils and wildfires in this Plan. Additional limitations to the above described analysis method include:

- Assuming random distribution
- Limited data sets for water, gas, electrical, resulting in incomplete numbers for these features
- Lack of digital parcels data for Morgan and Tooele Counties
- Relied on state wide data not intended for manipulation at the scale it was used
- Data was not field checked, resulting in an analysis wholly dependent on accuracy of data
- Meta data was lacking on some of the used data sets

In this document, simple maps were created to provide a graphical illustration of location. These maps are done at a scale, which allows them to fit on a standard letter sized page. Data manipulation and maps were created as a planning tool, to be used by interested persons within Davis County. This information should not take the place of accurate field verified mapping from which ordinances need to be based.

Effort to analyze hazards related to potential future development areas was also addressed where applicable. This proved to be a very difficult exercise and at best can only identify areas which need additional research before development should be allowed. No viable source of data exists for this study area to facilitate analysis of future development. Limited zoning data was available, but this data does not necessarily indicate which areas will be developed and which will not.

E. Mitigation Strategies, Objectives, Actions

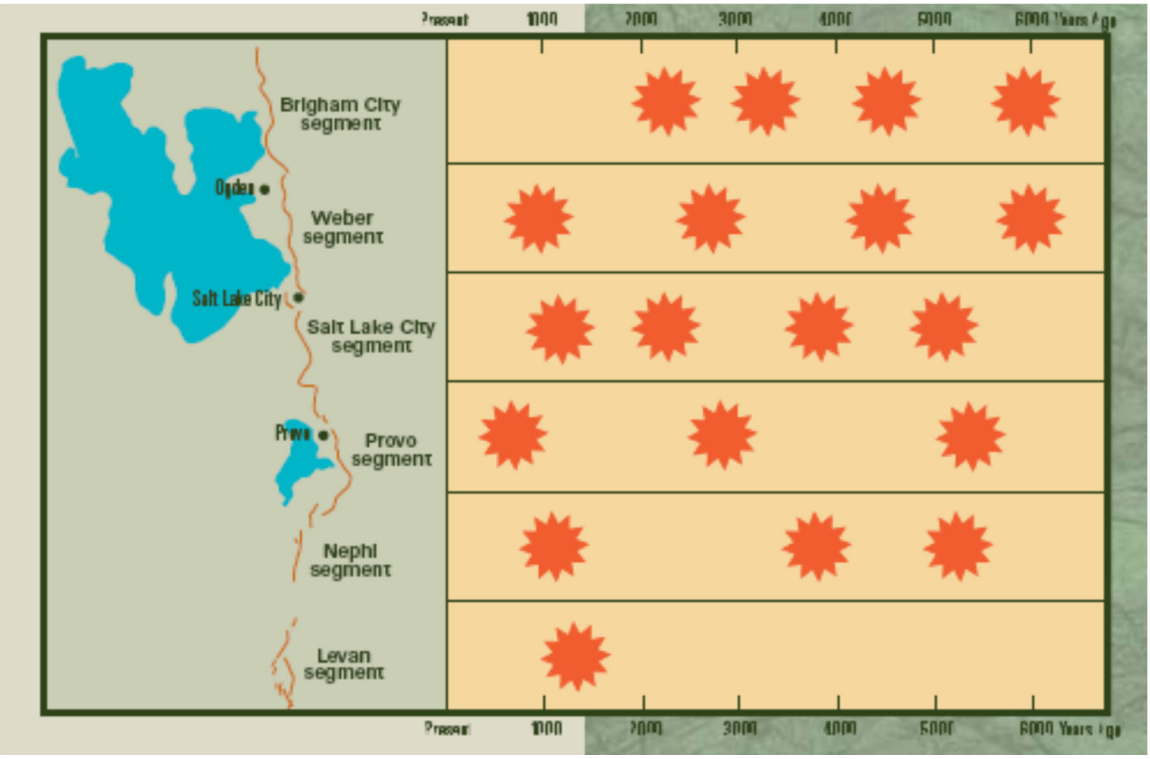
Using the findings from the risk assessment and the capabilities assessment as a guide, several mitigation strategies and implementing actions were identified that would benefit each jurisdiction. Each action has been formalized and placed into this Plan in each of the county mitigation sections. These actions were identified in the planning group meetings which included input from the core planning team, local planning team, state and local agencies, county government, and city and county residents. Goals and objectives were developed in a working session between the above-mentioned groups with a period provided for comment and revision.

Each of the jurisdictions identified mitigation actions based on the identified goals and objectives. These actions are included in each county section of this Plan. The mitigation actions identify the responsible agency, the funding source, timeline, background, and their priority. Actions were selected using the information obtained from the capabilities assessment, which identified existing programs and shortfalls related to mitigation activities.

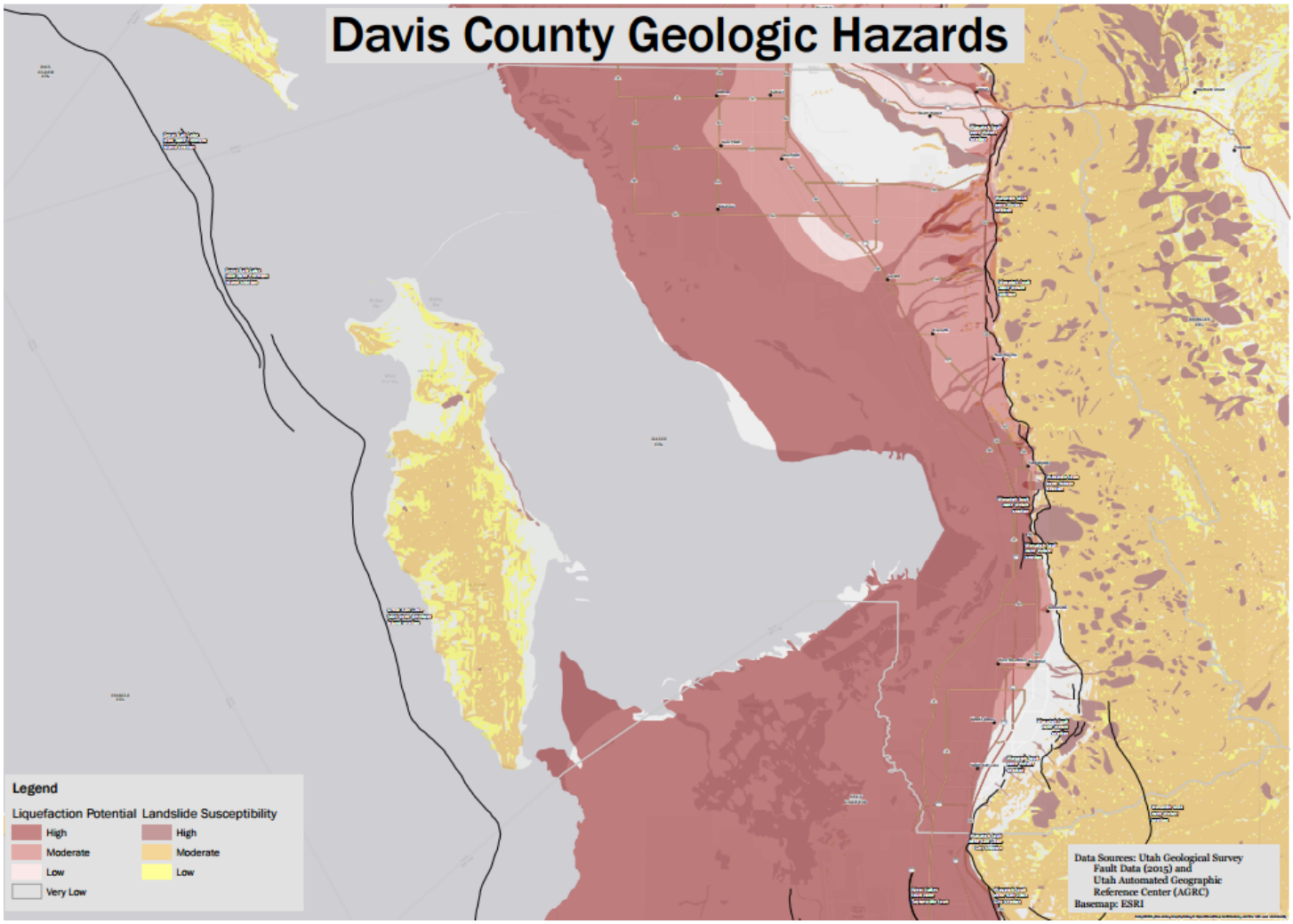
The actions were prioritized based on the Social, Technical, Administrative, Political, Legal, Economic, Environmental (STAPLEE) method identified in the FEMA How-To Guides. The STAPLEE method of prioritization emphasizes the effectiveness of the actions with respect to their cost, as well as their social, technical, administrative, political, legal, environmental, and economic effects. Each action is judged and ranked against these criteria and assigned the priority of High, Medium, or Low.

F. Hazard Description

Each of the natural hazards that could affect the County has been described. These are general descriptions about each hazard to give an idea of what, why, when, and how the hazards occur.



Wasatch Fault Segments and Timeline of Major Ruptures (Source: "The Wasatch Fault," Utah Geological Survey)



Davis County Geologic Hazards, 2016. Source: Utah Geological Survey Fault Data

1. Earthquake

The Utah Geologic Survey defines an earthquake as the result of "…sudden breakage of rocks that can no longer withstand the stresses that build up deep beneath the earth's surface" (DEM 2008). The energy that is released is abrupt shaking, trembling or sudden motion in the earth and rocks that break along faults or zone of weakness along which the rocks slip. Seismic waves are then transmitted outward and also produce ground shaking or vibrations in the earth. The Richter scale measures the magnitude of earthquakes on a seismograph. A Richter magnitude 6 earthquake is 30 times more powerful than a Richter magnitude 5. A Richter magnitude 7 is 1000 times more powerful than a Richter magnitude 5.

Utah experiences approximately 700 earthquakes each year, and approximately six of those have a magnitude 3.0 or greater (Table, this page). On average, a magnitude 5.5 or greater earthquake occurs in Utah every 10 years.

Generally, in order for humans to feel an earthquake it needs to be at least a magnitude 2.0. In order for significant damage to occur, an earthquake needs to be at least a magnitude of 5.5 or greater. The amount of damage that occurs from an earthquake depends on soil type, rock type, ground-water depth and topography. Other factors include the type of construction in an area and the population density.

Locations and Activity: Faulting can be evident on the earth's surface or not evident at all, therefore earthquakes are believed to be able to occur anywhere in Utah.

The earthquake history of the Wasatch Fault is complicated by the fact that there has not been a large earthquake since the first pioneers first arrived in the valley in 1847. The Utah Geological Survey estimates that the last major earthquake in the Wasatch Front was approximately 1,350 years before present. Yet, when looking at the Wasatch Fault Zone, the potential for a large earthquake exists considering that "since 1850 at least 16 earthquakes (excluding aftershocks) of magnitude 6.0 or greater have occurred within the Intermountain Seismic Belt (ISB)" (DEM 2008). The greatest earthquake hazard is considered to be in the areas surrounding the Wasatch, East Cache, East Bear Lake, Bear River, Hansel Valley, Northern Oquirrh, West Valley, and East Great Salt Lake fault zones. On the Wasatch fault, the segments between Brigham City and Nephi, the "composite recurrence interval for large surface-faulting earthquakes (magnitude 7.0 to 7.5) is 395 $\pm$ 60 years. The most recent surface-faulting earthquake on the Wasatch fault occurred 400 years ago on the Nephi segment" (DEM 2008).

	Wasatch Front	**Utah**
Magnitude	***Frequency***	***Frequency***
≥3.0	3 per year	6 per year
≥4.0	1 every 2 years	1 per year
≥5.0	1 every 10 years	1 every 4 years
≥5.5	1 every 20 years	1 every 10 years
≥6.0	1 every 50 years	1 every 20 years
≥6.5	1 every 120 years	1 every 50 years
≥7.0	1 every 330 years	1 every 150 years

*Average Earthquake Frequency (Source: UUSS unpublished data in UGS PI-38 1996) *excludes foreshocks, aftershocks and human-triggered seismic events*

The two largest measured earthquakes to occur in Utah were the Richfield earthquake of 1901, with a magnitude of 6.5 and the Hansel Valley earthquake of 1934 with a magnitude of 6.6.

"The Hansel Valley earthquake produced MM intensities of VIII in Salt Lake City, with numerous reports of broken windows, toppled chimneys, and structures twisted on their foundations. A clock mechanism weighing more than 2 tons fell from the main tower of the Salt Lake City County Building and crashed through the building. The only death that occurred during the event was caused when the walls of an excavation collapsed on a public-works employee south of downtown Salt Lake City." (Lund 2005)

Utah's most damaging earthquake was of a smaller magnitude (5.7), which occurred near Richmond in Cache Valley in 1962. This earthquake damaged over 75 percent of the houses in Richmond, as well as roads and various other structures. The total damage in 1962 dollars was about one million dollars.

"Earthquakes in 1909, 1914, and 1943 produced MM intensities in Salt Lake City of up to VI, and earthquakes in 1910, 1949, and 1962 had MM intensities of VII in Salt Lake City. Damage produced by these events included broken windows, cracked walls, fallen plaster, toppled chimneys, and buildings shifted on their foundations. The 1949 earthquake also ruptured a water main causing loss of water to a portion of the city." (Lund 2005)

On average, Utah experiences a moderate, potentially damaging earthquake (magnitude 5.5 to 6.5) every 7 years. The history of seismic activity in Utah and along the Wasatch Front suggests that it is not a matter of "if" but when an earthquake will occur.

Secondary Hazards: Associated earthquake hazards include ground shaking, surface fault rupture and tectonic subsidence, soil liquefaction, flooding, avalanches, dam failure, fire, and slope failure.

Ground Shaking: Ground shaking is caused by the passage of seismic waves generated by an earthquake. Shaking can vary in intensity but is the greatest secondary hazard because it affects large areas and stimulates many of the other hazards associated with earthquakes. The waves move the earth's surface laterally and horizontally and vary in frequency and amplitude. High frequency, small amplitude waves cause more damage to short, stiff buildings. Low frequency, large amplitude waves have a greater effect on high-rise buildings. The intensity depends on geologic features such as bedrock and rock type, topography, and the location and magnitude of the earthquake. Other significant factors include ground water depth, basin shape, thickness of sediment, and the degree of sediment consolidation. Moderate to large earthquake events generally produce trembling for about 10 to 30 seconds. Aftershocks can occur erratically for weeks or even months after the main earthquake event. (DEM 2008)

Surface Fault Rupture and Tectonic Subsidence**:** Surface fault rupture or down dropping and tilting associated with tectonic subsidence can rupture the ground surface and in Utah the result is the formation of scarps or steep breaks in the slope. The 1934 Hansel Valley earthquake resulted in a surface displacement of approximately 1.6 feet. The highest potential for surface faulting exists in the central segments of the Wasatch fault.

Also, earthquakes having a magnitude of 6.5 or greater could result in surface faulting of 16 to 20 feet high and 12 to 44 mile long break segments. Surface displacement generally occurs over a zone of hundreds of feet wide called the zone of deformation. Tectonic subsidence generally depends on the amount of surface fault displacement. The greatest amount of subsidence will be in the fault zone and will gradually diminish out into the valley (DEM 2008).

Soil Liquefaction**:** Liquefaction occurs when there is a sudden large decrease in shear strength of sandy soils. It is caused by the collapse of the soils structure in which the soil loses its bearing capacity, and also by a temporary increase in pore-water pressure, or water saturation during earthquake ground shaking. Liquefaction is common in areas of shallow ground water and sandy or silty sediments. Two conditions must be met in order for soils to liquefy; first, the soils must be susceptible to liquefaction (sandy, loose, water-saturated, soils typically between 0 and 30 feet below the ground surface) and second, ground shaking must be strong enough to cause susceptible soils to liquefy (UGS 2015). The result is soils that will flow even on the gentlest of slopes.

Lateral Spreading: Lateral spreading is a type of failure that results in surficial soil layers breaking up and moving, up to 3 feet or more, independently over the liquefied layer. On slopes more than 5 percent, flow failures can move several miles at speeds up to 10s of miles per hour. On slopes less than 0.5 percent the bearing capacity will lessen and can cause buildings to settle or tip. No matter the slope percent, ground cracking and differential settlement will occur. Liquefaction can also cause foundation materials to liquefy and fail and/or cause sand boils. Sand boils are deposits of sandy sediment ejected to the surface during an earthquake along fissures. Liquefaction can occur during earthquakes of magnitude 5.0 or greater. (DEM 2008)

Slope Failure**:** Ground shaking can cause rock falls and landslides in mountainous or canyon areas. Rock falls are the most common slope failure and can occur up to 50 miles away from a 6.0 magnitude earthquake. Landslides occur along benches in wet unconsolidated materials. During a 6.0 magnitude earthquake, landslides may happen within 25 miles of the source. (DEM 2008)

Flooding: "*Flooding can happen due to tectonic subsidence and tilting, dam failure, seiches (waves generated in standing bodies of water) in lakes and reservoirs, surface-water diversion or disruption, and increased ground-water discharge."* (DEM 2008)

Avalanches: Avalanches could be triggered because of the associated ground movement. The most vulnerable areas include those that have steep terrain, high precipitation, high earthquake potential, and high population density. In winter or spring months with a snowpack, avalanches may be expected anywhere along the Wasatch Front following an earthquake. (DEM 2008).

Sensitive Clays: Sensitive clays are a soil type that loose strength when disturbed and result in liquefaction or collapse. The resulting type of ground failure is similar to liquefaction (DEM 2008).

Subsidence: A settling or sinking of the earth's crust in loose granular materials such as gravel that do not contain clay. Western Utah is subject to this type of ground settlement (DEM 2008).

2. Flood

Flooding is a natural event for rivers and streams. Flood is determined to be the overflow of water onto land that is normally dry. Floods are related to an excess of snowmelt, rainfall, or failure of natural or engineered impoundments onto the banks and adjacent floodplains. Floodplains are lowland areas near river, lakes, reservoirs, and low terrain urban areas that are subject to recurring floods. Flooding occurs when the peak discharge, or rate of flow in cubic feet per second, is larger than the channel of the river or the storm sewer capacity in a city. The peak discharge for a stream is associated with a probability of occurrence. The probability of occurrence can be stated in terms of recurrence intervals or return periods. For example, a probability of occurrence of 10 percent would be a flood expected to occur once in 10 years or 10 times in a 100 years. Flooding damage includes saturation of land and property, erosion from water, deposition of mud and debris, and the fast flowing waters from the flood itself. Most injuries and deaths occur from the fast moving floodwaters and most of the property damage results from the inundation by sediment-filled water. Flash flood conditions result from intense rainfall over a short period of time (DEM 2008).

Snowmelt floods occur from the rapid snowmelt in the mountains. These floods generally happen in April, May and June. Warm air masses with mostly sunny skies melt the mountain watershed snowpack. The large accumulations of water generally last several days and the magnitude depends on the amount of snowpack and the warm weather. Snowmelt flood risk is reduced when the snowpack is below normal and/or the weather changes from winter to spring and summer gradually without an abrupt warming trend (DEM 2008).

Rainfall floods result from large amounts of precipitation. Short duration local storms such as cloudburst or thunderstorms with a high intensity rainfall as well as the general storms that last several days with a less intense rainfall can produce a flooding event (DEM 2008).

Areas prone to flooding, according to the Utah Natural Hazards Handbook, include lake and reservoir shorelines which may flood when the flow of water into the lakes or reservoirs is greater than the outflow capacity. The Great Basin has several terminal lakes, such as the Great Salt Lake and Sevier Lake, which mean there is no outlet to the sea. These types of lakes are subject to considerable variations in water levels because the only outflow is by evaporation. Successive wet or dry periods lasting several years can result in a large change in size of terminal lakes. Development near this type of lake during a dry period is risky and certain to get flooded during wet periods (DEM 2008).

In 2016, the Great Salt Lake was reduced to only 4,206' due to a nine year period of excessive drought in the Salt Lake Valley. The historic low elevation for the lake was 4,191' in 1963.

River and creek floodplain areas range from narrow zones to extensive lowlands extending great distances from a natural drainage area. Construction in floodplains is also dangerous because of the high flood risk.

Urban areas are also prone to flooding because of the decrease in vegetation of the natural watershed. Houses, driveways, parking lots, buildings, and streets are all replacing the vegetative cover that is so important in lessening the potential for flood. This type of development prevents water infiltration into the soil and greatly increases the runoff. In some areas undersized piping and channels are used which may cause flooding. Manmade drainage channels can also play a role in flooding. Trash and debris can obstruct passageways (DEM 2008).

3. Landslide

Utah ranked third in the nation in terms of largest total landslide damage cost and cost per person between 1973 and 1983. Utah's landslide hazard rating is "severe", the highest level of five hazard classes given by the U. S. Geological Survey. The three main contributing factors to slope failure include areas with moderate to steep slopes, conductive geology, and high precipitation. The main elements that cause slope failure include precipitation events, topography and vegetation (DEM 2008). Landslide distribution in Utah is associated with topography and physiographic provinces. The two physiographic regions that are conducive to landslides in Utah are the Middle Rocky Mountains province and the High Plateaus subdivision of the Colorado Plateau physiographic province. Landslides are also known as slope failure and are classified according to the type of movement and the material involved. The five types of movement include falls, topples, slides, lateral spreads, and flows. The types of materials include rocks, debris (course-grained soil), and earth (fine-grained soil). Slope failure types are identified as rock falls, rock topples, rock slides, debris flows, debris topples, debris slides, slumps, and earth flows (DEM 2008). North Salt Lake experienced the Spring Hill landslide in 2014 which destroyed 1 home, damaged another home, and also damaged a tennis club. An agreement was reached in 2015 by the developer, the city, and the property owners to begin remediation of this slide.

Rock Falls and Rock Topples occur when loosened blocks or boulders from an area of bedrock move down slope. Rock falls and topples generally occur along steep canyons, cliffs, and steep road cuts. Rock fall damage usually affects roads, railroad tracks, and utilities. In Davis County, Farmington Canyon road has been frequently damaged or blocked by rock falls from the steep terrain above the road. In the spring of 2015, boulders the size of automobiles blocked the road for several days until the debris could be cleared by the Forest Service.

Debris Slides and Debris Flows generally occur in mountainous areas and involve the relatively rapid, viscous flow of course-grained soil, rock, and other surficial materials. Debris flows generally occur in mountainous areas and are considered a flow rather than a slide because of the high water content coupled with the debris. Debris flows are typically more dangerous because of the high speeds under which they form and travel. Debris flows generally remain in stream channels but can flow out from canyon mouths for a considerable distance. Debris flows and slides can damage anything in their path

including buildings, roads, railroad tracks, life lines/utilities, and reservoirs. Davis County has experienced numerous debris flows over the years. Significant debris flows occurred in 1983 as floods occurred in Farmington and Centerville. In order to mitigate this hazard, several debris basins have been constructed in the mouths of the canyons along the Front.

Slumps are common along road embankments and river terraces. They slip or slide along a curved failure plane away from the upper part of a slope leaving a scarp (a relatively steeper slope separating two more gentle slopes). Slumps generally do not move very far from the source area.

Earth Flows are slumps with the addition of water that slump away from the top or upper part of a slope, leaving a scarp. These can range in size from very small to flows involving hundreds of tons of material and result in a bulging toe that can block streams and cause flooding, and damage buildings or other structures.

Causes of landslides are the result of hillside instability. Slope makeup, slope gradient, and slope weight all play a role. Other important factors of slope instability include rock type and structure, topography, water content, vegetative cover, and slope aspect. Debris flows, for example, occur when these elements are modified by natural processes or by human created processes.

Natural processes that can induce slope failure include ground shaking, wind and water weathering and erosion.

Human created processes such as lawn watering and irrigation may place excess water on already unstable ground by adding water weight to the material and raise the pore pressure, leading to a loss of shear strength. Water can also change the consistency of the slope material reducing cohesion leading to an unstable mixture.

Rock types containing clay, mudstone, shale, or weakly cemented units, which, are strongly affected by weathering and erosion, are particularly prone to landsliding because of expansive and lubricating properties. Other processes include the removal or addition of slope materials during construction. Vegetation is very important in the stabilization of slopes because it prevents rainfall from impacting the soil directly and helps protect from erosion by retaining water and decreasing surface runoff. The roots systems serve as slope-stabilizing elements by binding the soil together or binding the soil to the bedrock. Increase in slope gradient such as placing heavy loads at the top of a slope and /or the removal of material at the toe of a slope all affect the equilibrium and result in slope failure because of slope instability.

4. Wildfire

The Wildland-Urban Interface (WUI) area, or I-Zone, is where residential areas meet wildland areas. It is known as the interface zone and presents a serious fire threat to people and property.

The urban aspect includes homes, schools, storage areas, recreational facilities, transmission lines and commercial buildings. Wildland refers to unincorporated areas including hills, benches, plateaus, and forests. Homes are built on the benches adjacent to wildland areas. Wildfires remove vegetation which results in slope failure, erosion, water runoff and depletion of wildlife resources. The three conditions that affect fire behavior are topography, vegetation and weather (DEM 2008).

Topography includes such factors as slope, aspect, and elevation. Fires spread faster upslope because the fuels are closer to the flames on the upslope. The heat from a fire moves uphill and dries fuels in front of the fire allowing for easier ignition. The aspect of slope dictates moisture content. In short, the sun dries out fuels on south and west facing slopes more than on north and east facing slopes. Elevation and weather are interrelated because, generally, higher elevations result in cooler temperatures and a higher relative humidity. Elevation also determines the types of vegetation present (DEM 2008).

Vegetation plays a major role in the speed of a fire. Light grasses burn rapidly and heavy dense fuels burn slowly but with a greater intensity. The five major fuel types in Utah's vegetation include grass/sagebrush, pinion-juniper, mountain bush, hardwoods, and softwoods. The grass/sagebrush area poses a serious threat because people under estimate the danger of wildfires in this area.

These fires burn across thousands of acres rapidly and pose a serious threat to not only property but also life. Pinion-juniper fuel will contribute to the fire hazard when conditions are hot, dry, and windy. When a fire does occur here, it will burn intensely and spread rapidly. Mountain brush is commonly found in Utah's foothills and if moderate to extreme fire conditions are present, this type of fuel will burn hot and fast. Hardwood-forest and softwood (deciduous) fuel types are generally less risky (DEM 2008).

Size, continuity and compactness all affect the fuel's rate of spread. Large fuels do not burn as readily as smaller fuels and need more heat to ignite. Small fuels on the other hand ignite easier, and a fire will spread more rapidly through them. Continuity is described by how fuel is arranged horizontally. Fuels that are broken up burn unevenly and slower than uniform fuels. Compactness is how fuel is arranged vertically. Tall, deep fuels have more oxygen available so they burn more rapidly. Less oxygen is available to compact fuels such as leaf litter and stacked logs, therefore they burn slower (DEM 2008).

Weather factors include temperature, humidity, precipitation, and wind. Weather affects the ease with which a fuel ignites, the intensity at which it burns, and how easy or difficult fire control may be.

High temperatures increase fire danger because it heats fuels and reduces water content, which increases flammability. Humidity influences fuel ignition and how intensely fuel burns. A decrease in relative humidity causes fuels to dry, promoting easier ignition and more intense burning. Wind speed can increase burning intensity and the direction that the fire moves. Wind carries heat from a fire into unburned fuels drying them out and causing them to ignite easier. The wind may also blow burning embers into unburned areas well ahead of the main fires starting spot fires (DEM 2008).

Fire protection in these areas is difficult because the tactics used for wildland fire suppression cannot be used for structure protection and suppression. The energy that is emitted from a wildland fire is very dangerous to firefighters and homeowners and makes protection of homes almost impossible. One third of all firefighter deaths occur fighting wildfires. Many believe that WUI areas increase the risks to firefighters significantly. Legally, federal wildland protection agencies seldom have the responsibility to protect structures. The legal responsibility for protecting structures on non-federal wildlands varies widely among state forestry agencies (DEM 2008).

5. Dam Failure

Dams and associated water delivery systems serve various functions and are built by different agencies and entities including; the Bureau of Reclamation, Army Corps of Engineers, Soil Conservation Service, cities, counties, and private irrigation companies. Dams are built for hydroelectric power generation, flood control, recreation, water storage for irrigation, as well as municipal and industrial uses. Utah's dry climate makes it critical for the storage of the winter snowmelt runoff for uses all year round. Federal dams impound more than 84% of Utah's stored water. The 650 non-federal dams store more than 1.2 million acre-feet of water. Dam placement is important and needs to be in an area where it can collect and distribute the greatest amount of water.

Dam sites with strong impermeable bedrock are the best in terms of strength. Davis County does not have any federal dams however, a significant portion of the water utilized in Davis County is received from federal dams located in Morgan and Summit Counties. Upstream from Davis County are several large impoundments, including Echo, Wanship, East Canyon, and Lost Creek reservoirs. A failure of any of these dams would likely impact residents in the South Weber community of Davis County.

"*Rainy day failures occur when floodwaters overstress the dam, spillway, and outlet capacities. The floodwater flows over the top of the dam and eventually erodes the structure from the top down. At this point the floodwater meets with the floodwaters from the rainstorm and a very destructive, powerful flood is created"* (DEM 2008).

Sunny day dam failures are the most dangerous because they happen without warning. Downstream residents or inhabitants have little or no time to prepare or even evacuate the area; the results may be catastrophic. Sunny day failures occur from seepage or erosion inside the dam. This erosion removes fine materials creating a large void that can cause the dam to collapse, or overtop and wash away. Earthquake ground shaking or liquefaction can also create structure problems. Ground shaking will cause the dam to start piping, slumping, settling, or experience a slope failure similar to a landslide. The dam then fails internally or overtops and washes away.

Other sunny day failures occur when vegetation or rodents get into a dam and leave holes or tunnels that can lead to failure. Not all dam failures are catastrophic; sometimes a dam can fail and be drained and repaired without a damaging flow of floodwaters (DEM 2008).

"*Hazard ratings are determined by downstream uses, size, height, volume and incremental risk/damage assessments. The hazard ratings are: Low- insignificant property loss; Moderate- significant property loss; and High- possible loss of life*" (DEM 2008). While Davis County does not have any identified high-hazard dams, the federal dams upstream are listed as high-hazard. Over two hundred Utah dams are rated as high-hazard.

6. Drought

According to the National Drought Mitigation Center, drought originates from a shortage of precipitation over an extended period of time, usually a season or more. This deficiency results in a water shortage for some activity, group, or environmental sector. "*Drought could be considered relative to some long-term average condition of balance between precipitation and evapotranspiration in a particular area*" (NDMC 2006). Drought is also related to the timing and effectiveness of precipitation. Drought is a normal, recurrent feature of weather and climate but is a particular concern to all affected because of its devastating outcome. It occurs in almost all climatic zones with varying characteristics. "*Drought is a temporary aberration and differs from aridity since aridity is restricted to low rainfall regions and is a permanent feature of climate*". Drought is a dry progression through the winter, spring, and summer months that could end in a year or last for many years. The number of dry years correlates with that impacted. Usually, a one to two year drought affects only agriculture, while a three-year drought may significantly impact culinary water in the local areas and communities.

Conceptual definitions of drought help people understand the idea of a drought. Operational definitions define the process of drought. This is usually done by comparing the current situation to the historical average, often based on a 30-year period of record. It is hard to develop a singular operational definition of drought because of the striking differences throughout the world (NDMC 2006).

Meteorological drought is defined by the degree of dryness in comparison to an average amount and the duration of the dry period. Meteorological drought must be considered as region specific since the atmospheric conditions that result in deficiencies of precipitation are highly variable from region to region (NDMC 2006).

Hydrological drought refers to the precipitation decline in the surface and subsurface water supply. The frequency and severity of hydrological drought is often defined on a watershed or river basin scale (NDMC 2006).

Agricultural drought occurs when there is not enough water available for a crop to grow. This drought links various characteristics of meteorological or hydrological drought to agricultural impacts, focusing on precipitation shortages, differences between actual and potential evapotranspiration, soil water deficits, and reduced ground water or reservoir levels (NDMC 2006)

Socioeconomic drought occurs when the physical water shortage begins to affect people (NDMC 2006). When drought begins, the agricultural sector is usually the first to be affected because of its heavy dependence on stored soil water. If precipitation deficiencies continue, then people dependent on other sources of water will begin to feel the effects of the shortage. Those who rely on surface and subsurface water are usually the last to be affected. Ground water users are often the last to be affected by drought during its onset but may be the last to experience a return to normal water levels. The length of the recovery period is a function of the intensity of the drought, its duration, and the quantity of precipitation received as the episode terminates (NDMC 2006).

Measuring Drought:

Palmer Drought Severity Index (PDSI): Developed in 1965, the PDSI is a soil moisture algorithm calibrated for relatively homogeneous regions used by government agencies and states to trigger drought relief programs. The PDSI provides a measurement of moisture conditions that were "standardized" so that comparisons using the index could be made between locations and between months. This is the oldest index for measuring drought and is less well suited for mountainous land or areas of frequent climatic extremes and does not include man-made changes. The PDSI is calculated based on precipitation and temperature data as well as local available water content of the soil. This scale is given as monthly values and is the most effective in determining long-term drought. The index ranges from –4 to 4 with negative values denoting dry spells and positive values indicating wet spells. The values 0 to -.5 equal normal, -0.5 to –1.0 equal incipient drought, -1.0 to –2.0 equal mild drought, -2.0 to –3.0 equal moderate drought, -3.0 to –4.0 equal severe drought, greater than –4.0 equals extreme drought. The wet spells use the same adjectives in the positive values (NDMC 2006).

Surface Water Supply Index (SWSI): Developed in 1982, the SWSI index uses the same basic classifications as the Palmer Drought Index and is designed to complement the Palmer Index in the western states. The SWSI is more of an indicator of surface water conditions and is described as "mountain water dependent", in which mountain snowpack is a major component; calculated by river basin, based on snowpack, stream flow, precipitation, and reservoir storage. The objective of the SWSI was to incorporate both hydrological and climatological features into a single standardized index value. The pros and cons of the SWSI is that the index is unique to each basin. The SWSI is centered on 0 and has a range between –4.2 (extremely dry) and 4.2 (abundant supply). The index is calculated by combining pre-runoff reservoir storage with forecasts of spring and summer stream flow that is based on hydrologic variables (NDMC 2006).

Standardized Precipitation Index (SPI): T.B. McKee, N.J. Doesken, and J. Kleist of the Colorado State University, Colorado Climate Center, formulated the SPI in 1993. The Standardized Precipitation Index was designed to quantify the precipitation deficit for multiple time scales; basically, the SPI is an index based on the probability of precipitation for any time scale. It assigns a single numeric value to the precipitation that can be compared across regions with different climates. The SPI is calculated by taking the difference of the precipitation from the mean for a particular time scale and dividing by the standard deviation.

The SPI is normalized and so the wetter and drier climates can be represented in the same way. The SPI can provide early warning of drought and help assess drought severity, yet the values based on preliminary data may change. The SPI values indicate an extremely wet period value at 2.0+, very wet equals 1.5 to 1.99, moderately wet is 1.0 to 1.49, -.99 to .99 is near normal, -1.0 to –1.49 moderately dry, -1.5 to –1.99 is severely dry, -2 and less is extremely dry. The time scales were originally calculated for 3-, 6-, 12-, 24-, and 48- months (NDMC 2006).

A drought analysis review of 33 gauging stations data in Utah indicated that a localized drought has occurred on at least one stream every year since 1924. The duration of drought lasts longer in basins where runoff is mainly from snowmelt. The frequency of occurrence is greater for areas in the Wasatch Range than in the Wasatch Plateau, the mountains of southwestern Utah, or the Uintah Mountain range. Because Utah relies on surface water supplies, about 81% of the population relies on off-stream water use and 35% of the population relies on surface water supplies, drought severely affects the people and industry of the whole state.

7. Severe Weather

Winter Storms

Winter storms gain energy from the collisions of two air masses. In North America, a winter storm is usually generated when a cold air mass from dry Canadian air moves south and interacts with a northward moving warm moist air mass from the Gulf of Mexico. The position where a warm and a cold air mass meet is called a front. If cold air is advancing and pushing away the warm air, the front is known as a cold front. If warm air is advancing, it will ride up over the cold air mass and the front is known as a warm front. A winter storm will typically begin under what is known as a stationary front. A stationary front is when neither air mass is advancing.

The atmosphere will try to even out the pressure difference by generating an area of lower pressure; this creates wind that blows from high pressure towards a low-pressure area. As the air travels toward the center of the low-pressure area, it is pushed up into the colder regions of the upper atmosphere because it has nowhere else to go. This causes the water vapor to condense as snow in the northern areas because of the colder temperatures. In the south, if the temperatures are warm enough the water vapor will fall as heavy rain in thunderstorms. Because of the easterlies in Northern America, the winter storm moves quickly over the area and generally does not last longer than a day in one area. However, in Utah, because of the Great Salt Lake “lake-effect”, snowstorms can last for many days. This is because of the amount of moisture from an unfrozen body of water. When a strong cold wind blows over a larger area of water, the air can attain a substantial amount of moisture; this moisture turns into heavy snow when it reaches land causing a lake effect snowstorm (Scholastic 2008).

Ice Storms

Ice storms are rare in Utah, but may occur when rain falls through a temperature inversion and the air near the ground is below freezing. The rain freezes on contact with everything it touches and can bring down electrical wires, telephone poles and lines, trees, and communication towers. Ice also freezes on contact with roads and highways resulting in extreme hazards to motorists and pedestrians. Bridges and overpasses are likely to freeze first. (NWS 2001)

Heavy Snow

Heavy snow has occasionally has immobilized Davis County stranding commuters, stopping the flow of commerce, disrupting emergency services, closing infrastructure and services. When heavy snow occurs with high winds, blowing snow or blizzard conditions may exist. (NWS 2001).

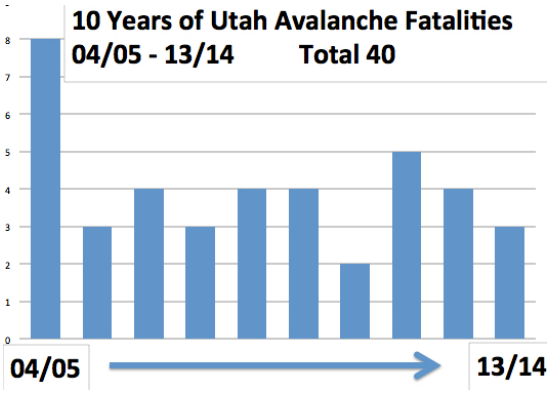
Avalanche

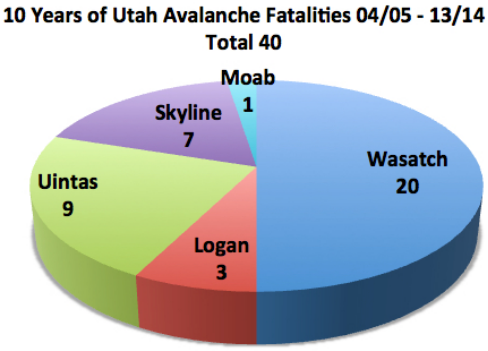
Utah DEM defines an avalanche as a mass of snow sliding down a mountainside. Avalanches occur when stresses (driving forces), such as the pulling of snow downhill by gravity, exceeds the strength (resisting forces) such as the bonds between snow grains. Four ingredients are needed to produce an avalanche:

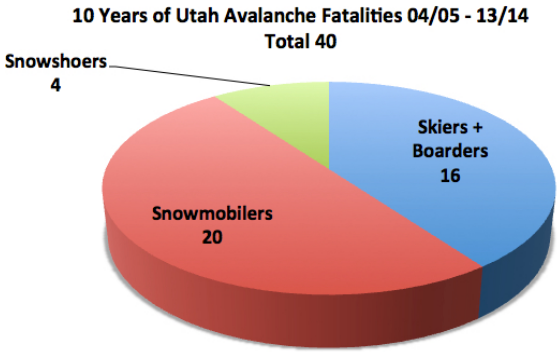
1. Snow
2. Weak layer in the snow cover
3. Steep slope
4. A trigger

About 90% of all avalanches start on slopes of 30 - 45 degrees; about 98% of all avalanches occur on slopes of 25 - 50 degrees. Avalanches release most often on slopes above timberline that face away from prevailing winds (leeward slopes collect snow blowing from the windward sides of ridges.) Avalanches can run, however, on small slopes well below timberline, such as gullies, road cuts, and small openings in the trees. Very dense trees can anchor the snow to steep slopes and prevent avalanches from starting; however, avalanches can release and travel through a moderately dense forest.

Avalanche victims are primarily backcountry recreationists: snowmobilers, climbers, snowboarders, skiers, and hikers. In 90% of avalanche incidents, the victim or someone in the victim's party triggers the avalanche. (UDEM 2015)







10 Years of Utah Avalanche Fatalities 2004-2014 (UDEM 2015)

An avalanche consists of a starting zone, a track, and a runout zone. The starting zone is where the ice or snow breaks loose and starts to slide; this zone can be triggered by human and/ or natural activities. Human induced avalanches can result from snowmobilers, backcountry skiers, or other outdoor recreationalists causing ground shaking. The two main natural factors that affect avalanche activity include weather and terrain and large, frequent storms combined with steep slopes. Other factors that contribute to the stability of the snowpack include the amount of snow, rate of accumulation, moisture content, snow crystal types and the wind speed and direction. The track is the grade or channel down which an avalanche travels. The runout zone is where an avalanche stops and deposits the snow. For large avalanches, the runout zone can include a powder, or windblast zone that extends far beyond the area of snow deposition. In Utah, avalanches annually kill more people than any other natural hazard, and ironically, are often triggered by the victim. Each winter an average of four people dies in Utah due to avalanche activity (UDEM 2015).

Weather and terrain conditions affect avalanche conditions. The weather controls the durations and the extent of an avalanche while terrain is the element that determines where, why, and how an avalanche occurred. In Utah, the months of January through April pose the greatest avalanche potential. Weather related aspects that affect the snowpack stability include rate of accumulation, amount of snowfall, moisture content, wind speed and direction, and snow crystal type. Wind can deposit snow 10 times faster than snow falling from a storm without accompanying wind.

This affects avalanche potential because the underlying weak layer of snow cannot adjust to the new load. Rain and the melting of snow can almost instantly cause an avalanche because of the added weight (UDEM 2015).

Terrain includes such variables as slope, aspect, elevation, roughness and angle. The slope is important in understanding where an avalanche will occur. Slopes greater than 45 degrees are too steep because the snow continually sluffs off; however slopes greater than 20 degrees can produce avalanches. Optimum slope degree is between 30 to 45 degrees, which is also the optimum angle for backcountry skiers. This slope angle is where approximately 99.9 percent of avalanches occur. The slope aspect and elevation affect the snow depth, temperature, and moisture characteristics of the snowpack. Slope aspect, such as north facing or shady slopes usually produce more avalanches and more persistent avalanche hazards occur during mid winter months. In the spring, the strong sun on south facing slopes produce more wet avalanches (UAC 2015).

Slope shape and roughness correlate with snowpack stability. Roughness identifies boulders, shrubs, and trees that can help slow, or reduce avalanche speed and impact. A bowl shaped slope is more prone to an avalanche than a ridge or cliff.

Dry-slab avalanche is when a cohesive slab of snow that fractures as a unit slides on top of weaker snow and breaks apart as it slides. Dry-slab avalanches occur usually because too much additional weight has been added too quickly, which overloads the buried weak layer. Even the weight of a person can add a tremendous stress to a buried weak layer. Dry-slab avalanches usually travel between 60-80 miles per hour within 5 seconds of the fracture and are the deadliest form of avalanche (UAC 2015).

Wet-slab avalanches occur for the opposite reason of dry avalanches; percolating water dissolves the bonds between the snow grains on the pre-existing snow, which decrease the strength of the buried weak layer. Strong sun or warm temperatures can melt the snow and create wet avalanches. Wet avalanches usually travel about 20 miles per hour (UAC 2015).

Avalanches can result in loss of life as well as economic losses. At risk are some communities, individual structures, roads, ski areas, snowmobilers, backcountry skiers, snowshoers, snowboarders, and climbers. One of the major consequences of avalanches is the burial of structures, roads, vehicles, and people in the runout zone where tens of feet of debris and snow can be deposited (UAC 2015).

Between 1958 and 2015, there was one avalanche fatality listed on the Utah Avalanche Center website. In 1996, a snowmobiler was killed in the Bountiful Peak area. (UAC 2015)

<u>Severe Weather</u>:
Severe weather refers to winter storms, blizzards, heavy snow, freezing rain and lightning, all hazards common to the State of Utah.

Winter Storms

While the majority of Utah residents are no longer isolated, they are still vulnerable to the extreme conditions caused by the winter storms. Heavy snow can paralyze a city, stranding motorists, stopping the flow of supplies, disrupting emergency services, and halting classes at area schools. Heavy accumulations of snow can cause buildings to collapse and knock down trees and utility lines. The resulting danger of prolonged utility outages can become critical, during cold temperatures, which often coincide with these storms, especially to the elderly and very young. Cost of snow removal, repairing damage, and loss of business can place a large economic burden on cities. Many of the deaths due to this kind of disaster are often indirectly related, such as heart attacks from shoveling snow, and traffic accidents caused by icy roads.

Lightning

Deaths directly related to severe weather to occur, such is the case with lightning. Over 40 million lightning strikes occur each year in the United States. Since 1950 there has been 51 deaths and 131 injuries, in Utah, due to lightning. Lightning is Utah's second deadliest natural hazard, trailing only avalanches, when comparing the figures from 1951 to the present. Most lightning strikes, in Utah, occur during the summer months of May, June, July, and August, when large consecutive storms come. Severe Thunderstorms usually last around 30 minutes and are typically only 15 miles in diameter (NWS 1999), but all produce lightning, the “number one weather-related killer” in Utah (NWS 2008). Thunderstorms can also lead to flash flooding from heavy rainfall, strong winds, hail and tornadoes or waterspouts (NWS 1999).

<u>Tornado</u>

Tornadoes are defined as “a violently rotating column of air extending from a thunderstorm to the ground” (NWS 2015), and is often on the edge of the updraft or next to the air coming down from the thunderstorm. A tornado’s vortex is a low-pressure area and as air rushes into the vortex, its pressure lowers and cools the air. This cooler air condenses into water vapor in the funnel cloud, known as the vortex, and doesn’t touch the ground. The swirling winds of the tornado pick up dust, dirt, and debris from the ground, which turns the funnel cloud darker. Some tornadoes can have wind speeds greater than 250 miles per hour with a damage zone of 50 miles long and greater than 1 mile wide (NWS 2015). Most tornadoes in Utah typically have winds less than 110 miles per hour, are no wider than 60 feet and are on the ground longer than “a few minutes” (Brough, et al. 2007).

A change in wind direction and an increase in wind speed along with increasing height create a horizontal spinning effect in the lower atmosphere form a tornado while the rising air within the thunderstorm updraft tilts the rotating air vertically resulting in what we call a tornado. The area of rotation is generally 2-6 miles wide and extends through much of the storm (NWS 2015).

Scale: Tornadoes are classified by the National Weather Service using the Fujita Scale, which relates wind speed to damage to determine tornado intensity. The scale uses numbers from 0 through 5 with the ratings based on the amount and type of wind damage (SPC 2007). This scale has recently been

modified and is now referred to as the Enhanced Fujita Scale. The Enhanced Fujita Scale classifications are listed below:

Enhanced Fujita Scale
EF-0: 65-85 mph, Light damage, downed tree branches, chimney damage
EF-1: Winds 86-110 mph, Moderate damage, mobile home damage
EF-2: Winds 111-135 mph, Considerable damage, mobile home demolished, trees uprooted
EF-3: Winds 136-165 mph, severe damage, roofs and walls torn down, trains overturned, cars thrown
EF-4: Winds 166-200 mph, Devastating damage, well-constructed walls leveled
EF-5: Winds over 200 mph, incredible damage, homes lifted off foundation and carried, autos thrown as far as 100 feet. (SPC 2014)

Tornadoes are rare in Davis County but have been reported, occurring mostly in the west part of the county and around the Great Salt Lake. In August of 2005 a tornado was photographed over Antelope Island.

Waterspouts are weak tornadoes that form over warm water, and in Utah generally occur with cold, late fall or late winter storms (Brough, et al. 2007).

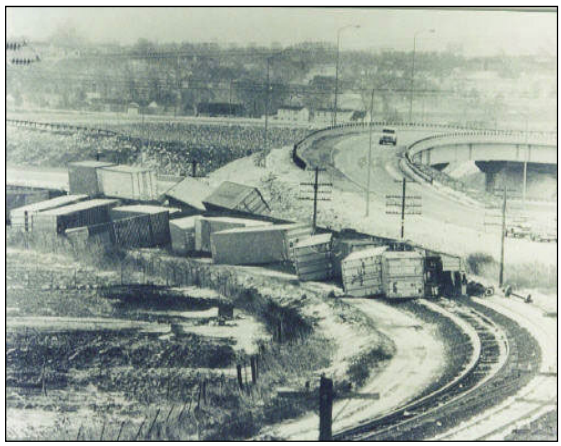
1. Severe Weather

Hazard Profile

Potential Magnitude		***Catastrophic (>50%)***	***Probability***	***X***	***Highly Likely***
		Critical (25-50%)			***Likely***
	X	***Limited (10-25%)***			***Possible***
		Negligible (< 10%)			***Unlikely***
Location	Occur in localized areas throughout the region. Although many severe weather phenomena generally have recognizable patterns of recurrence, it is difficult to identify exactly when and where the next event will take place.				
Seasonal Pattern	Year round				
Conditions	Vary based on latitude, elevation, aspect and land forms				
Duration	Severe weather hazards generally last hours and can persist for days.				
Secondary Hazards	Wildfire, flooding				
Analysis Used	National Climate Data Center, National Weather Service, Utah Avalanche Center, Utah DEM, local input, and review of historic events and scientific records.				

Description of Location and Extent

High Winds



Wasatch Front, April 4-6, 1983 – 70 mph "East Winds" derailed this train in the Lagoon area. Peak gusts were recorded at 104 mph. *(Source: Utah's Weather and Climate, Photo: Ogden Standard Examiner)*

High winds can occur with or without the presence of a storm and are unpredictable in regards to time and place. Each of the five counties that make up the Davis County has experienced high winds in the past (see Map 8-2 page 96), and can expect regional high wind future events.

Canyon winds can bring wind gusts greater than 100 mph through the canyon mouths into the populated areas of the Davis County. Winds are usually strongest near the mouths of canyons and have resulted in the loss of power and the inability to heat homes and businesses. Winds have also damaged roofs, destroyed and knocked down large trees and fences, overturned tractor trailers and railroad cars, and downed small airplanes. Davis County has experienced numerous high wind episodes resulting in several million dollars of property damage. In December 2011 winds in excess of 100 mph toppled thousands of trees and tore roofs and siding off of hundreds of buildings. Davis County received a Presidential Disaster Declaration for Public Assistance to help reimburse the cost of the cleanup.

Fog

Temperature inversions often occur during the winter months as a result of high pressure trapping cold air in the valley. These inversions keep cold, moist air trapped on the Wasatch Front valley floor forming

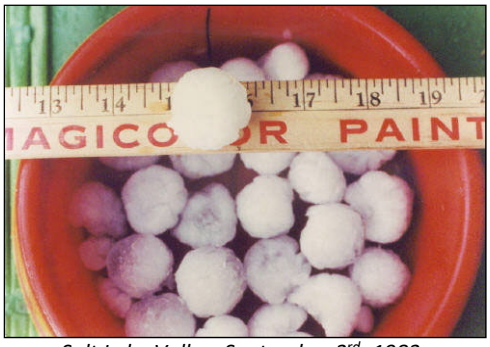
super-cooled fog. This fog can cause visibility restrictions and icy surfaces. Wind is needed to clear the inversion and fog. The Great Salt Lake has been shown to affect the prevalence of fog, especially when lake levels are high (Hill 1987).

Severe Storms

Severe storms can include thunderstorms, lightning, hailstorms, heavy snow or rain, extreme cold and avalanche. These storms are generally related to high precipitation events during the summer and winter months and can happen anywhere in the region. Damage can be extensive especially for agriculture, farming, and transportation systems; they can also disrupt business due to power outages.

Thunderstorms

Strong, rising air currents bring warm, moist air from the surface into the upper atmosphere where it condenses forming heavy rains, hail, strong winds and lightning. Based on historical evidence thunderstorms can strike anywhere in the region, mainly during the spring and summer months



Salt Lake Valley, September 3rd, 1983 - Thunderstorms produce 0.5" – 1.5" hail (Source: Utah's Weather and Climate, Photo: National Weather Service)

Hailstorms

Hailstorms occur when freezing water (in thunderstorm clouds) accumulates in layers around an icy core generally during the warmer months of May through September. Hail causes damage by battering crops, structures and automobiles. When hailstorms are large, damage can be extensive (especially when combined with high winds). See Map 8-3 (page 97) for spatial distributions of hail events.

Lewis Peak, North Ogden, Utah, August 8th, 2003 – Lightning (Source: Utah's Weather and Climate, Photo by Gene Poncelet)

Lightning

Lightning is the electric discharge between clouds or from a cloud to the earth. In Utah, lightning causes the highest number of weather-related fatalities (NWS 2008). Lightning casualties occur most frequently during the summer monsoonal flow in July and August. See Table 8-1 for the number of casualties caused by lightning. Lightning is also the primary cause of wildland fires in Utah (NWS 2008), which could cause casualties or be disruptive to the economy.

Between 2006 and 2015, Utah had 6 lightning caused deaths, none of these occurred in Davis County.

Tornado

Great Salt Lake, September 12th, 1998 – Waterspout *(Photo: KTVX News 4)*

Salt Lake City Tornado, August 11, 1999 – Orange fireball is a power sub-station exploding (*Photo: KTVX News 4)*

Historically, atmospheric conditions have not been favorable for tornado development in Utah due to a dry climate and mountainous terrain. Utah is one of the lowest ranked in the nation for incidences of tornadoes with only one F2 or stronger tornado every seven years. Utah averages about two tornados per year which typically occur between May and August.

Despite this fact, interactions of the relatively cool air of the Great Salt Lake and relatively warm air of urban areas could create situations more favorable for tornado development. This phenomenon possibly contributed to the formation of the August 1999 Salt Lake City tornado (Dunn and Vasiloff 2001) which was the costliest disaster in Salt Lake County history causing over $170 million in damages.

Heavy Precipitation

Heavy amounts of precipitation from rain or snow can result in flash flood events. The Wasatch Front has been susceptible to these types of storms because of close proximity to the mountain ranges. Major winter storms can produce five to ten times the amount of snow in the mountains than in the valley locations. Heavy snow can cause a secondary hazard in avalanches. Much of the valley's development has occurred on old alluvial fans from the canyon mouths. During heavy rain events, water and debris collect on these same alluvial fans, damaging residential, commercial property and infrastructure. See Map 8-6 (page 100) for the regional flash flood hazard.

East Bench, Salt Lake Valley, October 18, 1984 – 22 inches of snow falls in 24 hours. (*Source: Utah's Weather and Climate, Photo: Salt Lake Tribune)*

Extreme Temperatures

Temperatures in Utah can reach the extreme ends of the thermometer. Winter months often experience temperatures below zero degrees. Summer temperatures regularly reach into the nineties with many days above 100 degrees. Drastic temperature changes also occur, even in matter of hours. Temperature swings in such a short period of time can cause severe emotional stress in people, sometimes resulting suicide. Sub-zero temperatures occur during most winters; however, prolonged periods of extremely cold weather are infrequent. January is generally the coldest month of the year. Historically, extreme cold in the region has disrupted agriculture, farming and crops. Especially

vulnerable to extreme cold are the young, elderly, homeless and animals. Wind chill can further the effects of extreme cold.

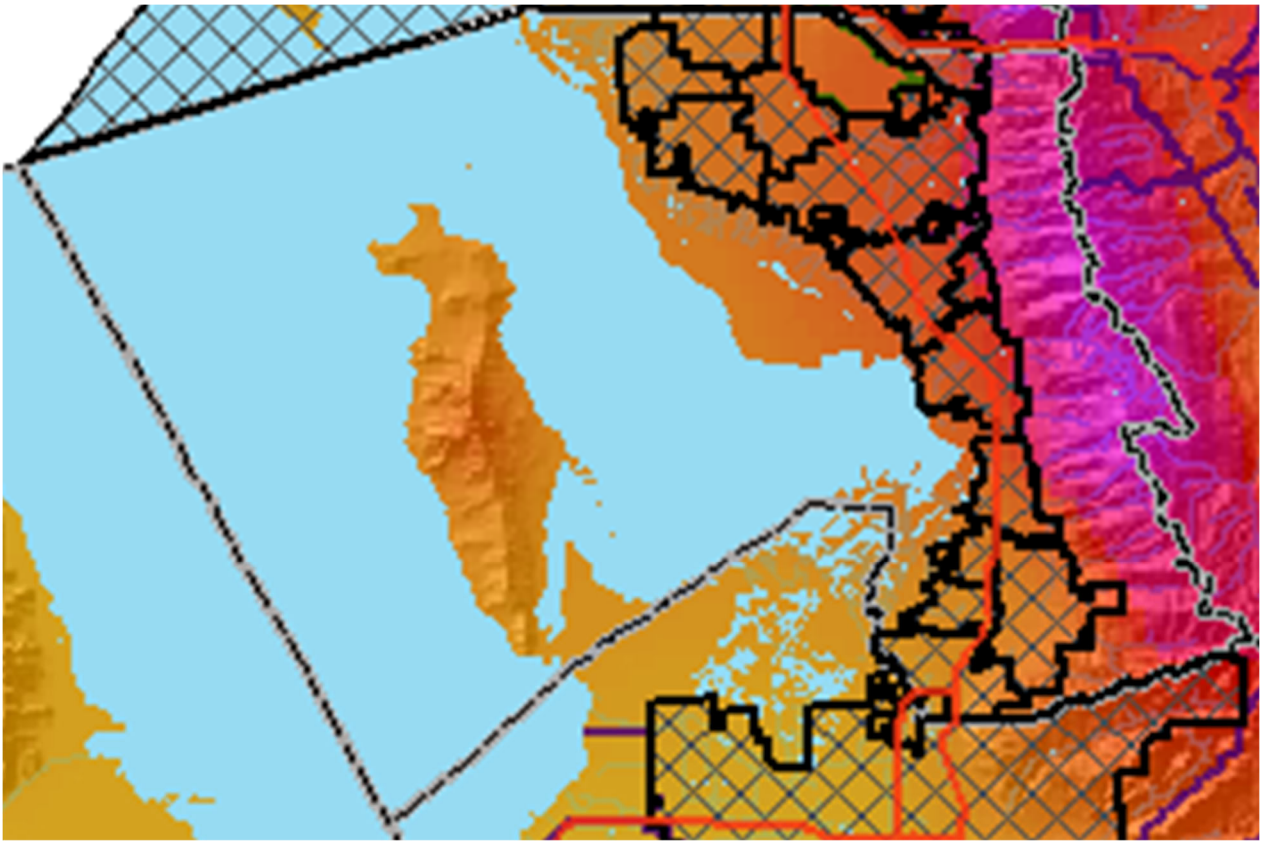
Extreme heat not only causes discomfort, but can lead to heat exhaustion or heat stroke. Extreme heat also places severe strain on electrical systems due to the widespread use of evaporative coolers and air conditioners. This strain can lead to brownouts or blackouts leaving many without electrical power.

Avalanche

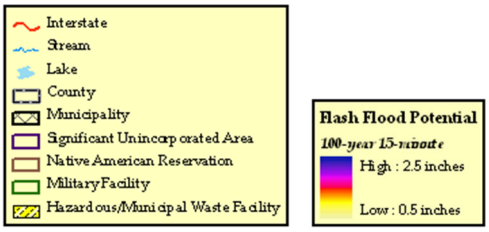
Heavy snows, high winds, extreme temperatures and steep mountain slopes combine to form avalanche hazards in the foothills and mountainous areas of the Davis County. Even though most avalanches occur in wildland areas, recreational endeavors – hiking, hunting, mountain climbing, skiing, snowboarding, snowmobiling and other wintertime activities – bring the population into contact with avalanche-prone areas. Due to the immense popularity of these activities, avalanches are actively mitigated within well-traveled areas. Persons venturing into the backcountry are more at risk. Homes and businesses along the foothills and in mountain areas have been damaged from avalanches.

White Pine, Little Cottonwood Canyon, December 23rd, 1988 – two to three feet of snow deposited in the mountains causes many avalanches (Source: Utah's Weather and Climate, Photos: National Weather Service)

The majority of avalanches occur on slopes between 30 and 50 degrees and with terrain barren of vegetation. Types of avalanches include wet and dry slab. *Wet-slab avalanches* occur most often in warming conditions on southerly-facing slopes. *Dry-slab avalanches* occur mostly on northerly facing slopes in mid-winter. Wind can accelerate snow deposition leading to larger and/or more frequent avalanches (UAC 2008).



Davis County flash flood potential



2. Drought

Hazard Profile

Potential Magnitude		***Catastrophic (>50%)***	***Probability***		***Highly Likely***
	X	***Critical (25-50%)***		***X***	***Likely***
		Limited (10-25%)			***Possible***
		Negligible (< 10%)			***Unlikely***
Location	Region wide				
Seasonal Pattern	Summer				
Conditions	*Meteorological Drought:* *Agricultural Drought:* *Hydrologic Drought:* *Socioeconomic Drought:*	Lack of precipitation Lack of water for crop production Lack of water in the entire water supply Lack of water sufficient to support population			
Duration	Months, Years				
Secondary Hazards	Wildfire, dust storms, air quality				
Analysis Used	National Weather Service, Utah Climate Center, Utah Division of Water Resources, Newspapers, Local input.				

Description of Location and Extent

Drought refers to an extended period of deficient rainfall relative to the statistical mean for a region. The entire region is emerging from drought conditions experienced since 1999. Drought dramatically affects this area because of the lack of water for agriculture and industry, which limits economic activity, irrigation and culinary uses. The severity of the drought results in depletion of agriculture lands and deterioration of soils. In the Wasatch Front region the risk of drought is high.

4.0 or more	Extremely wet
3.0 to 3.99	Very wet
2.0 to 2.99	Moderately wet
1.0 to 1.99	Slightly wet
0.5 to 0.99	Incipient wet spell
0.49 to -0.49	Near normal
-0.5 to -0.99	Incipient dry spell
-1.0 to -1.99	Mild drought
-2.0 to -2.99	Moderate drought
-3.0 to -3.99	Severe drought
-4.0 or less	Extreme drought

Palmer Drought Severity Index (NDMC 2006)

The Palmer Drought Severity Index (PDSI) developed by Wayne Palmer in the 1965, measures drought severity using temperature, precipitation and soil moisture (Utah Division of Water Resources 2007a). The PDSI has become the "semi-official" drought index as it is standardized across various climates. The

index uses zero as normal and assigns a number between +6 and -6, with dry periods having negative numbers and wet periods expressed using positive numbers (Table 8-2) (NDMC 2006).

The Davis County planning area falls within the Northern Mountains region. Each of these regions has differing characteristics, but often experience similar drought periods. The Northern Mountains region typically experiences droughts less frequently than other parts of the state (Utah Division of Water Resources 2007a).

It may be Northern Mountains region simply has more water to lose as the Wasatch and Uinta Mountains receive much more precipitation on average. The most severe drought period in recorded history for the Northern Mountains region occurred in 1934 at the height of the Great Depression and during the same drought period (1930 to 1936) that caused the “Dust Bowl” on the Great Plains (Utah Division of Water Resources 2007a).
Times of extended drought can turn into socioeconomic drought, or drought that begins to affect the general population. When this occurs, reservoirs, wells and aquifers are low and conservation measures are required. Some forms of water conservation are water-use restrictions, implementation of secondary water or water recycling and xeriscaping. Other conservation options include emergency water agreements with neighboring water districts or transporting water from elsewhere.

1. Earthquake
Hazard Profile

Potential Magnitude	***X***	***Catastrophic (>50%)***	***Probability***		***Highly Likely***
		Critical (25-50%)		***X***	***Likely***
		Limited (10-25%)			***Possible***
		Negligible (< 10%)			***Unlikely***
Location	Eastern areas of Bountiful, Centerville, Farmington, Kaysville, Kaysville, and Layton along the western portion of the Intermountain Seismic Belt. Ground shaking will be felt throughout the entire County. Surface fault ruptures will be found along and near the current fault trace. Liquefaction can be expected in areas of deep sediment and shallow groundwater, from the foothills to the western portion of the county near the Great Salt Lake.				
Seasonal Pattern	There is no seasonal pattern for earthquakes, they can occur at any time of the year or day during any or all weather conditions.				
Conditions	Liquefaction Potential is greatest near the Great Salt Lake along the low-lying areas of the county, in soils that are comprised of old lakebed sediments. Historic movement along faults. Intermountain Seismic Zone, and the Wasatch Fault Zone.				
Duration	Actual ground shaking will be under one minute, aftershocks can occur for weeks or even months.				
Secondary Hazards	Fire, landslide, rock falls, avalanche, flooding				
Analysis Used	Review of hazard analysis plans and other information provided by the University of Utah Seismograph Station, UGS, USGS, DEM, AGRC.				

Description of Location and Extent

According to the Davis County Emergency Operations Plan, Davis County contains the highest density of faults in the entire state of Utah. These faults are primarily normal faults, meaning the two sides of the fault are moving away from one another. Davis County has experienced earthquakes in the past, but few damaging earthquakes have had their epicenters within the county boundary in recent history (Map 9-2, page 121).

In northern Utah, the Wasatch Fault Zone (WFZ) is an active fault zone that is capable of producing a large 7.0+ Richter magnitude earthquake on average every 300-400 years. There is a 25% probability of a damaging earthquake occurring along one of the WFZ segments in the next 100 years (McCalpin and Nishenko 1996 in UGS 2002). The average repeat time on any single segment ranges from about 1,200-2,600 years. The last major earthquake for each of the five central segments ranges from 250 to 2,900 years ago (Lund 2005). Davis County is situated between two segments of the Wasatch Fault, the Weber Segment and the Salt Lake Segment. The Weber Segment, running from North Salt Lake along the eastern edge of the valley to Willard Bay, represents the fault segment of greatest concern within the County. The Weber Segment has produced four large earthquakes over the past 4,000 years, making it one of the most active fault segments. The Weber and Salt Lake segments of the Wasatch Fault both

have the potential for a magnitude 7.0 or greater earthquake which would cause much damage to the entire county.

The East Great Salt Lake fault is another active fault with two segments (Fremont Island and Antelope Island) in Davis County. Less is known about this fault due to its proximity to populated areas. Dinter and Pechmann (2005) conducted Carbon-14 dating of the two segments in 2004 and found the fault to be very active. For general information on all Quaternary faults in Davis County, see Table 9-2.

Name	Fault Type	Length (km)	Time of Most Recent Deformation	Recurrence Interval
Fremont Island section, EGSLFZ	Normal	30	3150 +235/-211 cal yr B.P.	4200 years
Antelope Island section, EGSLFZ	Normal	35	586 +201/-241 cal yr B.P.	4200 years
Salt Lake segment, WFZ	Normal	43	1300 ±650 cal yr B.P.	1300 years
Weber segment, WFZ	Normal	56	950 ±450 cal yr B.P.	1400 years

Table 9-2. Davis County Quaternary Faults (UGS 2002, Lund 2005) (EGSLFZ=East Great Salt Lake Fault Zone, WFZ=Wasatch Fault Zone, cal yr B.P.=calendar years before present)

Maps 9-3 and 9-4 (pages 122-123) represent ground shaking potential within Davis County for a 2500-year earthquake event. This represents an event with an approximate magnitude of 7.5 on the Richter scale. Spectral acceleration of 0.2 seconds represents the frequency of shaking which affects primarily one- to two-story buildings. Spectral acceleration of 1.0 seconds represents the frequency most likely to affect buildings three stories or higher. Values are represented as a percent of the force of gravity. Ten percent of gravity (0.1G) is the threshold at which poorly-built structures begin to suffer significant damage (FEMA 1995).

Liquefaction is one of the secondary hazards associated with an earthquake and affects almost the entire County. Davis County is located atop the ancient Lake Bonneville lakebed, which is made up of unconsolidated sandy soils. The area is also subject to shallow ground water and a high earthquake threat. For a further explanation of the liquefaction threat, see Map 9-5 (page 124). Refer to the "regional hazards identification" section for a narrative explanation.

Vulnerability Analysis

Vulnerability to earthquake in Davis County was obtained from the modeling program Hazards United States – Multihazards (HAZUS-MH) **. The following numbers were based on a probabilistic 2500-year event with a Richter magnitude of 7.1 as well as an arbitrary 5.9 event located in close proximity to the county's most populated areas. These locations and magnitudes were chosen for their likelihood and proximity respectively. Default HAZUS-MH inventory for all infrastructure was used. (***For a more detailed explanation of the loss estimation methodology of HAZUS-MH MR2, please see Part VI or the HAZUS-MH Technical Manual (Earthquake Model) at www.fema.gov/hazus).*

Building Damage

HAZUS-MH classifies building damage into five states: none, slight, moderate, extensive and complete. Table 9-3 lists the number of buildings by occupancy estimated to sustain moderate to complete levels of damage during either an arbitrary Richter magnitude 5.9 (M5.9) or a probabilistic Richter magnitude 7.1 (M7.1) earthquake. Also listed are the estimated monetary losses to structures, contents/inventory and income.

Category	Number of Structures with >50% Damage		Category	Estimated Losses	
	Davis M5.9	2500-yr M7.1		Davis M5.9	2500-yr M7.1
Residential	7,618	41,310	Structural Losses	$96,362,000	$751,502,550
Commercial	282	954	Non-Structural Losses	$345,379,000	$2,646,616,900
Industrial	91	294	Content Losses	$131,812,000	$844,568,670
Government	15	49	Inventory Losses	$4,504,000	$38,314,060
Education	11	38	Income and Relocation Losses	$90,090,000	$3,983,479,080
Totals	**8,017**	**42,645**	Totals	**$668,147,000**	**$8,264,481,260**

Table 9-3. Building Damage Counts and Estimated Losses

Transportation and Utilities Damage

Damages to transportation and utility infrastructure are in Table 9-4. Infrastructure sustaining moderate or worse damage and estimated monetary losses are both shown.

Category	Total	At Least Moderate Damage (>50%)		Estimated Losses	
		Davis M5.9	2500-yr M7.1	Davis M5.9	2500-yr M7.1
Waste Water Facilities	3	1	3	$21,559,000	$77,769,000
Waste Water Pipelines	1,242 km	203 leaks/breaks	4,455 leaks/breaks	$730,000	$16,039,000
Potable Water Pipelines	2,069 miles	256 leaks/breaks	5,633 leaks/breaks	$923,000	$20,279,000
Natural Gas Pipelines	828 km	216 leaks/breaks	4,775 leaks/breaks	$780,000	$17,145,000
Electrical Power Facilities	1	0	1	$11,375,000	$51,503,000

Communication Facilities	5	0	4	$46,000	$220,000
Highway Bridges	130	0	81	$3,359,000	$61,530,000
Railway Facilities	2	0	2	$712,000	$2,169,000
Airport Facilities	4	0	4	$2,569,000	$9,719,000
Total Losses				**$42,053,000**	**$256,373,000**

Table 9-4. Damage to Transportation and Utilities

Debris Removal

Table 9-5 shows how much debris would be generated by the earthquake and how many loads it would take to remove the debris, based on 25 tons per load. One truck can likely haul one load per hour. A second debris removal issue is landfill space. Fifty thousand tons at a weight-to-volume ratio of one ton per cubic yard would cover more than ten acres with a depth of three feet.

Category	**Davis M5.9**	**2500-yr M7.1**
Brick, Wood & Others	111,000 tons / 4,440 loads	758,000 tons / 30,320 loads
Concrete & Steel	197,000 tons / 7,880 loads	1,603,000 tons / 64,120 loads

Table 9-5. Debris Generated/Number of Loads

Fire Following

Multiple ignitions and broken water mains following an earthquake can make firefighting nearly impossible. HAZUS-MH uses estimated building damages, loss of transportation infrastructure and estimated winds to calculate the estimated area that would be burned following an earthquake. Table 9-6 provides estimates of ignitions, people at risk and the building stock exposed to fires following an earthquake.

Category	Number of Structures	
	Davis M5.9	**2500-yr M7.1**
Ignitions	11	12
Persons Exposed	261	447
Value Exposed	$13,663,000	$28,594,000

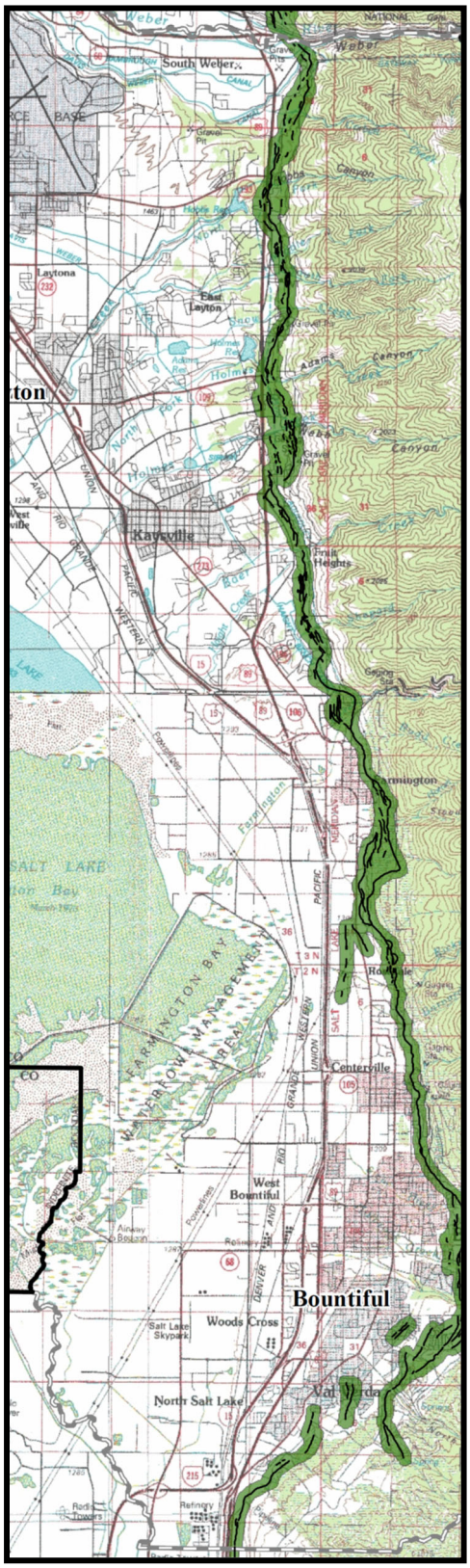
Table 9-6. Fire Following Event, Population Exposed, and Building Stock Exposed

Casualties

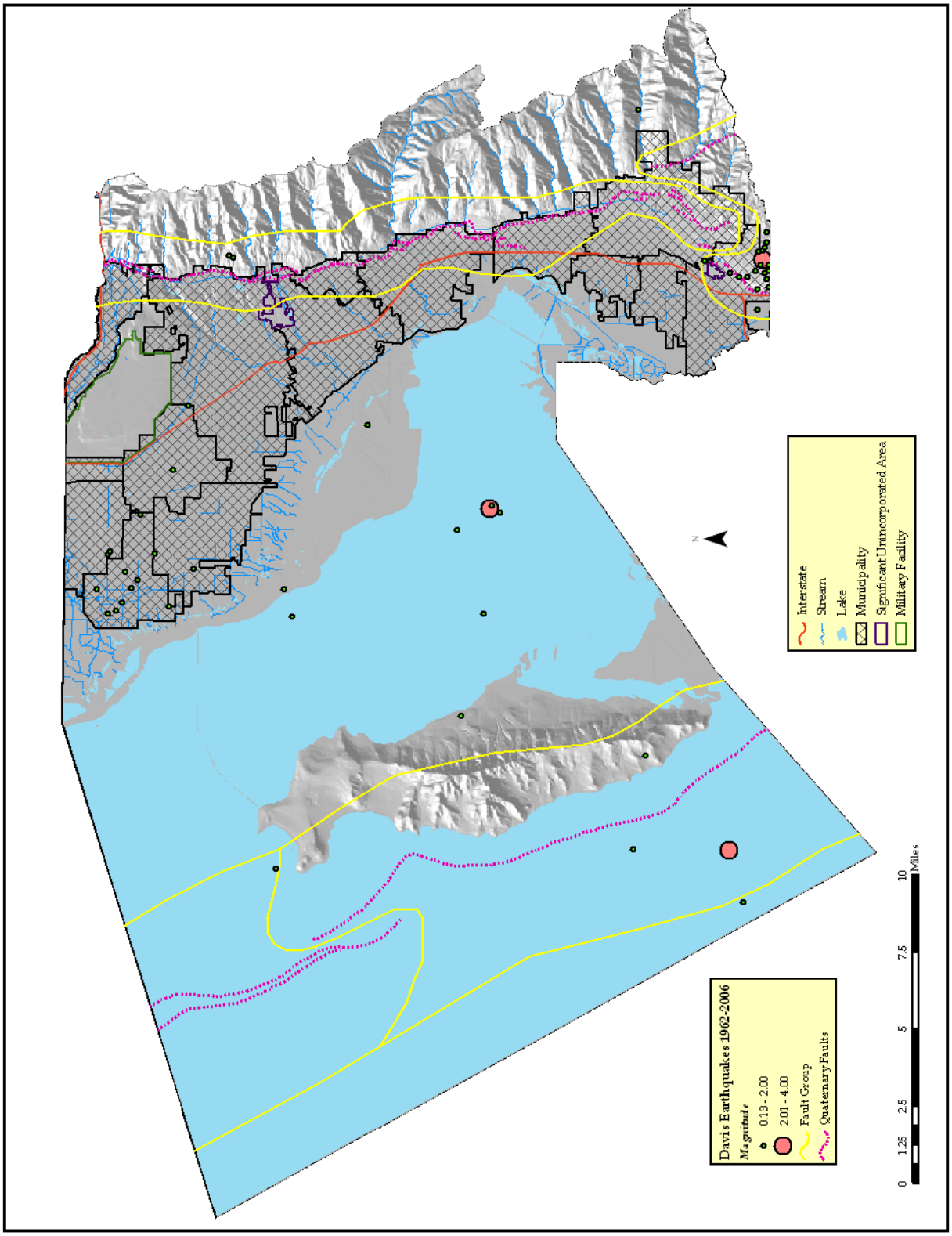
Table 9-7 estimates casualties likely to occur during each earthquake scenario. The nighttime scenario (2 a.m. local time) assumes a primarily residential concentration of persons, the daytime scenario (2 p.m. local time) a commercial concentration, and the commute scenario (5 pm. local time) a concentration of persons on commuting routes. Categories of casualties include those not requiring hospitalization (minor), those requiring treatment at a medical facility (major), and fatalities.

Night Event	Davis M5.9	2500-yr M7.1	Day Event	Davis M5.9	2500-yr M7.1	Commute Event	Davis M5.9	2500-yr M7.1
Minor	223	2,589	***Minor***	250	3,039	***Minor***	227	2,700
Major	46	792	***Major***	62	1,086	***Major***	59	924
Fatalities	9	186	***Fatalities***	14	302	***Fatalities***	13	243

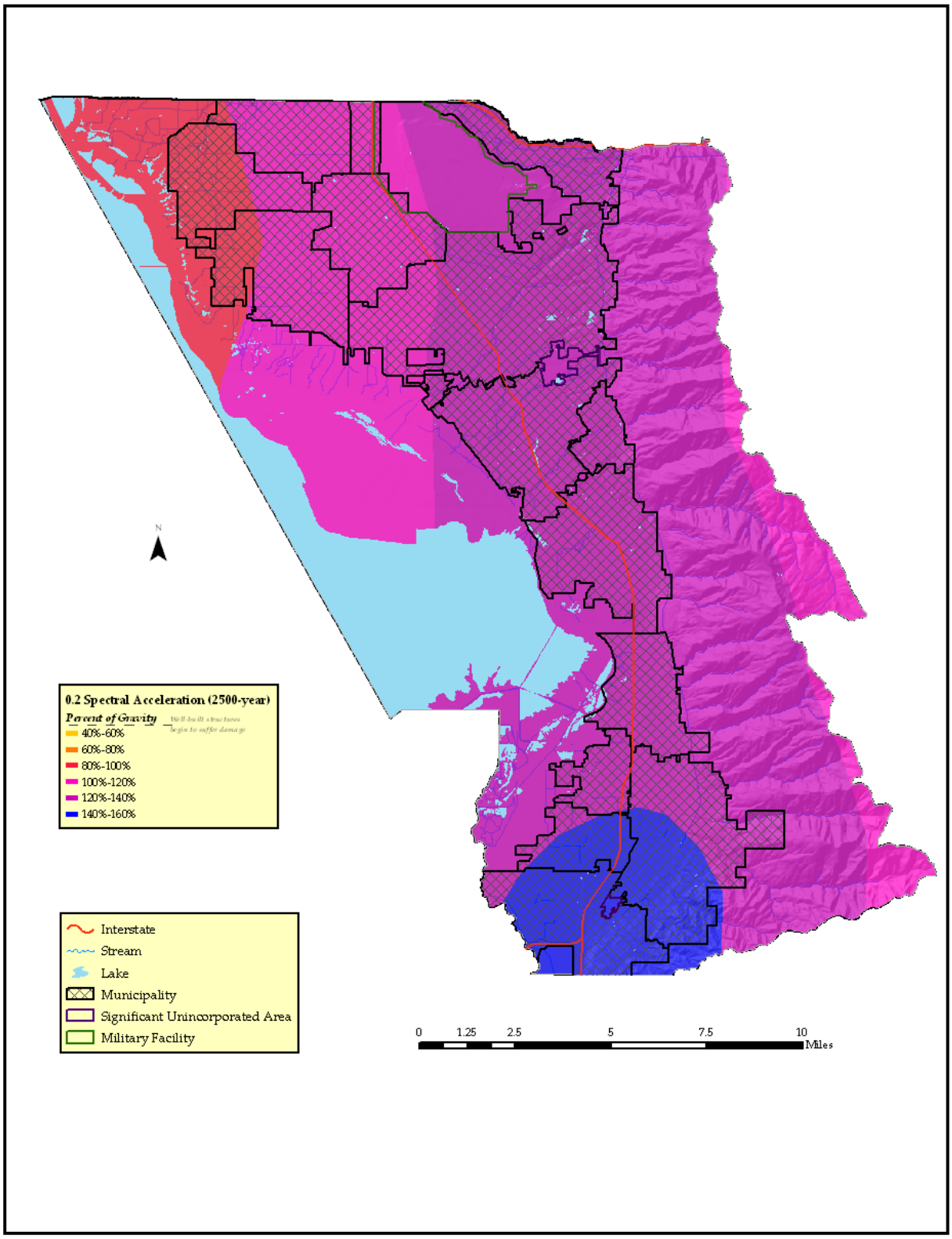
Table 9-7. Casualties



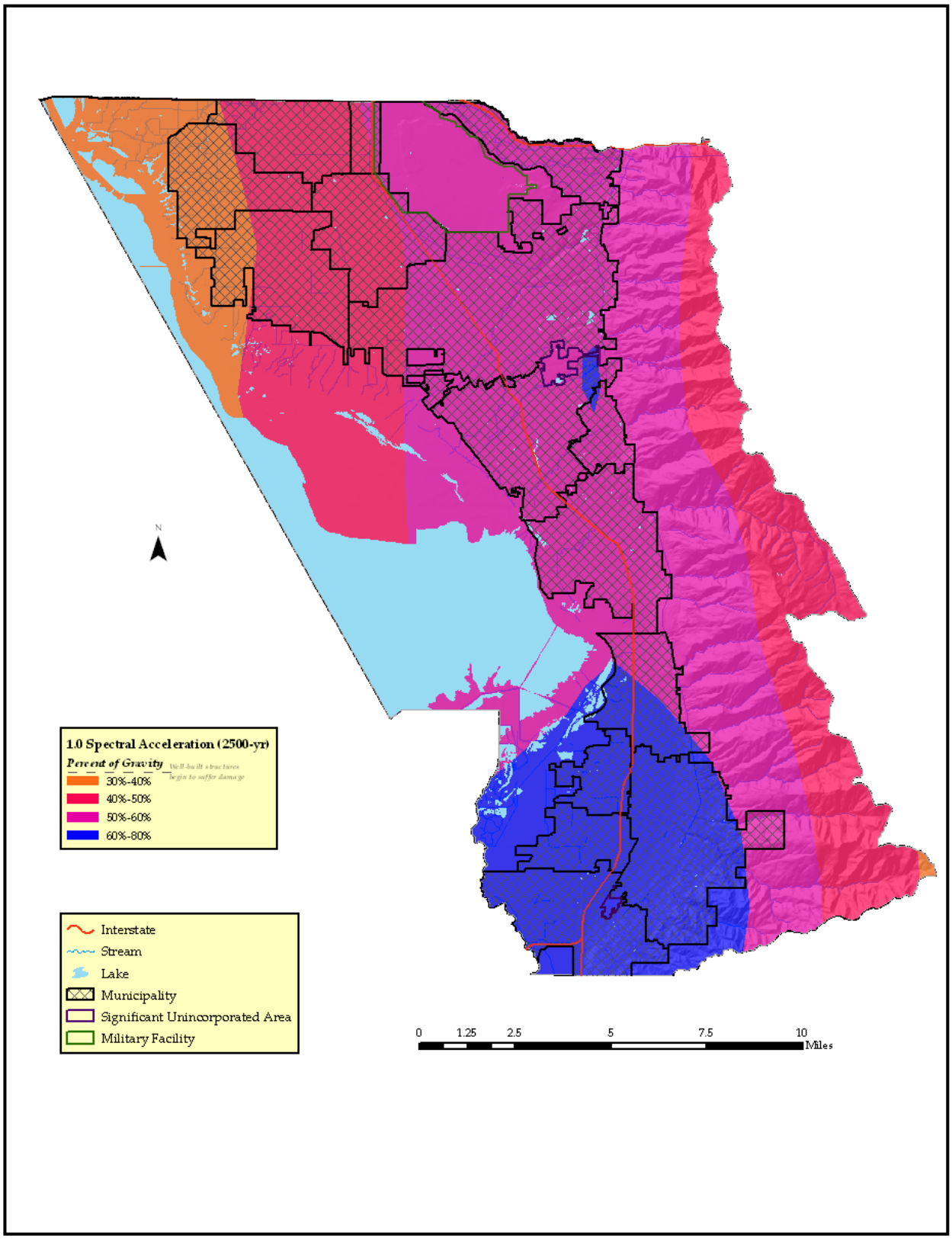
DAVIS COUNTY UTAH SURFACE FAULT RUPTURE
Compiled by Gary E. Christenson and Lucas M. Shaw
2008



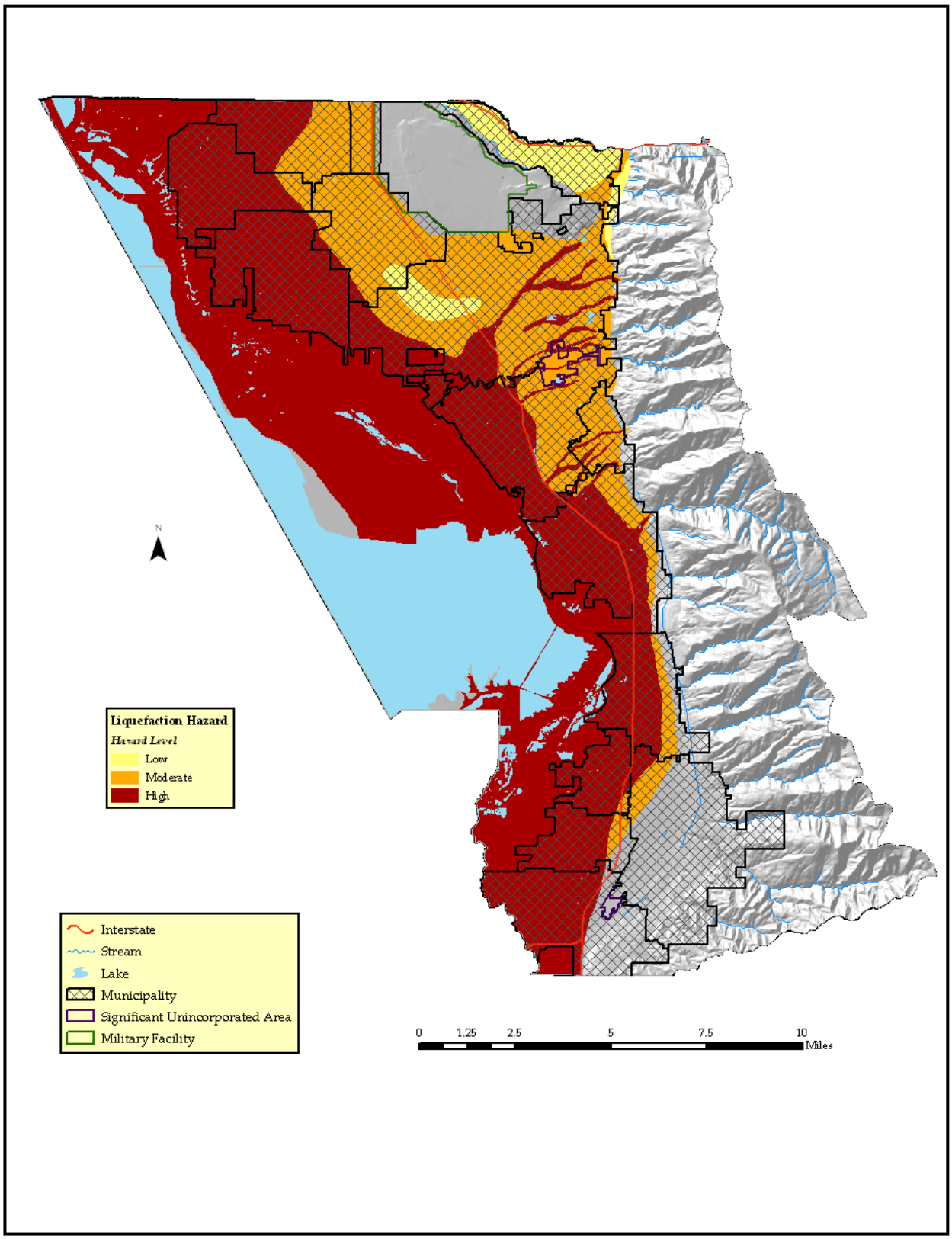
Historical Davis County Earthquake Epicenters, 1962-2006 (Source: UUSS)



0.2-Second Spectral Acceleration, Davis County (NSHMP 2002)



1.0-Second Spectral Acceleration, Davis County (NSHMP 2002)



Liquefaction Potential, Davis County (Christenson and Shaw 2008)

2. Flooding

Hazard Profile

Potential Magnitude		***Catastrophic (>50%)***	***Probability***		***Highly Likely***
	X	***Critical (25-50%)***			***Likely***
		Limited (10-25%)		***X***	***Possible***
		Negligible (< 10%)			***Unlikely***
Location	Weber River; many creeks along Wasatch Front				
Frequency	Spring, late summer				
Conditions	Cloudburst storms and heavy snowfall runoff				
Duration	Flooding can last anywhere from hours to days and even months				
Secondary Hazards	Raw sewage/health risk, electrical fires, gas spills				
Analysis Used	Review of FIS, FIRM, HAZUS-MH				

Description of Location and Extent

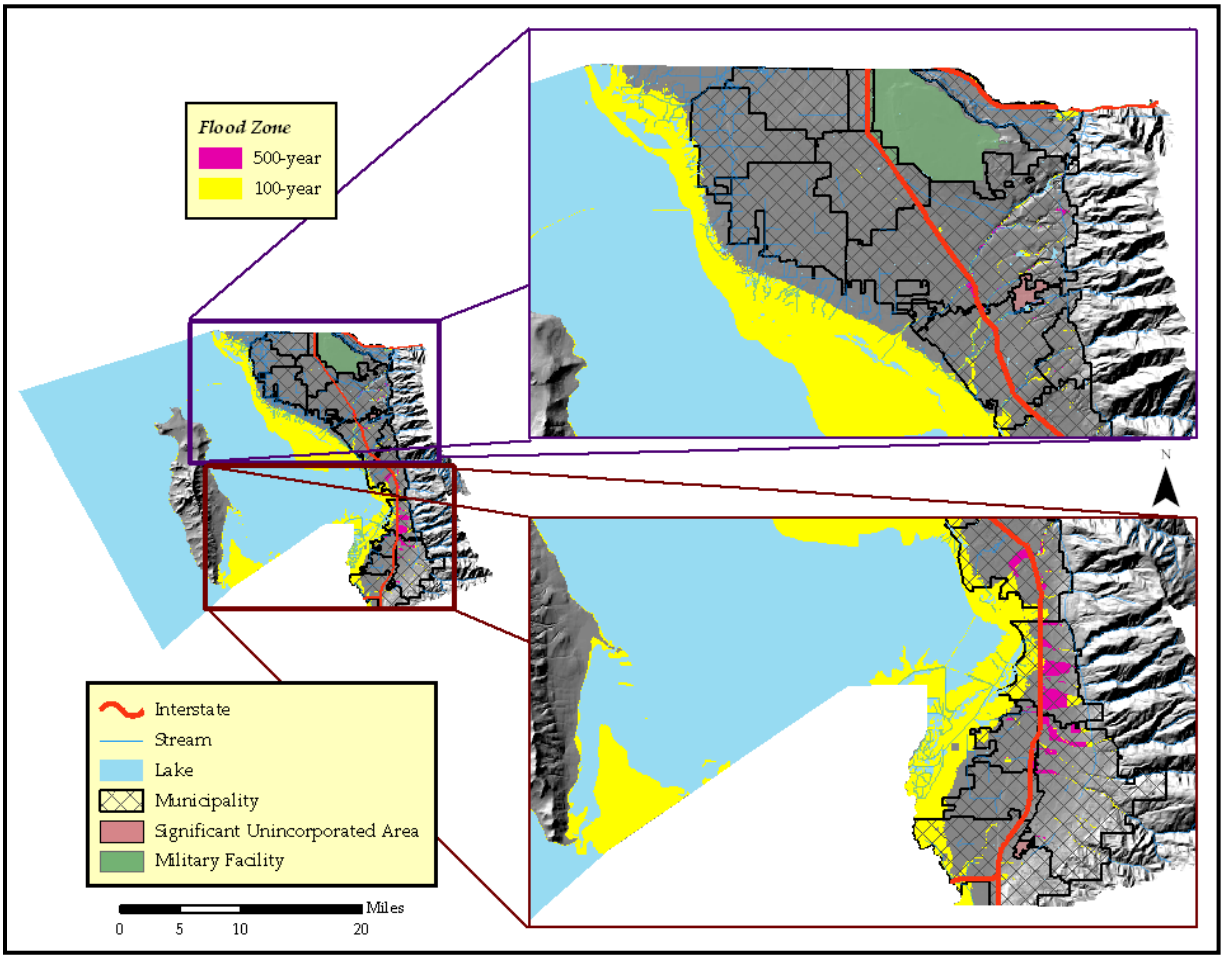
The greatest flood risk within Davis County has been associated with cloudburst storms that generally result in flash flooding in localized areas. Heavy rain and rapid snowpack melt can also result in unusually heavy water, and/or mud and debris flows. Davis County's precipitation is associated with the Wasatch Mountain Range, which is where most of the County's surface water originates. All of the streams originate in canyons and pass along alluvial fans, across the eastern portion of the County into the Great Salt Lake.

The major river that poses a flood threat is the Weber River. The Weber River flowing through South Weber, acts as a partial northern county boundary. Many small creeks flow out of the Wasatch Mountain Front in Layton, Kaysville, Kaysville, Centerville, Bountiful, and North Salt Lake. These streams have flooded in the past and also pose a future flood threat, many of which are mapped through the NFIP. Many channels within the county can pose a threat due to channel constrictions from debris and could result in residential flooding. All of the alluvial fans in the county have been developed or are being developed, and therefore, residential and commercial flooding is probable. Flood can also pose a threat to the agricultural lands that are in the lower portions of the alluvial fans.

A little more than 50% of Davis County is under the Great Salt Lake. This results in a very high ground water table in those areas near the lake, threatening shorelines and, in some cases, agricultural lands and roads. Flooding in wetlands areas, along the shores of the Great Salt Lake, also threatens urban development.

High stream flows and velocity can affect the residential, commercial and recreational development on Farmington Creek, Kays Creek, Ricks Creek and Steeds Creek. Roads can be affected from high stream flows on Barton Creek and Holmes Creek. Primary threatened utilities are power substations and water treatment plants located on Stone Creek, Farmington Creek, Holmes Creek and Millcreek.

In 1983, Rudd Creek experienced a debris flow that damaged several homes, roads and other infrastructure in Bountiful. Farmington Creek also flooded that year, damaging homes and also contaminating the city's water supply.



Map 9-6. 100-year and 500-year Flood Plains, Davis County (FIMA 2007)

Davis County Public Works has projected to spend over $50 million in flood control mitigation projects over the next few years. Much of that work will concentrate in existing creek beds throughout the County. The County spends over $1 million in yearly maintenance and new project costs.

Vulnerability Assessment

Assessing flood in Davis County was obtained from the modeling program Hazards United States – Multihazards (HAZUS-MH), for both 100-year (NFIP Zone A) and 500-year (NFIP Zone B or Zone X (shaded)) flood events. Analysis was completed using Flood Insurance Rate Maps (FIRM) or Digital Flood Insurance Rate Maps (DFIRM). Only streams which contained detailed flood cross-section data could be evaluated. Flooding from the Great Salt Lake was not included. Consequently, the results should be considered conservative. Total monetary losses include structures, contents and business interruption.

(*For a more detailed explanation of the loss estimation methodology of HAZUS-MH MR2, please see Part VI or the HAZUS-MH Technical Manual (Flood Model) at www.fema.gov/hazus).*

Number of Structures in Flood Plains				
	Acres Flooded	**Population Displaced**	***Residential Units*** **Total Losses**	***Commercial/Industrial Units*** **Total Losses**
100-year Flood	683	2,311	*245* **$37,810,000**	*3* **$18,370,000**
500-year Flood	1155	2,492	*266* **$43,430,000**	*3* **$23,210,000**
Table 9-8. Davis County Flood Hazard				

Agricultural Losses

Agricultural losses are listed in Table 9-9. Losses are computed according to the number of days in which the crops are inundated with water. All numbers are estimated for a flood occurring near April 15.

	100-year Losses Day 3	**100-year Losses Day 7**	**500-year Losses Day 3**	**500-year Losses Day 7**
Barley	$14,749	$19,665	$15,899	$21,198
Corn Silage	$151,723	$202,297	$163,549	$218,066
Table 9-9. Agricultural Losses, June 15 Scenario				

Vehicle Losses

Table 9-10 contains losses for vehicles in floods during both daytime and nighttime scenarios. The scenarios assume ninety percent (90%) of vehicles being removed from hazard areas due to warning.

Category	**100-year**	**500-year**
Daytime Scenario	$1,535,794	$1,603,936
Nighttime Scenario	$2,533,427	$2,751,553
Table 9-10. Vehicle Losses		

Debris Removal

Table 9-11 shows how much debris would be generated by flooding and how many loads it would take to remove the debris, based on a capacity of 25 tons per load. One truck can likely haul one load per hour. A second debris removal issue is landfill space. Fifty thousand tons at a weight-to-volume ratio of one ton per cubic yard would cover more than ten acres to a depth of three feet.

Category	100-year	500-year
Finishes	3,563 tons/143 loads	4,145 tons/166 loads
Structures	3,637 tons/146 loads	4,289 tons/ 172 loads
Foundations	3,771 tons/151 loads	4,461 tons/179 loads
Totals	**10,970 tons/440 loads**	**12,895 tons/517 loads**

Table 9-11. Debris Generation and Removal

3. Wildland Fire

Hazard Profile

Potential Magnitude		***Catastrophic (>50%)***	***Probability***	***X***	***Highly Likely***
	X	***Critical (25-50%)***			***Likely***
		Limited (10-25%)			***Possible***
		Negligible (< 10%)			***Unlikely***
Location	Wildland-Urban Interface (WUI) areas near the foothills and in forested areas in South Weber, Layton, Kaysville, Kaysville, Farmington, Centerville, Bountiful, and North Salt Lake				
Frequency	Summer months				
Conditions	Areas affected by drought and/or heavily overgrown dry brush and debris Common triggers: lightning and humans				
Duration	Days to months; depends on climate and fuel load as well as resources (financial, manpower) to extinguish the fire				
Secondary Hazards	Landslides, debris flows, erosion, traffic accidents, air pollution				
Analysis Used	Review of plans and data provided by US Forest Service, National Climatic Data Center, FEMA, AGRC, County Hazard Analysis Plans, and DEM				

Description of Location and Extent

Potential wildfire hazard within Davis County is growing as population growth is spreading into wildland areas known as the Wildland-Urban Interface (WUI) where the threat is most severe. Over the past 30 years, urban sprawl has encroached upon forested foothill areas and wildland areas.

The wildfire threat in Davis County has had a significant effect on watersheds, including landslide, debris flow, and other forms of erosion. Federal, state and local agencies have worked together to enforce ordinances and other programs such as re-vegetation zones to protect watersheds.

Wildland fire risk is found on Map 9-7, page 130. The map layers were provided by the Utah Division of Forestry, Fire and State Lands and show four categories of wildfire risk (Extreme, High, Medium and Low). These ratings cover all of Davis County and are based on the type and density of vegetation in each area as well as vulnerable populations. Additional factors that influence wildfires (weather conditions, wind speed and direction) are not considered in this risk assessment.

The entire County has a moderate or greater risk for wildfires. Municipalities primarily affected include the foothill communities of Bountiful, Centerville, Kaysville, Farmington, Kaysville, Layton, North Salt Lake, and South Weber. Antelope Island also has a considerable risk for experiencing a wildfire. Development has been advancing further and further into the WUI, with many of the most vulnerable homes some of the most costly to replace. Without effective fuel reduction measures and sufficient defensible space, these areas are likely to see considerable losses.

Vulnerability Assessment

Table 9-12 (below) estimates infrastructure vulnerable to wildland fire in Davis County. Provided are the number of units or total length of infrastructure vulnerable and the estimated replacement costs as provided by HAZUS-MH lost estimation software. Table 9-13 (page 129) estimates the total area, population, and buildings vulnerable to wildland fire for individual cities and unincorporated areas.

Item	Length (Miles) or Number of Units	Replacement Cost
Highways/Interstates	4.9 miles	$24,200,027
Highway Bridges	10 bridges	$15,469,072
Railway Segments	3.4 miles	$1,682,730
Railway Bridges	0 bridges	$0
Water Distribution Lines	N/A	N/A
Gas Lines	N/A	N/A
Sewer Lines	N/A	N/A
Total Estimated Infrastructure Replacement Cost		**$41,351,829**

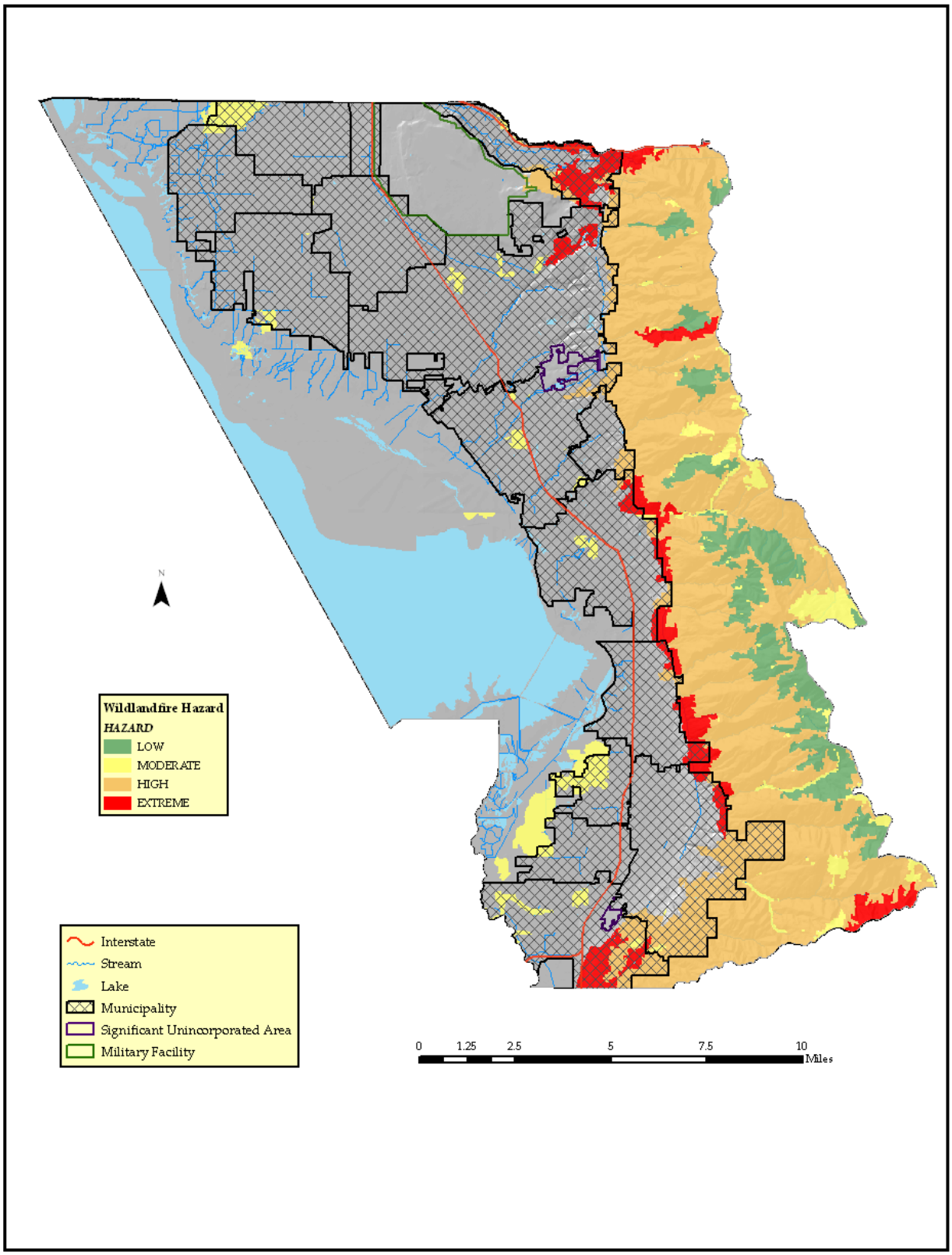
Table 9-12. Infrastructure Vulnerable to Wildland Fire, Davis County

Incorporated Areas	City Area (Acres)	Population in Hazard Area	Structures in Areas of Moderate or Greater Hazard	
			Residential **(Replacement Value)**	***Commercial*** **(Annual Sales)**
Bountiful	8,450	3,146	*1,538* **$341,889,000**	*163* **$136,290,000**
Centerville	3,808	277	*87* **$18,206,298**	*8* **$4,400,000**
Clearfield	4,897	0	0	0
Clinton	3,809	0	0	0
Farmington	6,356	680	*297* **$45,245,145**	*3* **$250,000**
Kaysville	1,465	126	*34* **$9,055,820**	*4* **$18,000,000**
Kaysville	6,615	215	*72* **$11,938,498**	*1* **$150,000**
Layton	14,036	1,726	*366* **$64,019,439**	*60* **$86,680,000**
North Salt Lake	5,474	3,750	*1,364* **$273,551,328**	*44* **$23,160,000**
South Weber	3,091	80	*25* **$2,343,726**	*7* **$60,000,000**
Sunset	930	0	*0*	0
Syracuse	5,833	0	0	0
West Bountiful	1,908	0	0	0

West Point	4,455	0	0	0
Woods Cross	2,432	0	0	0

Unincorporated Areas	**Area (Acres)**	**Population Affected**	**Structures in Areas of Moderate or Greater Hazard**	
			Residential **(Replacement Value)**	***Commercial*** **(Annual Sales)**
Hill AFB	6,919	0	0	0
Mutton Hollow	911	345	*108* **$19,249,600**	*0* **0**
Val Verda	259	459	*136* **$18,640,300**	*0* **0**

Table 9-13. Vulnerability Assessment for Wildland Fire, Davis County *(2006 socioeconomic values)*



Wildland Fire Risk, Davis County (UDFFSL 2007)

4. Slope Failure

Hazard Profile

Potential Magnitude		***Catastrophic (>50%)***	***Probability***		***Highly Likely***
	X	***Critical (25-50%)***		***X***	***Likely***
		Limited (10-25%)			***Possible***
		Negligible (< 10%)			***Unlikely***
Location	See Map 9-8. Generally occur in canyon mouths and foothill areas.				
Frequency	Spring and Summer; after heavy or long-duration precipitation				
Conditions	Usually caused by the stress release of over-weighted soils, shallow groundwater in certain soils, or loosening of rock and debris.				
Duration	Hours to years				
Secondary Hazards	Flooding (natural dams), traffic accidents				
Analysis Used	Information and maps provided by UGS, DEM				

Description of Location and Extent

Future landslide areas are usually located in the areas of historical landslides, which are well defined and localized. Landslides have been one of the most reoccurring hazards within Davis County along the canyon benches. The homes in these areas have the greatest vulnerability to rockfalls, debris flows, landslides and other types of slope failure. Map 9-8 (page 134) delineates areas of potential landslides for Davis County.

Recent landslides in Davis County include the Heather Drive landslide (2001) and the South Weber Drive landslides (2005 and 2006). Damages from the Heather Drive landslide have been estimated at over $1 million affecting homes and utilities (Elliot 2007). The South Weber Drive landslides each caused less than $50,000 in damages (HVRI 2007). There have been two significant road collapses on Farmington Canyon road over the past six years. In 2011, the road suffered a major failure due to a collapse of the land above. A significant section of the road, over a quarter mile in length was lost. The Forest Service redesigned and rebuilt the damaged road, however it remained closed for over a year. In the spring of 2015, heavy precipitation caused some large boulders to break loose above the roadway which had it blocked for several days.

There have been two significant slope failures in Davis County over the past six years. The Utah Geological Survey (UGS) has been monitoring conditions at the Springhill landslide in North Salt Lake, Davis County since 1998. In the late 1990s, residents in the Springhill area of North Salt Lake, Davis County began noticing cracking and other distress related to relatively minor movement of the landslide. By 1998, a house at 160 Springhill Drive that straddled the northern boundary of the landslide was severely damaged and condemned. Relatively severe distress also occurred to several houses along Valley View Drive (formerly 350 E) and Springhill Circle. Little movement or damage occurred during a dry period between 1999 and 2004, but the rate of movement accelerated during the 2005 wet year. Since 2005, the amount of movement each year has increased, except in 2007 and 2011-2012 (dry

years), resulting in an increased amount of damage and distress, particularly to houses in the upper and lower parts of the landslide and to Springhill Drive.

The Springhill landslide is about 720 feet long and about 290 feet wide where it is crossed by Springhill Drive. The local relief (change in elevation) is about 150 feet and the average slope of the landslide is approximately 21 percent (the ground rises 21 feet over a distance of 100 feet).
The depth of the landslide varies along its length. Along the north edge of Springhill Circle, the landslide is about 48 feet deep and likely deeper than 70 feet beneath Springhill Drive. The landslide is shallower along its southern edge, and in the head and toe.
On June 28, 2012, the City of North Salt Lake announced that they had been awarded an almost $2 million matching fund Federal Emergency Management Agency Pre-Disaster Mitigation Grant to buy and demolish 11 homes and turn the landslide site into an open-space park. The grant requires a local match of about $600,000. The city plans to apply for other grants, hold fundraisers, and use park funds to get the matching money.
Debris flows associated with ground saturation and runoff has been a major problem in Davis County. Many of the alluvial fans at the mouths of Davis County's fifteen canyons have been developed. This development is vulnerable due to the debris flows and flash flooding associated with the alluvial fans. Ten of the fifteen canyons have enforced structural mitigation through the use of debris and detention basins. The protected canyons include Barnard Creek, Barton Creek, Stone Creek, Parish Creek, Ricks Creek, Steed Creek, Farmington Creek, Shepherd Creek, Baer Canyon, and the South Fork of Holmes Creek with one debris basin each and Mill Creek which contains two debris basins. Unprotected canyons include Deuel Creek, Davis Creek, Snow Canyon, North, South, and Middle Forks of Kays Creeks.

Heather Drive Landslide, Layton (*Source: American Geological Institute*)

Many homes are built on alluvial fans and additional detention basins and/or an upgrade of existing basins is needed. Davis County and local jurisdictions recognize the need to protect alluvial fans from slope failure. Davis County has made progress in the past by becoming Utah's first Project Impact Community to help mitigate landslides through projects in the Centerville Canyon alluvial fan and Barnard Creek alluvial fan.

Vulnerability Assessment

Table 9-14 estimates infrastructure vulnerable to landslides in Davis County. Provided are the number of units or total length of infrastructure vulnerable and the estimated replacement costs as provided by HAZUS-MH lost estimation software. Table 8-15 estimates the total area, population, and buildings vulnerable to landslides for individual cities and unincorporated areas. Repair and/or replacement of the Davis Aqueduct and associated distribution network would increase the numbers below by an additional $100-200 million.

Item	Length (Miles) or Number of Units	Replacement Cost
Highways/Interstates	1.39 miles	$9,581,012
Highway Bridges	11 bridges	$17,140,206
Railway Segments	.26 miles	$295,634
Railway Bridges	0 bridges	$0
Water Distribution Lines	235.50 miles	$7,579,602
Gas Lines	94.14 miles	$3,031,846
Sewer Lines	141.42 miles	$4,547,764
Total Estimated Infrastructure Replacement Cost		$42,176,064

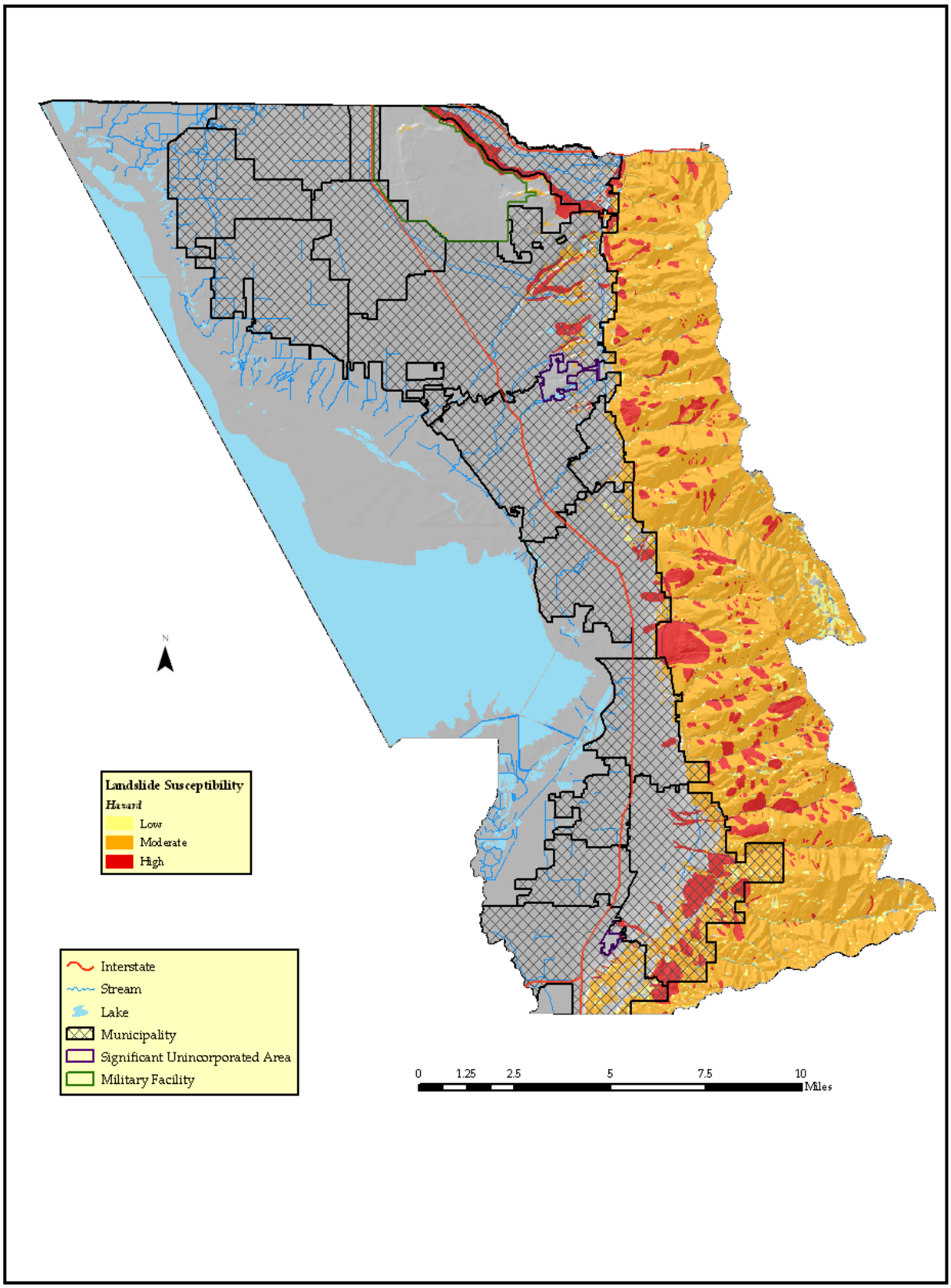
Table 9-14. Infrastructure Vulnerable to Landslides, Davis County

Incorporated Areas	Acres Affected	Population Affected	Structures in Areas of Moderate or Greater	
			Residential (Replacement Value)	Commercial (Annual Sales)
Bountiful	2,477	15,575	4,678 **$906,128,600**	248 **$7,963,830**
Centerville	327	3,600	738 **$152,509,600**	18 **$2,641,732**
Clearfield	0	0	0	0
Clinton	0	0	0	0
Farmington	723	4,752	1,011 **$195,830,700**	16 **$2,104,783**
Kaysville	247	1,669	422 **$81,741,400**	1 **$12,489**
Kaysville	131	1,282	340 **$65,858,000**	2 **$134,522**
Layton	1,518	7,792	2,199 **$425,946,300**	38 **$26,739,586**
North Salt Lake	1,018	4,287	1,362 **$263,819,400**	31 **$5,163,445**
South Weber	808	2,418	674 **$130,553,800**	9 **$1,786,389**
Sunset	0	0	0	0

Incorporated Areas	Acres Affected	Population Affected	Structures in Areas of Moderate or Greater	
			Residential (Replacement Value)	Commercial (Annual Sales)
Syracuse	0	0	0	0
West Bountiful	0	0	0	0
West Point	0	0	0	0
Woods Cross	0	0	0	0

Unincorporated Areas	Acres Affected	Population Affected	Structures in Areas of Moderate or Greater	
			Residential (Replacement Value)	Commercial (Annual Sales)
Hill AFB	115	0	0	0
Mutton Hollow	23	135	40 $7,748,000	0
Val Verda	2	34	12 $2,324,400	0

Vulnerability Assessment for Landslides, Davis County *(2006 socioeconomic values)*



Landslide Susceptibility, Davis County (Giraud and Shaw 2007)

5. Dam Failure

Hazard Profile

Potential Magnitude	***X***	***Catastrophic (>50%)***	***Probability***		***Highly Likely***
		Critical (25-50%)			***Likely***
		Limited (10-25%)		***X***	***Possible***
		Negligible (< 10%)			***Unlikely***
Location	See Map 9-9 (page 137)				
Frequency	*Rainy Day Failure:* Spring, late summer *Sunny Day Failure:* Anytime				
Conditions	*Rainy-day failure* happens mainly during heavy precipitation events, can have some warning time. *Sunny day failure* happens with no warning at all usually from sudden structural failure.				
Duration	Hours to days				
Secondary Hazards	Raw sewage/health risk, electrical fires, gas spills				
Analysis Used	Review of BOR inundation maps and plans, FIS, Utah Division of Water Rights				

Description of Location and Extent

Ninety dams and irrigation impoundments are located in Davis County. Twenty-six of these are listed as high hazard; meaning if they fail, they have a high probability of causing loss of life and extensive economic loss. Twenty-three dams have a moderate hazard threat; if they fail, they have a low probability of causing loss of life. Both threats would cause appreciable property damage. Mitigation efforts should be developed and pursued. Thirty-two dams have a low hazard threat, if they were to fail there would be a minimal threat to life and economic losses would be minor. Damage would be limited to the owner of the dam. However, they should still be monitored. No hazard rating is provided for nine dams. These dams have yet to be inspected. Table 9-16 is a list of all high and moderate hazard dams in Davis County.

The dam safety hazard is classified by the State Engineer. This classification is based upon the damage caused if the dam were to fail. The classification of a high hazard dam does not mean that the dam has a high probability of failure.

Vulnerability Assessment

Table 9-17 estimates infrastructure vulnerable to dam failure in Davis County. Provided are the number of units or total length of infrastructure vulnerable and the estimated replacement costs as provided by HAZUS-MH lost estimation software. Table 9-18 estimates the total area, population, and buildings vulnerable to dam failure for individual cities and unincorporated areas.

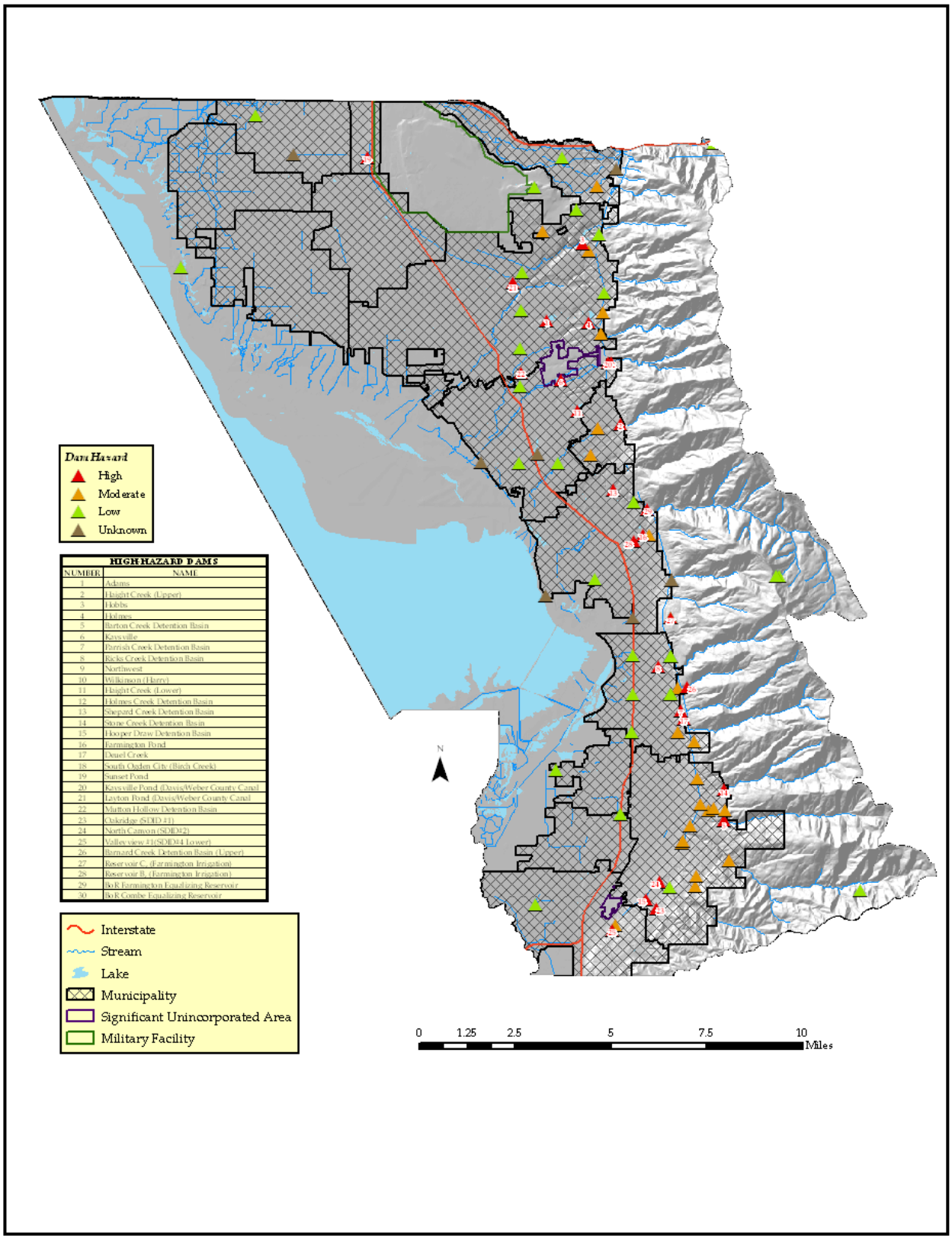
Name	Rating	Name	Rating
Adams	High	Valleyview #1(SDID#4 Lower)	High
BOR Farmington Equalizing Reservoir	High	BOR 1.9 Equalizing Reservoir	Moderate

Bountiful – North Canyon (SDID#2)	High	BOR 17.2 Equalizing Reservoir	Moderate
Bountiful – Oakridge (SDID #1)	High	BOR 17.8 Equalizing Reservoir	Moderate
Centerville – Barnard Creek (Lower) DB	High	BOR 18.0 Equalizing Reservoir	Moderate
Davis County – Barton Creek DB	High	BOR 18.0 Upper Equalizing Reservoir	Moderate
Davis County – Farmington Pond	High	BOR 18.5 Equalizing Reservoir	Moderate
Davis County – Holmes Creek DB	High	BOR 18.8 Equalizing Reservoir	Moderate
Davis County – Hooper Draw DB	High	BOR 18.9 Equalizing Reservoir	Moderate
Davis County – Mutton Hollow DB	High	BOR 19.5 Lower Equalizing Reservoir	Moderate
Davis County – Parrish Creek DB	High	BOR 19.5 Upper Equalizing Reservoir	Moderate
Davis County – Ricks Creek DB	High	BOR 2.6 Equalizing Reservoir	Moderate
Davis County – Shepherd Creek DB	High	BOR 4.3 Equalizing Reservoir	Moderate
Davis County – Stone Creek DB	High	BOR 5.0 Equalizing Reservoir	Moderate
Davis/Weber County Canal Co. –	High	Bountiful City – Eagle Ridge	Moderate
Davis/Weber County Canal Co. – Layton	High	Bountiful City – Millcreek DB #3	Moderate
Davis/Weber County Canal Co. – Sunset	High	Centerville City Erosion Dike	Moderate
Deuel Creek (Former BOR Regulating)	High	Centerville City – Deuel Creek DB	Moderate
Benchland Irrigation – Reservoir B	High	Davis County – Barnard Creek (Lower)	Moderate
Benchland Irrigation – Reservoir C	High	Farmington City – Rudd Creek DB	Moderate
Haights Creek (Lower)	High	Kaysville – Dry Hollow DB	Moderate
Haights Creek (Upper)	High	Haights Creek (Middle)	Moderate
Hobbs	High	Lower (Dennis)	Moderate
Holmes	High	Valleyview #2(SDID#3 Upper)	Moderate
Kaysville	High		

Table 9-16 High and Moderate Hazard Dams, Davis County (Utah Division of Water Rights 2007)

Item	Length (Miles) or Number of Units	Replacement Cost
Highways/Interstates	12.85 miles	$105,801,968
Highway Bridges	38 bridges	$71,093,046
Railway Segments	14.57 miles	$16,733,995
Railway Bridges	0 bridges	$0
Water Distribution Lines	N/A	N/A
Gas Lines	N/A	N/A
Sewer Lines	N/A	N/A
Total Estimated Infrastructure Replacement Cost		$193,629,009

TabTable 9-17. Infrastructure Vulnerable to Dam Failure, Davis County



Map 9-9. Dam Failure Hazard, Davis County (Utah Division of Water Rights 2007)

6. Problem Soils

Hazard Profile

Potential Magnitude			Probability		
		Catastrophic (>50%)			*Highly Likely*
		Critical (25-50%)			*Likely*
		Limited (10-25%)		*X*	*Possible*
	X	*Negligible (< 10%)*			*Unlikely*
Location	See Map 9-10 (page 139)				
Frequency	Continuous				
Conditions	Conditions vary by geologic formation				
Duration	Minutes to Years				
Secondary Hazards	Flooding (broken water pipes), fire (broken gas pipes)				
Analysis Used	Utah Geological Survey				

Description of Location and Extent

Problem soils are soils that present problems for buildings and other engineered structures. Three types of problems soils are present in Davis County – oolitic sands, limestone and peat bogs. Oolitic sands are found on the northwest shore of Antelope Island. Limestone karst structures are found in the Mueller Park area in the far southeastern portion of the county. Finally, peat bogs are found along the shores of the Great Salt Lake in Farmington Bay. All of these areas are thinly populated and pose little danger. See Map 9-10 for more information on the locations of problem soils in Davis County.

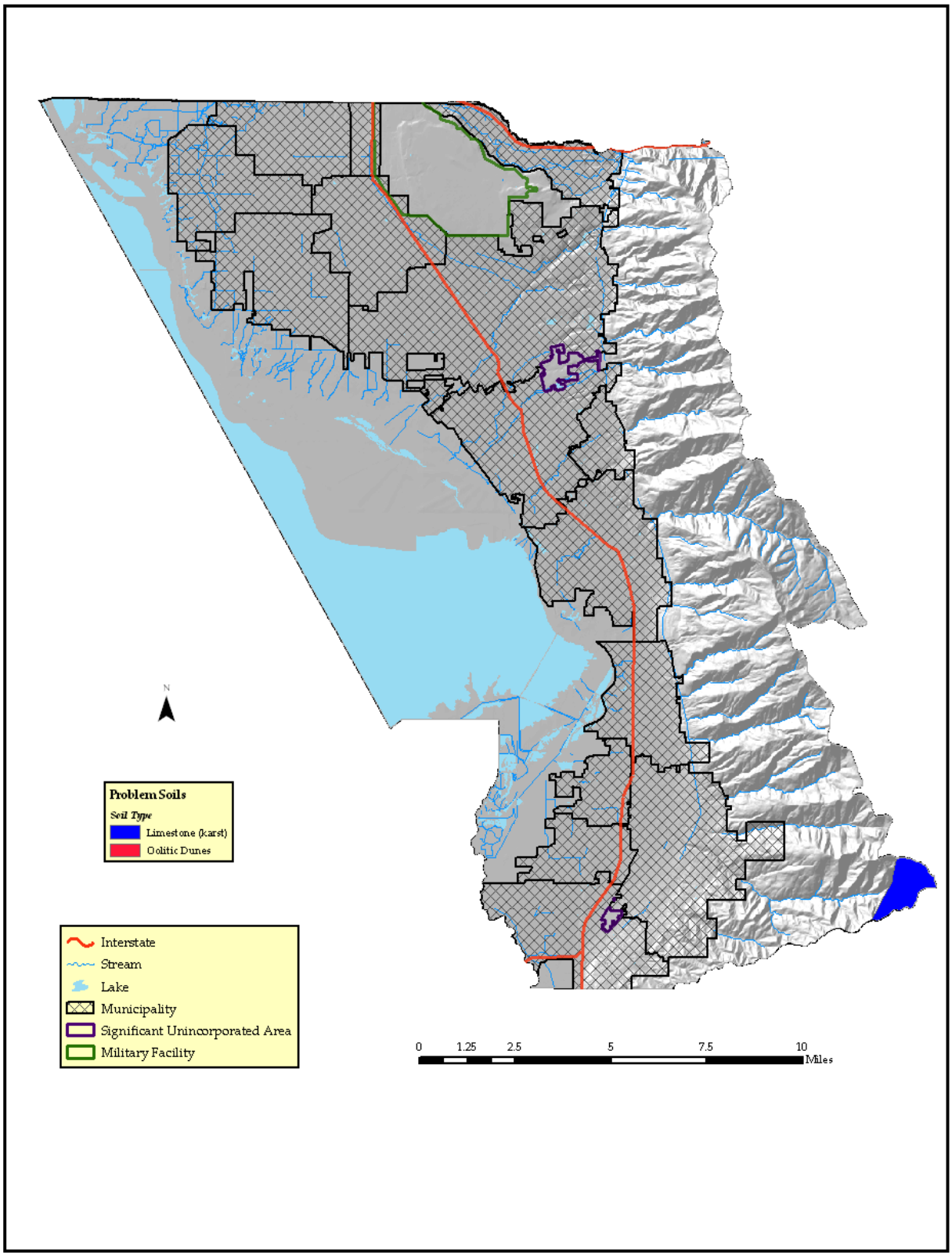
The oolitic sands on Antelope Island are on a public beach. Periods of flooding on the Great Salt Lake have eroded away much of the sands. The sands pose little threat to buildings, but can cover nearby roads at times.

Limestone karst structures are easily eroded by water and therefore often form caverns and crevices. If these caverns become large enough, the overlying ground can give way casing sink holes and other forms of subsidence. Structures directly over the karst structure have a high potential for collapse. Ground water contamination is also possible (Mulvey 1992). Fortunately, the karst structures in Davis County are located in remote areas.

Peat bogs are collections of dead and dying plants. Areas of this problem soil can experience subsidence and can be compressed easily (Mulvey 1992). Furthermore, these bogs can produce methane which is highly flammable.

Vulnerability Assessment

Problem soils were found not to affect any population or infrastructure in Davis County. Therefore, no significant vulnerability exists.



Problem Soils Susceptibility, Davis County (Mulvey 1992)

Population Estimates									
County	**2000 Pop (July 1)**	**2006 Pop (est.)**	**Absolute Change 2000-2006**	**% Change 2000-2006**	**AARC 2000-2006**	**Rank by 2000 Pop**	**Rank by Absolute Change**	**Rank by % Change**	**Rank by AARC**
Davis County	240,204	282,217	16,634	23.2%	3.5%	3	3	8	8
Population by County and Multi-County District									
MCD/ County	**1980**	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**AARC 2000-2050**
Wasatch Front	941,172	1,104,356	1,389,252	1,665,238	1,966,372	2,207,282	2,429,057	2,654,682	1.3%
Davis County	146,540	187,941	240,204	304,502	352,320	382,219	404,170	424,177	1.2%
Households by County and Multi-County District									
MCD/ County	**1980**	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**AARC 2000-2050**
Wasatch Front	298,700	357,257	446,844	565,333	679,589	780,369	870,671	960,756	1.5%
Davis County	39,994	53,643	71,201	97.801	117,172	130,248	139,178	146,811	1.5%

Table 9-18. Demographic and Economic Projections (UPEC 2007, 2008) All statistics are based on July 1 snapshot. AARC = Average Annual Rate of Change

Davis County's population will continue to grow in the eastern and southern portions of the county where new development is occurring because housing and land values are slightly lower than nearby Salt Lake County (refer to Table 9-18). The Wasatch Mountain Range and the Great Salt Lake restrain development in Davis County. Therefore, new development is located along the I-15 corridor and in the foothills. Other development is occurring where farmland and agricultural lands used to be.

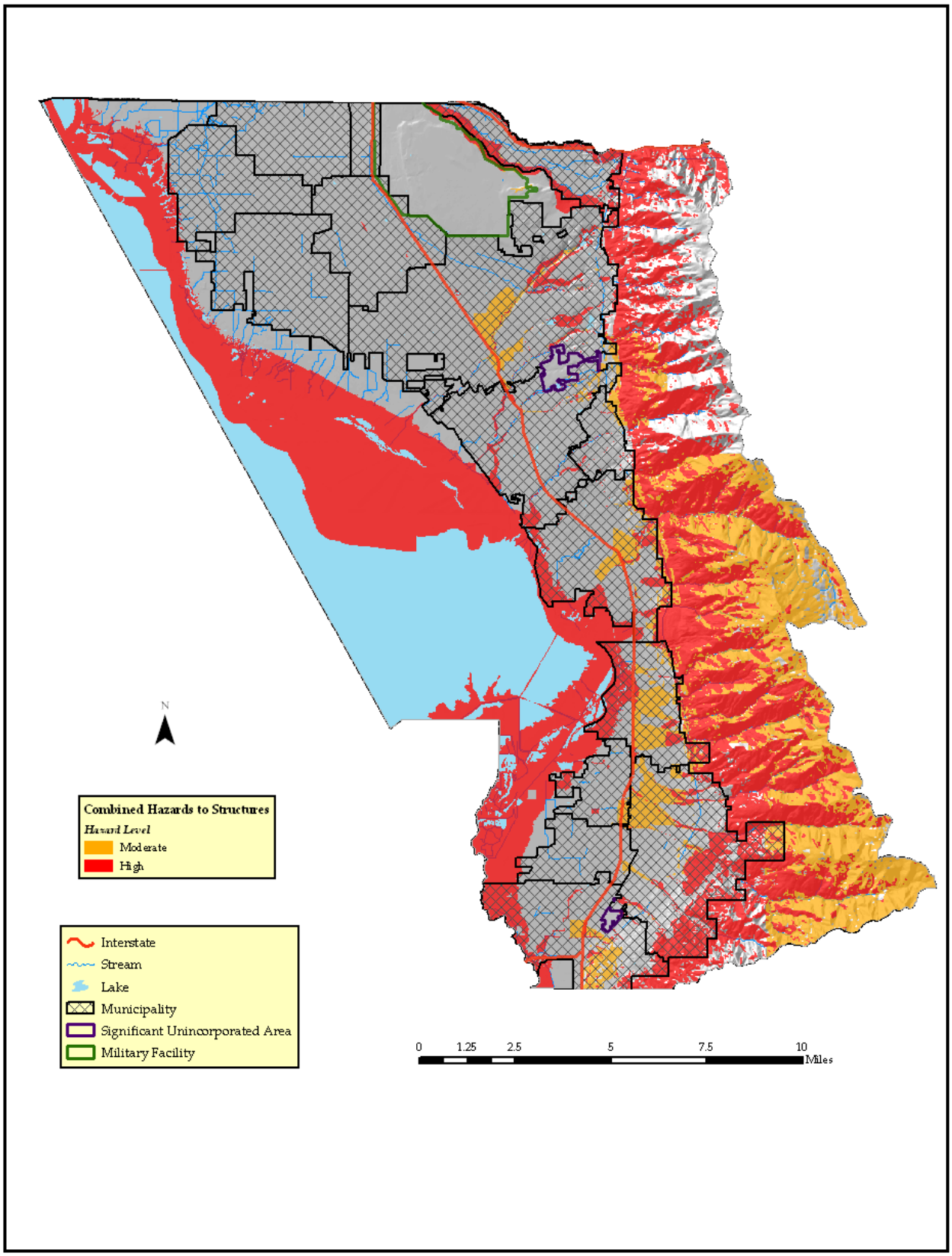
Those portions of the county that are near the Great Salt Lake are subject to high liquefaction in the event of an earthquake which poses a risk to incoming residents and new structures. One way for the county to mitigate the earthquake threat and its secondary risks is to continue to establish zoning ordinances and building codes that will recognize the threat and reduce it. Examples of more appropriate forms of land use along fault lines include "farms, golf courses, parks, and undeveloped open space" (UGS 1996).

Wildfire risk is most severe in the foothills of northern Davis County. These areas, known as WUI zones, are most vulnerable due to the amount and types of vegetation and new structures that act as fuel to a burning fire. Some ways to mitigate this threat are to encourage communities to become "Fire Wise Communities", continue to require building and zoning codes and increase the public's awareness.

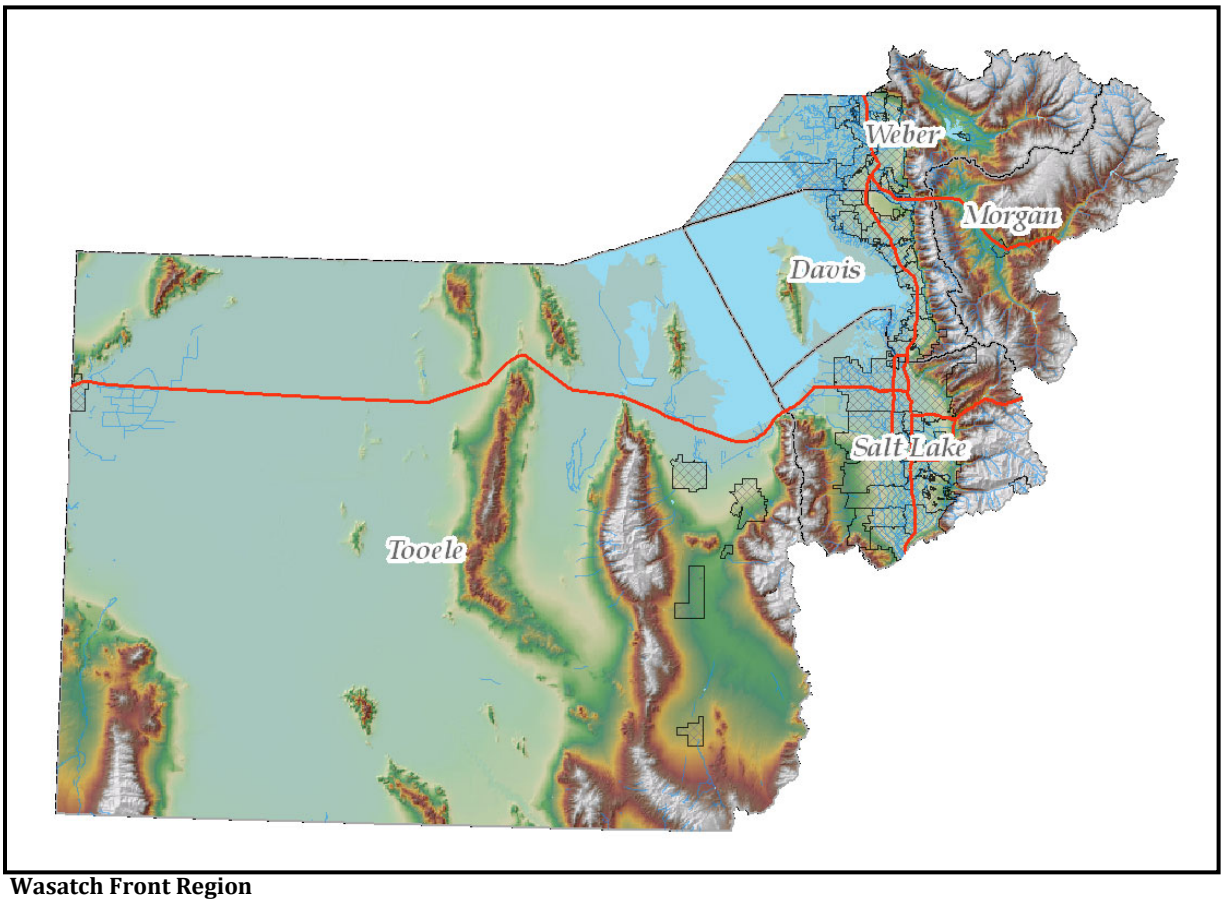
Landslide/slope failure is another threat near the foothills of the Wasatch Mountain Range. Much new development can be found near areas of current landslides. More detailed landslide studies and zoning appropriate for high hazard areas will decrease the likelihood of landslides damaging persons and property.

Flooding is of considerable concern along the Great Salt Lake and within alluvial fans along the foothills of the Wasatch Mountains. Much of the new development in Davis County is moving westward toward the lake and the 100-year floodplain. Zoning restrictions on building location and building codes that prevent basements would be well-suited in these areas.

Map 9-11 (page 142) shows the combined risk of nine structurally-threatening hazards (dam failure, earthquake, flood, landslide, lightning, problem soils, tornado, wildland fire and wind) in Davis County. The areas of high hazard (red) are areas of high landslide and flood risk as well as the “extreme” risk wildland fire areas. These areas are best preserved as open space to protect citizens from almost certain disasters. The moderate areas of the map (orange) are those areas having moderate or greater risk from five (5) or more structurally-threatening hazards. These areas should be preserved as open space if not already developed or hazard-appropriate development encouraged. If already developed, these areas should be the initial focus of education campaigns and for regulatory requirements of hazard mitigation techniques by residents.



Map 9-11. Combined Hazards to Structures, Davis County



Wasatch Front Region

Part X. Specialized Local Districts

Utah State Code, Annotated, Section 17B-1-102, defines Specialized Local Districts (SLD) as a local district that is a cemetery maintenance district, a drainage district, a fire protection district, an improvement district, an irrigation district, a metropolitan water district, a mosquito abatement district, a public transit district, a service area or a water conservancy district. An SLD is a body corporate with perpetual succession, a quasi-municipal corporation, and is a political subdivision of the state.

SLD's may be created to provide services consisting of: airport operations; cemetery operations; fire, paramedic, and emergency services; garbage collection and disposal; health care including health department or hospital service; library operations; abatement or control of mosquitoes and other insects; park or recreation facilities or services; sewage system operations; street lighting; construction and maintenance of curb, gutter and sidewalk; transportation, including public transit and providing streets and roads; water system operations, including the collection, storage, retention, control, conservation, treatment, supplying, distribution, or reclamation of water, including storm, flood, sewage, irrigation, and culinary water, whether the system is operated on a wholesale or retail level or both.

Because SLD's are defined as quasi-municipal, they may be eligible for FEMA disaster funding reimbursement under the Stafford Act. Most of the SLD's have jurisdictional boundaries within a specific county. Others, such as the Utah Transit Authority (UTA), have jurisdictional boundaries that include multiple counties.

Specialized local districts identified in Davis County are listed below. There may be others not identified here which will be included as they adopt this plan.

Weber Basin Water Conservancy District (serves Davis County)
2837 E Highway 193
Layton, UT 84040
(801) 771-1677

Utah Transit Authority (serves Davis County)
3600 S 700 W
Salt Lake City, UT 84119
(801) 262-5626

Davis School District
P.O. Box 588
Farmington, UT 84025
(801) 397-8400

Bountiful Water Sub-Conservancy District
385 W 500 S
Bountiful, UT 84010
(801) 295-5573

Central Davis Sewer District
2200 S Sunset Drive
Kaysville, UT 84037
(801) 451-2190

Clinton City Sanitary Sewer Special Service District
2267 N 1500 W
Clinton, UT 84015
(801) 614-0700

Davis and Weber Counties Canal Company
138 W 1300 N
Sunset, UT 84015
(801) 774-6373

Echo Creek Ranches Special Service District
670 N 900 E
Bountiful, UT 84010
(801) 298-7422

Benchland Water District
485 E Shepherd Lane
Kaysville, UT 84037
(801) 451-2105

Haights Creek Irrigation District
820 E 200 N
Kaysville, UT 84037
(801) 546-4242

Mutton Hollow Improvement District
1272 W 2700 S
Syracuse, UT 84075
(801) 614-0405

North Davis Fire District
381 N 3150 W
Clearfield, UT 84015
(801) 525-2850

North Davis Sewer District
4252 W 2200 S
Syracuse, UT 84075
(801) 825-0712

South Davis Metro Fire Agency
255 S 100 W
Bountiful, UT 84010
(801) 677-2400

South Davis Recreation District
550 N 200 W
Bountiful, UT 84010
(801) 298-6220

South Davis Sewer Improvement District
1800 W 1200 N
West Bountiful, UT 84087
(801) 295-3469

South Davis Water Improvement District
407 W 3100 S
Bountiful, UT 84010
(801) 295-4468

Specialized Local Districts (SLD) are subject to the same hazards as the local jurisdictions in which they are located. The following general mitigation objectives have been developed for SLD's.

Problem Identification: Infrastructure vulnerability – Special Local Districts

Objective: Assess the vulnerability of critical facilities owned outside Davis County that can impact service delivery inside the county.

Objective: Retrofit or replace critical lifeline facilities and or their backup facilities that are shown to be vulnerable to damage in natural disasters.

Objective: Conduct comprehensive programs to identify and mitigate problems with facility contents, architectural components, and equipment that will prevent critical buildings from being functional after major natural disasters.

Objective: Develop and maintain a system of interoperable communications for first responders from cities, counties, special service districts, local school districts, state and federal agencies.

Objective: Identify and undertake cost effective retrofit measures on critical facilities when these buildings undergo major renovations.

Objective: Engage in, support and or encourage research by others on measures to further strengthen transportation, water, sewer, and power systems so that they are less vulnerable to damage in natural disasters.

Objective: Encourage a higher priority for funding seismic retrofit of existing transportation and infrastructure systems, such at UTA.

Problem Identification: Vulnerability of critical educational facilities

Objectives: Retrofit or replace critical education facilities that are shown to be vulnerable to damage in natural disasters.

Objectives: Conduct comprehensive programs to identify and mitigate problems with facility contents, architectural components, and equipment that will prevent critical buildings from being functional after major natural disasters.

Objective: Identify and undertake cost effective retrofit measures on critical facilities when these buildings undergo major renovations.

Objective: Develop and maintain a system of interoperable communications for first responders from cities, counties, special service districts, local school districts, state and federal agencies.

Objective: As a secondary focus, assess the vulnerability of non-critical educational facilities to damage in natural disasters based on occupancy and structural type, make recommendations on priorities for structural improvements or occupancy reductions, and identify potential funding mechanisms.

Part XII. Plan Maintenance and Implementation

Monitoring, Evaluating and Updating the Plan

Periodic monitoring and updates of this Plan are required to ensure that the goals and objectives for the region are kept current and that local mitigation strategies are being carried out. This Plan has been designed to be user-friendly in terms of maintenance and implementation.

Annual Review Procedures

Local jurisdictions shall annually review this Plan, or as situations dictate such as following a disaster declaration. If the participating jurisdictions or DEM determines that a modification of the Plan is warranted, an amendment to the Plan may be initiated.

Revisions and Updates

Each county emergency manager will regularly monitor and annually review the Plan and is responsible to make revisions and updates. The annual review is required to ensure that the goals and objectives for the Region are kept current. More importantly, revisions may be necessary to ensure the Plan is in full compliance with Federal regulations and State statutes. 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.

Five Year Plan Review

The entire Plan including any background studies and analysis shall be revised and updated every five years to determine if there have been any significant changes in the region that would affect the Plan. Increased development, increased exposure to certain hazards, the development of new mitigation capabilities or techniques and changes to Federal or State legislation are examples of changes that may affect the condition of the Plan.

The Natural Hazard Pre-Disaster Mitigation Planning Committee and Local Working Group, with a potential membership representing every jurisdiction in Davis County, 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 DEM determine that the recommendations warrant modification to the Plan, an amendment may be initiated as described below.

Plan Amendments

The Utah DEM State Hazard Mitigation Officer, Local Mitigation Committee, or Mayor/City Manager of an affected community, will initiate amendments and updates to the Plan.

Upon initiation of an amendment to the Plan, DEM will forward information on the proposed amendment to all interested parties including, but not limited to, all affected city or county departments, residents and businesses. Depending on the magnitude of the amendment, the full planning committee may be reconstituted.

At a minimum, the information will be made available through public notice in a newspaper of general circulation or on the DEM website at dem.utah.gov. The review and comment period for the proposed Plan amendment will last for not less than 45 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. DEM will review the

proposed amendment along with comments received from other parties and submit a recommendation to FEMA within 60 days.

In determining whether 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; and/or
2. New issues or needs have been identified which were not adequately addressed in the Plan; and/or
3. There has been a change in information, data or assumptions from those on which the Plan was based.
4. The nature or magnitude of risks has changed.
5. There are implementation problems, such as technical, political, legal or coordination issues with other agencies.

Upon receiving the recommendation of DEM, a public hearing will be held. DEM will review the recommendation (including the factors listed above) and any oral or written comments received at the public hearing. Following that review, DEM 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 hearing.
4. Reject the amendment request.

Implementation through Existing Programs

Once the Plan is promulgated, participating cities and counties 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 Mitigation Plan, City Mitigation Plans. Many of the mitigation actions developed by the cities and counties have elements of mitigation implementation including the National Flood Insurance Program (NFIP), the Utah Wildland-Urban Interface Code, the Building Code Effectiveness Grading System (BCEGS), and Community Rating System (CRS), all of which have been implemented.

Process

It will be the responsibility of Mayor/Council/Commissioner(s) of each jurisdiction, as he/she/they see fit, to ensure these actions are carried out no later than the target dates unless reasonable circumstances prevent their implementation (i.e. lack of funding availability).

Funding Sources

Although all mitigation techniques will likely save money by avoiding losses, many projects are costly to implement. Davis County jurisdictions shall continue to seek outside funding assistance for mitigation projects in both the pre- and post-disaster environment. This portion of the Plan identifies the primary Federal and State grant programs for Davis County jurisdictions to consider, and also briefly discusses 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:

Title: Pre-Disaster Mitigation Program

Agency: Federal Emergency Management Agency

Through the Disaster Mitigation Act of 2000, Congress approved the creation of a national program to provide a funding mechanism that is not dependent on a Presidential Disaster Declaration. The Pre-Disaster Mitigation (PDM) program provides funding to states and communities for cost-effective hazard mitigation activities that complement a comprehensive mitigation program and reduce injuries, loss of life, and damage and destruction of property.

The funding is based upon a 75% Federal share and 25% non-Federal share. The non-Federal match can be fully in-kind or cash, or a combination. Special accommodations will be made for "small and impoverished communities", who will be eligible for 90% Federal share/10% non-Federal.

FEMA provides PDM grants to states that, in turn, can provide sub-grants to local governments for accomplishing the following eligible mitigation activities:

- State and local Natural Hazard Pre-Disaster Mitigation Planning
- Technical assistance (e.g. risk assessments, project development)
- Mitigation Projects
- Acquisition or relocation of vulnerable properties
- Hazard retrofits
- Minor structural hazard control or protection projects
- Community outreach and education (up to 10% of State allocation)

Title: Flood Mitigation Assistance Program

Agency: Federal Emergency Management Agency

FEMA's Flood Mitigation Assistance program (FMA) provides funding to assist states and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes and other structures insurable under the National Flood Insurance Program (NFIP). FMA was created as part of the National Flood Insurance Reform Act of 1994 (42 USC 4101) with the goal of reducing or eliminating claims under the NFIP.

FMA is a pre-disaster grant program, and is available to states on an annual basis. This funding is available for mitigation planning and implementation of mitigation measures only, and is based upon a 75% Federal share/25% non-Federal share. States administer the FMA program and are responsible for selecting projects for funding from the applications submitted by all communities within the state. The state then forwards selected applications to FEMA for an eligibility determination. Although individuals cannot apply directly for FMA funds, their local government may submit an application on their behalf.

Title: Hazard Mitigation Grant Program

Agency: Federal Emergency Management Agency

The Hazard Mitigation Grant Program (HMGP) was created in November 1988 through Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistant Act. The HMGP assists states and local communities in implementing long-term mitigation measures following a Presidential disaster declaration.

To meet these objectives, FEMA can fund up to 75% of the eligible costs of each project. The state or local cost-share match does not need to be cash; in-kind services or materials may also be used. With the passage of the Hazard Mitigation and Relocation Assistance Act of 1993, federal funding under the HMGP is now based on 15% of the federal funds spent on the Public and Individual Assistance programs (minus administrative expenses) for each disaster.

The HMGP can be used to fund projects to protect either public or private property, so long as the projects in question fit within the state and local governments overall mitigation strategy for the disaster area, and comply with program guidelines. Examples of projects that may be funded include the acquisition or relocation of structures from hazard-prone areas, the retrofitting of existing structures to protect them from future damages; and the development of state or local standards designed to protect buildings from future damages.

Eligibility for funding under the HMGP is limited to state and local governments, certain private nonprofit organizations or institutions that serve a public function, Indian tribes and authorized tribal organizations. These organizations must apply for HMPG project funding on behalf of their citizens. In

turn, applicants must work through their state, since the state is responsible for setting priorities for funding and administering the program.

Title: Public Assistance (Infrastructure) Program, Section 406
Agency: Federal Emergency Management Agency
FEMA's Public Assistance Program, through Section 406 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, provides funding to local governments following a Presidential Disaster Declaration for mitigation measures in conjunction with the repair of damaged public facilities and infrastructure.
The mitigation measures must be related to eligible disaster related damages and must directly reduce the potential for future, similar disaster damages to the eligible facility. These opportunities usually present themselves during the repair/replacement efforts.
Proposed projects must be approved by FEMA prior to funding. They will be evaluated for cost effectiveness, technical feasibility and compliance with statutory, regulatory and executive order requirements. In addition, the evaluation must ensure that the mitigation measures do not negatively impact a facility's operation or risk from another hazard.
Public facilities are operated by state and local governments, Indian tribes or authorized tribal organizations and include:

- Roads, bridges & culverts
- Draining & irrigation channels
- Schools, city halls & other buildings
- Water, power & sanitary systems
- Airports & parks

Private nonprofit organizations are groups that own or operate facilities that provide services otherwise performed by a government agency and include, but are not limited to the following:

- Universities and other schools
- Hospitals & clinics
- Volunteer fire & ambulance
- Power cooperatives & other utilities
- Custodial care & retirement facilities
- Museums & community centers

Title: Small Business Administration (SBA) Disaster Assistance Program
Agency: U.S. SBA
The SBA Disaster Assistance Program provides low-interest loans to businesses following a Presidential disaster declaration. The loans target businesses to repair or replace uninsured disaster damages to property owned by the business, including real estate, machinery and equipment, inventory and supplies. Businesses of any size are eligible, along with non-profit organizations.
SBA loans can be utilized by their recipients to incorporate mitigation techniques into the repair and restoration of their business.
Title: Community Development Block Grants
Agency: US Department of Housing and Urban Development

The Community Development Block Grant (CDBG) program provides grants to local governments for community and economic development projects that primarily benefit low- and moderate-income people. The CDBG program also provides grants for post-disaster hazard mitigation and recovery following a Presidential disaster declaration.
Funds can be used for activities such as acquisition, rehabilitation or reconstruction of damaged properties and facilities and for the redevelopment of disaster areas.

State Programs

Local

Local governments depend upon local property taxes as their primary source of revenue. These taxes are typically used to finance services that must be available and delivered on a routine and regular basis to the general public. If local budgets allow, these funds are used to match Federal or State grant programs when required for large-scale projects.

Non-Governmental

Another potential source of revenue for implementing local mitigation projects are monetary contributions from non-governmental organizations, such as private sector companies, churches, charities, community relief funds, the American Red Cross, hospitals, land trusts and other non-profit organizations.
Paramount to having a Plan deemed to be valid is its implementation. There is currently no new fiscal note attached to the implementation of this Plan.

Continued Public Involvement

Throughout the planning process, public involvement has been and will be critical to the development of the Plan and its updates. The Plan will be available on the Davis County and Utah DEM website's to provide opportunities for public participation and comment.
The Davis County Sheriff's Office has been designated as the lead agency in preparing and submitting the Davis County Natural Hazards Pre-Disaster Mitigation Plan, which includes coverage for all incorporated cities and unincorporated county. The strategy of the county in preparing the Plan is to use available resources and manpower in the most efficient and cost effective manner to allow cities continued access to data, technical planning assistance and FEMA eligibility. In addition, the county will reach out to non-profits, public agencies, special needs organizations, groups and individuals in allowing them input and access to the Plan. With limited resources, however, it becomes difficult to both identify and to individually contact the broad range of potential clients that may stand to benefit from the Plan. This being the case, we have established the following course of action:
STEP 1. The county will publicly advertise all hearings, requests for input and meetings directly related to the Natural Hazard Pre-Disaster Mitigation Planning process. Davis County meetings where Plan items are discussed and where actions are taken will not receive special notifications as they are already advertised according to set standards. All interested parties are welcome and invited to attend such meetings and hearings, as they are public and open to all.

Advertisement will be done according to the pattern set in previous years, i.e. the county will advertise each hearing and request for input at least 7 days in advance of the activity and will publish notices of

the event local newspapers. The notices will advertise both the hearing and the means of providing input outside the hearing if an interested person is unable to attend.

STEP 2. Davis County has established a mailing list of many local agencies and individuals that may have an interest in the Natural Hazard Pre-Disaster Mitigation Plan. Each identified agency or person will be mailed a notice of the hearings and open houses.

STEP 3. Comments, both oral and written, will be solicited and accepted from any interested party. Comments, as far as possible, will be included in the final draft of the Plan; however, the county reserves the right to limit comments that are excessively long due to the size of the Plan.

STEP 4. Specific to risk assessment and hazard mitigation, needs analysis, and capital investment strategies, the county will make initial contact and solicitation for input from each incorporated jurisdiction within the region. All input is voluntary. Staff time and resources do not allow personal contact with other agencies or groups, however, comments and strategies are welcomed as input to the planning process from any party via regular mail, fax, e-mail, phone call, etc. In addition, every public jurisdiction advertises and conducts public hearings on their planning, budget, etc. where most of these mitigation projects are initiated. Input can be received from these prime sources by the region as well.

STEP 5. The following policies will guide county staff in making access and input to the Natural Hazard Pre-Disaster Mitigation Plan as open and convenient as possible:

A. Participation

All citizens of the region are encouraged to participate in the planning process, especially those who may reside within identified hazard areas. The county will take whatever actions possible to accommodate special needs of individuals including the impaired, non-English speaking, persons of limited mobility, etc.

B. Access to Meetings

Adequate and timely notification to all area residents will be given as outlined above to all hearings, forums, and meetings.

C. Access to Information

Citizens, public jurisdictions, agencies and other interested parties will have the opportunity to receive information and submit comments on any aspect of the Natural Hazards Pre-Disaster Mitigation Plan, and/or any other documents prepared for distribution by the county that may be adopted as part of the Plan by reference. The county may charge a nominal fee for printing of documents that are longer than three pages.

D. Technical Assistance

Residents as well as local jurisdictions may request assistance in accessing the program and interpretation of mitigation projects. County staff will assist to the extent practical, however, limited staff time and resources may prohibit staff from giving all the assistance requested. The County will be the sole determiner of the amount of assistance given all requests.

E. Public Hearings

The county will plan and conduct public hearings according to the following priorities:

1. Hearings will be conveniently timed for people who might benefit most from mitigation programs.
2. Hearings will be accessible to people with disabilities (accommodations must be requested in advance according to previously established policy).
3. Hearings will be adequately publicized. Hearings may be held for a number of purposes or functions including: identify and profile hazards, develop mitigation strategies, review plan goals, performance and future plans.

F. Future Revisions:

Future revisions of the Plan shall include:

1. Expanded vulnerability assessments to include flood and dam failure inundation.
2. Continue the search for more specific mitigation actions.
3. An analysis of progress of the Plan as it is revised.
4. Expanded look into how the identified natural hazards will affect certain populations including the young and elderly.

Appendix A. Environmental Considerations

Natural disasters are naturally occurring phenomena. They play an integral part in maintaining balance in our world. Meteorological, geological, or hydrological processes have shaped Utah for millions of years and will continue to shape the valley for millions more. These unique phenomena only cause disasters when they affect humans and their structure. Modern engineering has made it possible to prevent damage from natural hazards. However, the economic and environmental costs can be rather high. Tampering with natural systems can also create an imbalance in the natural environment. The effects of many of these imbalances are still unknown. It is better to live with a small amount of risk, respecting natural processes where appropriate, than to construct mitigation at every chance. Nature provides its own mitigation and measures the need to be identified, protected and/or strengthened. To ensure that our environment is not harmed through mitigation measures, all applicable city/county ordinances and state/federal laws pertaining to the environment must be followed. The majority of the proposed mitigation programs in this Plan will be funded through federal programs, and thus tied to federal funding.

"44 CFR 10.8(d)(2)(iii) excludes this rule from the preparation of an environmental assessment or environmental impact statement, where the rule relates to actions that qualify for categorical exclusions under 44 CFR 10.8(d)(2)(iii), such as the development of plans under this section" (United States 2002).

The following acts will be taken into consideration and will be incorporated when needed while organizing and implementing the PDM Plan: Clean Air Act, Clean Water Act, Endangered Species Act, Floodplain Management, National Historic Preservation Act.

Clean Air Act (CAA) 1970: *The Clean Air Act is the comprehensive Federal Law that covers the entire country under the Environmental Policy Act 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 and the emissions of air pollutants. These limits ensure that all Americans have the same basic health and environmental protections. Maximum pollutant standards were set, though states may have stronger pollution controls than the national standards. 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 the Environmental Protection Agency (EPA). The 1977 amendment 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 toxins. This act required facilities with large amounts of certain hazardous chemicals to have a special emergency planning requirement. Based on a facilities potential threat or risk from chemical spills, fires, explosions, etc., facilities prepare a Risk Management Plan (RMP) 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 (United States 1970).*

Clean Water Act (CWA): *The Federal Water Pollution Control Act Amendments of 1972 came about because of the growing awareness for the need to control 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 EPA the authority to set wastewater standards for industry. The act also requires 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 through construction grant programs from the EPA and recognized the need for planning for future threats from nonpoint source pollution. (United States 1977a)*

Clean Water Act, Section 404 – Wetland Preservation: *This section regulates activities in wetland areas and authorizes the EPA to restrict or prohibit the use of an area as a disposal site for dredged or fill material if the discharge will have adverse effects on municipal water supplies, shellfish beds and fishery areas, wildlife or recreational areas. A permit must be issued that is based on regulatory guidelines developed in conjunction with the U.S. Army Corps of Engineers and the EPA. (United States 1977a)*

Endangered Species Act of 1973: *This act provides a plan for the protection of threatened or endangered plants and animals and the habitats in which they are found. Congress declared 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 as a result 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 by 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 connection with conservation of endangered species (United States 1973).*

Floodplain Management Policy: *The main points of this 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 provides the most benefit to society. Activities will pursue and encourage the appropriate use of floodplains, avoid long and short term negative impacts associated with the development and modification of floodplains, and avoid direct and indirect support of floodplain development whenever there is a practicable alternative. "Functions of floodplains include natural moderation of floods; fish, wildlife, and plant resources and habitat; groundwater recharge; and water quality maintenance. Uses of floodplains include 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." (United States 1977b).*

National Historic Preservation Act of 1966 (NHPA): *This act was enacted 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 in order to give a sense of orientation to the American people." Another main point of the act mandates 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 uses measures that will foster conditions in which historic resources can exist in productive harmony with present and future generations (United States 2000).*

Section 106 of NHPA "requires all Federal agencies to take into account the effects of their actions on historic properties, and provide 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 (United States 2000).

Appendix B. General Mitigation Strategies

For the purpose of this mitigation Plan, mitigation strategies will be divided into one of five categories according to how they accomplish mitigation. The six categories include:

- Emergency Services
- Natural Resource Protection
- Prevention
- Property Protection
- Public Information and Involvement
- Structural Protection

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

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

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

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 or 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 financial loss minimization actions
- Technical evaluations and mapping

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

Structural Protection/Projects: These 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

1. 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 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 a number of means such as sirens, radio, television, mobile public address system, emergency notification system, 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. An example of flood response is the turning Salt Lake City's State Street into a river during the 1983 flood event. Many of the below actions should be part of an Emergency Operations 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
- Protective actions for children in schools
- 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 when 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:

- 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
- Vaccinating 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 large 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 Measures

Planning and Zoning: Land use plans are put in place to guide future development, recommending where development should or should not take place. Sensitive and vulnerable lands can be designated for uses that would be compatible with occasional flood events. 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 all new 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. Most large 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; grading and filling should also be regulated.

D. Property Protection

Relocation: Moving structures out of the floodplain is 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: Elevation of 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 be brought in to elevate the site on which the building sits.

Insurance: Above and beyond standard homeowners 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 financial loss/risk to 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 is able to 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 owners handbook tailored for local conditions
- Presentations at public meetings and neighborhood groups

Real Estate Disclosure: Disclosure of information regarding flood or hazard prone properties is important if potential buyers are to be in a position to mitigate damage. Federally regulated lending institutions are required to advise applicants 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 of the flood hazard areas. These maps can be used by anyone interested in a particular property to determine if it is in the floodplain. These maps are available from FEMA, the Utah Division of Emergency Management (DEM), 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 sale 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 may be 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 measures, levees and floodwalls are earthen, 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. Diversion 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.

2. Earthquakes
Generic Mitigation

Below 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
- Densify 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 an important 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 faculty 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 don't affect the overall look or purpose of the building yet prevent damage to no structural aspects and reduce 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: Retrofitting upgrades the seismic safety of a building through structural and nonstructural mitigation techniques.
Insurance: Above and beyond standard homeowners 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 financial loss/risk onto another party.

E. Public Information and Involvement

Public information and involvement for earthquakes is similar to 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 are in a position to mitigate damage. Unlike floodplains there are no federal laws, which require disclosure of earthquakes.

F. Structural Protection/Projects

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.

3. Dam Failure

Generic Mitigation

- Proper floodplain maps, including dam breach flood potential
- Public knowledge of floodplains for the general 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 help with snowmelt floods/runoff- releases, better forecasting
- 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

B. 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/Projects

- 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

4. 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 WUI fires before they occur
- Good visibility

E. Public Information and Involvement

- Educating homeowners and future homeowners about risk
- Planning how to deal with WUI 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/Projects

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

5. 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: irregular or subdued hill-like topography
  - Younger or more recently occurring landslides: 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: 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/Projects

- 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

6. 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/Projects

- Strengthen un-reinforced masonry

7. Problem Soils

Generic Problem Soil Mitigation

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

A. Emergency Service

B. Natural Resource Protection

- Soil awareness

C. Prevention

- Landscaping with vegetation that does not concentrate or draw large 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 large 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

8. 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

Appendix C. Hazard Histories

Davis County

	Injuries	% of Total Injuries	Fatalities	% of Total Fatalities	Property Damage	% of Total Property	Crop Damage	% of Total Crop Damage
Avalanche	1.63	2.3%	**1.25**	**22.8%**	$0	0.0%	$0	0.0%
Extreme Cold	0.17	0.2%	0.03	0.5%	$537,791	2.0%	**$1,457,399**	**20.8%**
Flooding	0.24	0.3%	**0.68**	**12.4%**	**$4,901,262**	**17.9%**	**$4,901,262**	**69.9%**
Fog	**13.80**	**19.2%**	0.40	7.3%	$159,947	0.6%	$0	0.0%
Hail	**6.07**	**8.4%**	0.02	0.4%	$444,374	1.6%	$189,368	2.7%
Heavy Snow	**38.69**	**53.8%**	**2.32**	**42.3%**	**$5,169,331**	**18.9%**	$64,299	0.9%
Ice	5.00	7.0%	0.00	0.0%	$101,575	0.4%	$0	0.0%
Landslide	0.00	0.0%	0.17	3.0%	$82,029	0.3%	$0	0.0%
Lightning	0.24	0.3%	0.02	0.4%	$446,492	1.6%	$690	0.0%
Tornado	0.00	0.0%	0.00	0.0%	$199,629	0.7%	$2,994	0.0%
Wind	**6.04**	**8.4%**	0.60	2.5%	**$15,269,889**	**55.9%**	**$398,328**	**5.7%**
TOTAL	71.87	100.0%	5.49	91.5%	$27,312,318	100.0%	$7,014,340	100.0%

Table C-1. Major Disaster Statistics 1962-2005, Davis County (2005 dollars) (HVRI 2007)

	Injuries	% of Total Injuries	Fatalities	% of Total Fatalities	Property Damage	% of Total Property Damage	Crop Damage	% of Total Crop Damage
1960s*	1.9	3%	0.07	1%	$2,111,058	7%	$114,743	2%
1970s	**15.7**	**21%**	**1.12**	**20%**	$3,415,339	12%	**$1,920,583**	**27%**
1980s	0.0	0%	0.57	10%	**$8,080,463**	**29%**	**$4,668,534**	**67%**
1990s	**38.2**	**51%**	**3.09**	**56%**	**$13,170,387**	**47%**	$224,746	3%
2000s*	**19.0**	**25%**	0.64	12%	$1,497,915	5%	$85,734	1%
TOTAL	74.8	100%	5.49	100%	$28,275,161	100%	$7,014,340	100%

Major Disaster Decadal Statistics 1962-2005 (2005 dollars) *Note: Not entire decade (HVRI 2007)

	Number of Events	Events Per Year	Injuries Per Event	Fatalities Per Event	Property Damage Per Event	Crop Damage Per Event	Total Damages Per Event	Total Annualized Losses
Avalanche	6	0.1	0.27	**0.21**	$0	$0	$0	$0
Extreme Cold	9	0.2	0.02	0.00	$59,755	**$161,933**	**$221,688**	$44,338
Flooding	**21**	**0.5**	0.01	0.03	**$233,393**	**$233,393**	**$466,787**	**$217,834**
Fog	3	0.1	**4.60**	**0.13**	$53,316	$0	$53,316	$3,554
Hail	4	0.1	**1.52**	0.01	**$111,094**	**$47,342**	**$158,436**	$14,083
Heavy Snow	**94**	**2.1**	0.41	0.02	$54,993	$684	$55,677	**$116,303**
Ice	2	0.0	**2.50**	0.00	$50,787	$0	$50,787	$2,257
Landslide	3	0.1	0.00	**0.06**	$27,343	$0	$27,343	$1,823
Lightning	7	0.2	0.03	0.00	$63,785	$99	$63,883	$9,937
Tornado	4	0.1	0.00	0.00	$49,907	$749	$50,656	$4,503
Wind	**64**	**1.4**	0.09	0.01	**$238,592**	$6,224	**$244,816**	**$348,183**
TOTAL	217	4.8	0	0	$125,863	$32,324	$158,187	$762,815

Major Disaster Event and Annual Statistics 1962-2005 (2005 dollars) (HVRI 2007)

Appendix D. Critical Facilities

The following identifies an inventory of all the critical facilities within Davis County. Critical facilities are of particular concern because of the essential products and services to the general public they provide. These critical facilities can also fulfill important public safety, emergency response, and/or disaster recovery functions. The critical facilities identified in this Plan include amateur radio repeaters, emergency operations centers, electric and oil facilities, hospitals, fire and police stations, schools, water and wastewater treatment plants. (Mod = Moderate)

Davis County Amateur Radio Resources 2008									
Call sign (Location, Band)	***Dam Failure***	***Flood***	***Ground Shaking***	***Severe Weather***	***Liquefaction***	***Problem Soils***	***Slope Failure***	***Wildfire***	***East Canyon Winds***
AI7J (Layton, 440)	Low	Low	High	Low	High	Low	Low	Low	Low
K0NOD (Clearfield, 440)	Low	Low	High	Low	Mod	Low	Low	Low	Low
K7CEM (Salt Lake, 2000)	Low	Low	High	Mod	Low	Low	Mod	High	Low
K7DAV (Antelope Island, 144)	Low	Low	High	Mod	Low	Low	Low	High	Low
K7DAV (Antelope Island, 440)	Low	Low	High	Mod	Low	Low	Low	High	Low
K7DAV (Bountiful, 440)	High	Low	High	Mod	Low	Low	Low	Low	Low
N7CRG (Clearfield, 440)	Low	Low	High	Low	High	Low	Low	Low	Low
N7TDT (Bountiful, 440)	Low	Low	High	Mod	Low	Low	Low	Low	Low
NJ7J (Clearfield, 440)	Low	Low	High	Low	Mod	Low	Low	Low	Low
NJ7J (Syracuse, 220)	Low	Low	High	Low	High	Low	Low	Low	Low
W7CWK (Bountiful, 144)	Low	Mod	High	Mod	Low	Low	Low	Low	Low
W7CWK (Bountiful, 440)	Low	Mod	High	Mod	Low	Low	Low	Low	Low

Electric Generation Facility Vulnerability									
	Dam Failure	*Flood*	*Severe Weather*	*Ground Shaking*	*Liquefaction*	*Problem Soils*	*Slope Failure*	*Wildfire*	*East Canyon Winds*
Bountiful City Light & Power	Low	Low	Low	High	Mod	Low	Low	Low	High

Emergency Operations Centers Vulnerability									
	Dam Failure	*Flood*	*Severe Weather*	*Ground Shaking*	*Liquefaction*	*Problem Soils*	*Slope Failure*	*Wildfire*	*East Canyon Winds*
Davis County EOC (DCSO)	Low	Low	Mod	High	High	Low	Low	Low	High

Oil Refining Facility Vulnerability									
	Dam Failure	*Flood*	*Severe Weather*	*Ground Shaking*	*Liquefaction*	*Problem Soils*	*Slope Failure*	*Wildfire*	*East Canyon Winds*
Big West Oil	Low	Low	Mod	High	High	Low	Low	Low	High
Chevron USA Products - Salt Lake Refinery	Low	Low	Mod	High	High	Low	Low	Low	High
Crown Asphalt (Cowboy Terminal)	Low	Low	Mod	High	High	Low	Low	Low	High
Holly Refining & Marketing (WC)	Low	Low	Mod	High	High	Low	Low	Low	High
Silver Eagle Refining (WC)	Low	Low	Mod	High	High	Low	Low	Low	High

Fire Station Vulnerability									
	Dam Failure	*Flood*	*Severe Weather*	*Ground Shaking*	*Liquefaction*	*Problem Soils*	*Slope Failure*	*Wildfire*	*East Canyon Winds*
North Davis Fire District Clearfield Fire Station #42	Low	Low	Mod	High	Mod	Low	Low	Low	High
North Davis Fire District West Point Fire Station #41	Low	Low	Mod	High	High	Low	Low	Low	High
Clinton City Fire Station #21									
Kaysville Fire Station #61									
Farmington Fire Station #71	Low	Low	Mod	High	High	Low	Low	Low	High
Hill AFB Fire - Station 1	Low	Low	Mod	High	Low	Low	Low	Low	High
Hill AFB Fire - Station 2	Low	Low	Mod	High	Low	Low	Low	Low	High
Hill AFB Station 3									
Layton Fire Station #51	Low	Low	Mod	High	Mod	Low	Low	Low	High
Layton Fire Station #52	Low	Low	Mod	High	Mod	Low	Low	Low	Mod
Layton Fire Station #53	Low	Low	Mod	High	Mod	Low	Low	Low	Low
South Metro Davis Fire - Station #81	Low	Low	Mod	High	Low	Low	Low	Low	High
South Metro Davis Fire - Station #82	Low	Low	Mod	High	Low	Low	Low	Low	High
South Metro Davis Fire - Station #83	Low	Low	Mod	High	High	Low	Low	Low	High
South Metro Davis Fire - Station #84	Low	Low	Mod	High	Low	Low	Low	Low	High
South Metro Davis Fire - Station #85	Low	Low	Mod	High	High	Low	Low	Low	High
South Weber Fire Station	High	Mod	Mod	High	Low	Low	Low	Low	High
Sunset Fire Station #11	Low	Low	Mod	High	Mod	Low	Low	Low	High
Syracuse Fire Station #31	Low	Low	Mod	High	High	Low	Low	Low	High

Hospital Vulnerability									
	Dam Failure	*Flood*	*Severe Weather*	*Ground Shaking*	*Liquefaction*	*Problem Soils*	*Slope Failure*	*Wildfire*	*East Canyon Winds*
Davis Hospital and Medical Center	Low	Low	Mod	High	Mod	Low	Low	Low	Mod
South Davis Community Hospital	Low	Low	Mod	High	Low	Low	Low	Low	High
Lakeview Hospital	Low	Low	Mod	High	Low	Low	Low	Low	High
University of Utah Medical Center Farmington	Low	Low	Mod	High	Mod	Low	Low	Low	High
Intermountain Healthcare Layton Hospital	Low	Low	Mod	High	Low	Low	Low	Low	Mod

Law Enforcement Facility Vulnerability									
	Dam Failure	*Flood*	*Severe Weather*	*Ground Shaking*	*Liquefaction*	*Problem Soils*	*Slope Failure*	*Wildfire*	*East Canyon Winds*
Bountiful Police	Low	Low	Mod	High	Low	Low	Low	Low	Mod
Centerville Police	Low	Low	Mod	High	High	Low	Low	Low	High
Clearfield Police	Low	Low	Mod	High	Mod	Low	Low	Low	Low
Clinton Police	Low	Low	Mod	High	High	Low	Low	Low	Low
Davis County Sheriff	Low	Low	Mod	High	Mod	Low	Low	Low	High
Farmington Police	Low	Low	Mod	High	High	Low	Low	Low	High
Kaysville Police	Low	Low	Mod	High	Mod	Low	Low	Low	High
Layton Police	Low	Low	Mod	High	Mod	Low	Low	Low	Mod
North Salt Lake City Police	Low	Low	Mod	High	Low	Low	Low	Low	Mod
Sunset Police	Low	Low	Mod	High	Mod	Low	Low	Low	Low
Syracuse Police	Low	Low	Mod	High	High	Low	Low	Low	Low

Law Enforcement Facility Vulnerability									
	Dam Failure	*Flood*	*Severe Weather*	*Ground Shaking*	*Liquefaction*	*Problem Soils*	*Slope Failure*	*Wildfire*	*East Canyon Winds*
West Bountiful Police	Low	Low	Mod	High	High	Low	Low	Low	Low
West Point Police	Low	Low	Mod	High	High	Low	Low	Low	Low
Woods Cross Police	Low	Low	Mod	High	Mod	Low	Low	Low	Low
Utah Highway Patrol Farmington Office									

School Vulnerability									
	Dam Failure	*Flood*	*Severe Weather*	*Ground Shaking*	*Liquefaction*	*Problem Soils*	*Slope Failure*	*Wildfire*	*East Canyon Winds*
High Schools									
Bountiful High	Low	Low	Mod	High	Low	Low	Low	Low	High
Clearfield High	Low	Low	Mod	High	Mod	Low	Low	Low	High
Davis High	Low	Low	Mod	High	Mod	Low	Low	Low	High
Layton High	Low	Low	Mod	High	Mod	Low	Low	Low	High
Northridge High	Low	Low	Mod	High	Mod	Low	Low	Low	High
Syracuse High	Low	Low	Mod	High	High	Low	Low	Low	Low
Viewmont High	Low	Low	Mod	High	Mod	Low	Low	Low	High
Woods Cross High	Low	Low	Mod	High	Low	Low	Low	Low	High
Junior High Schools									
Bountiful Junior High	Low	Low	Mod	High	Mod	Low	Low	Low	High
Centennial Junior High	Low	Low	Mod	High	Mod	Low	Low	Low	Low
Centerville Junior High	Low	Low	Mod	High	High	Low	Low	Low	High
Central Davis Junior High	Low	Low	Mod	High	High	Low	Low	Low	High

School Vulnerability									
	Dam Failure	*Flood*	*Severe Weather*	*Ground Shaking*	*Liquefaction*	*Problem Soils*	*Slope Failure*	*Wildfire*	*East Canyon Winds*
Fairfield Junior High	Low	Low	Mod	High	Mod	Low	Low	Low	High
Farmington Junior High	Low	Low	Mod	High	High	Low	Low	Low	High
Kaysville Junior High	Low	Low	Mod	High	Mod	Low	Low	Low	High
Legacy Junior High	Low	Low	Mod	High	High	Low	Low	Low	Low
Millcreek Junior High	Low	Low	Mod	High	Low	Low	Low	Low	High
Mueller Park Junior High	Low	Low	Mod	High	Low	Low	High	Low	High
North Davis Junior High	Low	Low	Mod	High	Mod	Low	Low	Low	High
North Layton Junior High	Low	Low	Mod	High	Mod	Low	Low	Low	High
South Davis Junior High	Low	Low	Mod	High	Low	Low	Low	Low	High
Sunset Junior High	Low	Low	Mod	High	Mod	Low	Low	Low	High
Syracuse Junior High	Low	Low	Mod	High	High	Low	Low	Low	Low
West Point Junior High	Low	Low	Mod	High	High	Low	Low	Low	Low
Elementary Schools									
Adams Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	High
Adelaide Elementary	Low	Low	Mod	High	Low	Low	Low	Low	High
Antelope Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	High
Bluff Ridge Elementary	Low	Low	Mod	High	High	Low	Low	Low	Low
Boulton Elementary	Low	Low	Mod	High	Low	Low	Low	Low	High
Bountiful Elementary	Low	Low	Mod	High	Low	Low	Low	Low	High
Buffalo Point Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	Low
Burton Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	High
Canyon Creek Elementary	Low	Low	Mod	High	High	Low	Low	Low	Low
Centerville Elementary	Low	Low	Mod	High	High	Low	Low	Low	High
Clinton Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	Low

School Vulnerability									
	Dam Failure	*Flood*	*Severe Weather*	*Ground Shaking*	*Liquefaction*	*Problem Soils*	*Slope Failure*	*Wildfire*	*East Canyon Winds*
Columbia Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	High
Cook Elementary	Low	Low	Mod	High	High	Low	Low	Low	Low
Creekside Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	High
Crestview Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	High
Doxey Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	High
Eagle Bay Elementary	Low	Low	Mod	High	High	Low	Low	Low	High
East Layton Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	High
Ellison Park Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	Mod
Endeavor Elementary	Low	Low	Mod	High	High	Low	Low	Low	Mod
Farmington Elementary	Low	Low	Mod	High	High	Low	Low	Low	High
Foxboro Elementary	Low	Low	Mod	High	High	Low	Low	Low	Mod
Fremont Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	Mod
Heritage Elementary	Low	Low	Mod	High	High	Low	Low	Low	Low
Hill Field Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	High
Holbrook Elementary	Low	Low	Mod	High	Low	Low	Low	Low	High
Holt Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	Mod
Kays Creek Elementary	Low	Low	Mod	High	High	Low	Low	Low	Low
Kaysville Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	High
King Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	High
Knowlton Elementary	Low	Low	Mod	High	High	Low	Low	Low	High
Lakeside Elementary	Low	Low	Mod	High	High	Low	Low	Low	Low
Layton Elementary	Low	Low	Mod	High	High	Low	Low	Low	Mod
Lincoln Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	High
Meadowbrook Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	High

School Vulnerability									
	Dam Failure	*Flood*	*Severe Weather*	*Ground Shaking*	*Liquefaction*	*Problem Soils*	*Slope Failure*	*Wildfire*	*East Canyon Winds*
Morgan Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	High
Mountain View Elementary	Low	Low	Mod	High	Low	Low	Low	Low	High
Muir Elementary	Low	Low	Mod	High	Low	Low	Low	Low	High
Oak Hills Elementary	Low	Low	Mod	High	Low	Low	Low	Low	High
Odyssey Elementary	Low	Low	Mod	High	High	Low	Low	Low	Low
Orchard Elementary	Low	Low	Mod	High	Low	Low	Low	Low	High
Parkside Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	Low
Reading Elementary	Low	Low	Mod	High	High	Low	Low	Low	High
Sand Springs Elementary	Low	Low	Mod	High	High	Low	Low	Low	Low
Snow Horse Elementary	Low	Low	Mod	High	High	Low	Low	Low	Low
South Clearfield Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	High
South Weber Elementary	High	Mod	Mod	High	Low	Low	Low	Low	High
Stewart Elementary	Mod	Low	Mod	High	High	Low	Low	Low	High
Sunset Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	High
Syracuse Elementary	Low	Low	Mod	High	High	Low	Low	Low	Low
Taylor Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	High
Tolman Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	High
Vae View Elementary	Low	Low	Mod	High	Low	Low	Low	Low	Mod
Valley View Elementary	Low	Low	Mod	High	Low	Low	Low	Low	High
Wasatch Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	High
Washington Elementary	Low	Low	Mod	High	Low	Low	Low	Low	High
West Bountiful Elementary	Low	Low	Mod	High	High	Low	Low	Low	Mod
West Clinton Elementary	Low	Low	Mod	High	High	Low	Low	Low	Low
West Point Elementary	Low	Low	Mod	High	High	Low	Low	Low	Low

School Vulnerability									
	Dam Failure	*Flood*	*Severe Weather*	*Ground Shaking*	*Liquefaction*	*Problem Soils*	*Slope Failure*	*Wildfire*	*East Canyon Winds*
Whitesides Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	High
Windridge Elementary	Low	Low	Mod	High	High	Low	Low	Low	High
Woods Cross Elementary	Low	Low	Mod	High	Mod	Low	Low	Low	High
Charter Schools									
Ascent Academy	Low	Low	Mod	High	Mod	Low	Low	Low	High
Highmark Charter	High	Low	Mod	High	Mod	Low	Low	Low	High
Jefferson Academy	Low	Low	Mod	High	Mod	Low	Low	Low	Low
Leadership Learning Academy	Low	Low	Mod	High	Mod	Low	Low	Low	Mod
Legacy Prep. Academy	Low	Low	Mod	High	High	Low	Low	Low	High
Northern Utah Academy for Math, Engineering, and Science (NUAMES)	Low	Low	Mod	High	Low	Low	Low	Low	Mod
North Davis Prep. Academy	Low	Low	Mod	High	Mod	Low	Low	Low	High
Northern Utah Academy	Low	Low	Mod	High	Mod	Low	Low	Low	High
Spectrum Academy	Low	Low	Mod	High	High	Low	Low	Low	High
Syracuse Arts Acad.	Low	Low	Mod	High	High	Low	Low	Low	Low
Wasatch Peak Academy	Low	Low	Mod	High	High	Low	Low	Low	Mod
Voyage Academy	Low	Low	Mod	High	High	Low	Low	Low	Low
Alternative Schools									
Renaissance Academy	Low	Low	Mod	High	Low	Low	Low	Low	High
Canyon Heights High	Low	Low	Mod	High	Mod	Low	Low	Low	High
Mountain High	Low	Low	Mod	High	Mod	Low	Low	Low	High
Vista Education Campus	Low	Low	Mod	High	Mod	Low	Low	Low	High
Early Learning Center	Low	Low	Mod	High	Mod	Low	Low	Low	High

Water and Wastewater Treatment Facility Vulnerability									
	Dam Failure	*Flood*	*Severe Weather*	*Ground Shaking*	*Liquefaction*	*Problem Soils*	*Slope Failure*	*Wildfire*	*East Canyon Winds*
WBWCD Davis North	Low	Low	Mod	High	Low	Low	Low	Low	High
WBWCD Davis South	Low	Low	Mod	High	Low	Low	Low	Low	High
WBWCD Wells	Low	Low	Mod	High	Mod	Low	Low	Low	High
WBWCD Davis Aqueduct	Low	Low	Mod	High	Low	Low	High	Low	Low
Central Davis County Sewer District	Low	Mod	Mod	High	High	Low	Low	Low	High
North Davis County Sewer District	Low	Mod	Mod	High	High	Low	Low	Low	High
South Davis Sewer Improvement District	Low	Mod	Mod	High	High	Low	Low	Low	High

Appendix E. Glossary of Terms

Abutment (dam) – the valley side against which a dam is constructed.

Acre-foot of water – approximately 326,000 gallons of water, or approximately a football field covered by one foot of water.

Active Faults – An active fault is defined as a fault displaying evidence of displacement along one or more of its traces during Holocene time (about the last 11,000 years).

Aftershocks – earthquakes during the seconds, hours, days to months following a larger earthquake (main shock) in the same general region.

Alluvial fan – a cone-shaped deposit of stream sediments, generally deposited at the base of a mountain where a stream encounters flatter terrain.

Amplitude (seismic waves) - the maximum height of a wave crest or depth of a trough. Amount the ground moves as a seismic wave passes, as measured from a seismogram.

Avalanche path – the area in which a snow avalanche runs; generally divided into starting zone, track, and runout zone.

Basin and Range physiographic province – consists of north-south-trending mountain ranges separated by valleys, bounded by the Rocky Mountains and the Colorado Plateau to the east and the Sierra-Cascade Mountains to the west (includes western Utah).

Bearing capacity – the load per unit area, which the ground can safely support without excessive yield.

Bedrock – solid in-place rock, sometimes exposed and sometimes concealed beneath the soil.

Block faulting – see **normal fault**

Collapsible soil (hydrocompaction) – loose, dry, low-density soil that decreases in volume or collapses when saturated for the first time following deposition.

Critical Areas – Environmentally sensitive areas which include wetlands fish and wildlife habitat conservation areas; geologically hazardous areas; areas with a critical recharging effect on aquifers used for potable water; and frequently flooded areas. Critical areas have measurable characteristics which, when combined, create a value for or potential risk to public health, safety and welfare.

Critical/Essential Facilities – Structures meeting one or more of the following criteria:

- Fire stations, police stations, storage facilities for vehicles/equipment needed after a hazard event, and emergency operation centers.
- Hospitals, nursing homes, and housing which is likely to contain occupants who may not be sufficiently mobile to avoid injury or death as a result of a hazardous event
- Public and private utility facilities, which are vital to maintaining or restoring normal services to, damaged areas after a hazardous event.
- Structures or facilities that produce, store, or use highly flammable, explosive, volatile, toxic and/or water reactive materials

Debris flow – involves the relatively rapid, viscous flow of surficial material that is predominantly coarse grained.

Debris slide – involves predominantly coarse-grained material moving mainly along a planar surface.

Drought (Agricultural) – lack of water for crop production in a given area

Drought (Hydrologic) – lack of water in the entire water supply for a given area.

Drought (Meteorological) – lack of precipitation compared to an area's normal

Drought (Socioeconomic) – lack of water sufficient to support an area's population

Earth flow – Involves fine-grained material that slumps away from the top or upper part of a slope, leaving a scarp, and flows down to form a bulging toe.

Earthquake – a sudden motion or trembling in the earth as fracture and movement of rocks along a fault release stored elastic energy.

Earthquake fault zone – earthquake fault zones are regulatory zones around active faults. The zones are used to prohibit the location of critical facilities and structures designed for human occupancy from being built astride an active fault. Earthquake Fault Zones are plotted on topographic maps at a scale of 1-inch equals 2,000 feet. The zones vary in width, but average about one-quarter mile wide.

Earthquake-induced seiche – Earthquake generated water waves causing inundation around shores or lakes and reservoirs.

Epicenter – the point on the earth's surface directly above the focus of an earthquake.

Epoch – geologic time unit lasting more than an age but shorter than a period (Epoch 2008).

Erosion – the removal of earth or rock material by many types of processes, for example, water, wind, or ice action.

Expansive soil and rock – soil and rock which contain clay minerals that expand and contract with changes in moisture content.

Fault – a break in the earth along which movement occurs.

Fault segment – section of a fault that behaves independently from adjacent sections.

Fault zone – an area containing numerous faults.

Federal Emergency Management Agency (FEMA) – authorized under Section 404 of the Stanford Act. Provides funding for hazard mitigation projects that are cost-effective and comply with existing post-disaster mitigation programs and activities. These projects cannot be funded through other programs to be eligible.

Fill – material used to raise the surface of the land generally in a low area.

Fire-resistant vegetation – plants that do not readily ignite and burn when subjected to fire because of inherent physiological characteristics of the species such as moisture content, fuel loading, and fuel arrangement.

Floodplain – an area adjoining a body of water or natural stream that has been or may be covered by floodwater.

Floodplain (100-year/500-year) – Floodplains that have the potential to flood once every 100 or 500 years or that has a 1% (100-year) or 0.2% (500-year) chance of flooding equal to or in excess of that in any given year.

Floodway – An area of land immediately adjacent to a stream or river channel that, in times of flooding, becomes an enlarged stream or river channel and carries the floodwater with the highest velocity.

Fluvial – concerning or pertaining to rivers or streams.

Focus – the point of origin of an earthquake within the earth, and the origin of the earthquake's seismic waves.

Formation (geologic) – a mappable rock unit consisting of distinctive features/rock types separate from units above and below.

Frequency (seismic waves) – the number of complete cycles of a seismic wave passing a point during one second.

Fuel (fire) – vegetation, building material, debris, and other substances that will support combustion.

Fuel break – a change in fuel continuity, type of fuel, or degree of flammability of fuel in a strategically located strip of land to reduce or hinder the rate of fire spread.

Fuel type – a category of vegetation used to indicate the predominate cover of an area.

Glacial moraine – debris (sand to boulders) transported and deposited by glacial ice along a glacier's sides or terminus.

Graben – a block of earth down dropped between two faults.

Gradient (slope) – a measure of the slope of the land surface.

Ground failure – a general term referring to any type of ground cracking or subsidence, including landslides and liquefaction-induced cracks.

Ground shaking – the shaking or vibration of the ground during an earthquake.

Ground water – that portion of subsurface water which is in the zone of saturation.

Gypsiferous deposits – soil or rock containing gypsum, which can be subject to dissolution.

Gypsum – a mineral composed of hydrated calcium sulfate. A common mineral of evaporites.

Hazard Mitigation Plan – The Plan resulting from a systematic evaluation of the nature and extent of vulnerabilities posed by a hazard present in society that includes the strategies needed to minimize future vulnerability to hazards.

Hazard Mitigation – Any action taken to reduce or permanently eliminate the long-term risk to human life and property and the environment posed by a hazard.

HAZUS-MH – Hazards United States – Multihazards; Earthquake loss estimation software using GIS databases developed by FEMA.

Head (landslide) – the upper parts of the slide material along the contact between the disturbed material and the main scarp.

Holocene – geologic epoch covering the last 10,000 years (after the last Ice Age).

Igneous rocks – rocks formed by cooling and hardening of hot liquid material (magma), including rocks cooled within the earth (for example, granite) and those that cooled at the ground surface as lavas (such as basalt).

Impermeable – materials having a texture that does not permit water to move through.

Interfluve – land between two streams in the same drainage basin (Interfluve 2004)

Intermountain Seismic Belt (ISB) – zone of pronounced seismicity, up to 120 miles wide and 800 miles long, extending from Arizona through central Utah to northwestern Montana.

Lacustrine – concerning or pertaining to lakes.

Lake Bonneville – a large, ancient lake that existed 30,000 to 12,000 years ago and covered nearly 20,000 square miles in Utah, Idaho, and Nevada. The lake covered many of Utah's valleys, and was almost 1,000 feet deep in the area of the present Great Salt Lake.

Lake Bonneville sediments – sediments deposited by Lake Bonneville, found in the valleys, which range from gravels and sands to clays.

Landslide – a general term for a mass of earth or rock, which moves down slope by flowing, spreading, sliding, toppling, or falling (see slope failure).

Lateral spread – lateral down slope displacement of soil layers, generally several feet or more, above a liquefied layer.

Levee (flood) – a berm or dike used to contain or direct water, usually without an outlet or spillway.

Liquefaction – sudden large decrease in shear strength of a cohesionless soil (generally sand or silt) caused by collapse of soil structure and temporary increase in pore-water pressure during earthquake ground shaking.

Magnitude (earthquake) – a quantity characteristic of the amplitude of the ground motion of an earthquake. The most commonly used measurement is the Richter magnitude scale; a logarithmic scale based on the motion that would be measured by a standard type of seismograph 60 miles from the earthquake's epicenter.

Metamorphic rocks – rocks formed by high temperatures and/or pressures (for example, quartzite formed from sandstone).

Mitigation – the act of reducing or preventing hazards which affect society or those things deemed important to society

Modified Mercalli Intensity (MMI) – the most commonly used intensity scale in the U.S.; it is a measure of the severity of earthquake shaking at a particular site as determined from its effect on the earth's surface, man, and man's structures.

Montmorillonite – a clay mineral characterized by expansion upon wetting and shrinking upon drying.

Natural vegetation – native plant life existing on a piece of land before any form of development.

Normal fault (block faulting) – fault caused by crustal extension in which relative movement on opposite sides is primarily vertical; for example, the Wasatch fault.

Oolite – spherical grains of carbonate sand with a brine shrimp fecal pellet nucleus.

Outlet (dam) - a conduit through which controlled releases can be made from the reservoir.

Palmer Drought Severity Index (PDSI) – developed by Wayne Palmer in the 1965; measures drought severity using temperature, precipitation and soil moisture (Utah Division of Water Resources 2007)

Peat – unconsolidated surficial deposit of partially decomposed plant remains.

Period (geologic) – a standard (world-wide) geologic time unit.

Permeability – the capacity of a porous rock or soil for transmitting a fluid.

Physiographic province – a region whose pattern of relief features or landforms differs significantly from that of adjacent regions.

Piping (problem soil and rock) – a weak incoherent layer in unconsolidated deposits that acts as a channel directing the movement of water. As the layer becomes saturated it conducts water to a free face (cliff or stream bank for example) that intersects the layer, and material exits out a "pipe" formed in the free face. Piping can occur in a dam as the result of progressive development of internal erosion by seepage.

Pore space – the open spaces in a rock or soil between solid grains. The spaces may be filled with gas (usually air) or liquid (usually water).

Porosity – the ratio of the volume of pore space in rock or soil to the volume of its mass, expressed as percentage.

Probable Maximum Flood (PMF) – a flood that would result from the most severe combination of critical meteorological and hydrologic conditions possible in a region.

Probable Maximum Precipitation (PMP) – the maximum amount and duration of precipitation that can be expected to occur on a drainage basin.

Problem soil and rock – geologic materials that are susceptible to volumetric changes, collapse, subsidence, or other engineering geologic problems.

Project Impact – An initiative of the Federal Emergency Management Agency intended to modify the way in which the United States handles natural disasters. The Goal of Project Impact from a Federal Government perspective is to reduce the personal and economic costs of hazard events by bringing together the private and public sector to better enable the citizens of a community to protect themselves from natural hazards.

Quaternary – a geologic time period covering the last 1.6 million years.

Recurrence interval – the length of time between occurrences of a particular event (an earthquake, for example).

Rock fall – abrupt free fall or down slope movement, such as rolling or sliding, of loosened blocks or boulders from an area of bedrock. The rock-fall runout zone is the area below a rock-fall source which is at risk from falling rocks.

Rock topple – forward rotation movement of a rock unit(s) about some pivot point.

Runout zone (avalanche) – where a snow avalanche slows down and comes to rest (deposition zone). For large avalanches, the runout zone can include a powder- or wind-blast zone that extends far beyond the area of snow deposition.

Sand blow (earthquake) – deposit of sandy sediment ejected as water and sand to the surface, formed when ground shaking has caused liquefaction at depth.

Scarp – a relatively steeper slope separating two more gentle slopes. Scarps can form as result of earthquake faulting.

Sediment – material that is in suspension, is being transported, or has been moved from its site of origin by water, ice, or wind, and has come to rest on the earth's surface either above or below the sea level.

Sedimentary rocks – rocks formed from loose sediment such as sand, mud, or gravel deposited by water, ice, or wind, and then hardened into rock (for example, sandstone); or formed by dissolved minerals precipitating out of solution to form rock (for example, tufa).

Seiche – a standing wave generated in a closed body of water such as a lake or reservoir. Ground shaking, tectonic tilting, sub aqueous fault rupture, or landsliding into water can all generate a seiche.

Seismic waves – vibrations in the earth produced during earthquakes.

Seismicity – seismic or earthquake activity.

Sensitive clay – clay soil that experiences a particularly large loss of strength when disturbed. Deposits of sensitive clay are subject to failure during earthquake ground shaking.

Shear strength – the internal resistance that tends to prevent adjacent parts of a solid from "shearing" or sliding past one another parallel to the plane of contact. It is measured by the maximum shear stress that can be sustained without failure.

Shear stress - a stress causing adjacent parts of a solid to slide past one another parallel to the plane of contact.

Slope failure – a general term referring to any type of natural ground movement on a sloping surface (see landslide).

Slump – a slope failure that slides along a concave rupture surface. Generally slumps do not move very far from the source area.

Snow avalanche – a rapid down slope movement of a mass of snow, ice, and debris.

Spectral Acceleration – measurement for approximate horizontal force experienced in a model earthquake. Measurements are specific to the frequency of shaking found to affect buildings during and earthquake. A 0.2-second period affects primarily one- and two-story buildings while 1.0- second period of spectral acceleration affects buildings approximately 10 stories in height.

Stafford Act – Robert T. Stafford Disaster Relief and emergency Assistance Act, PL 100-707, signed into law November 23 1988: amended the Disaster Relief Act of 1974, PL 93-288

Starting zone (avalanche) – where the unstable snow or ice breaks loose and starts to slide.

Subsidence – a settling or sinking of the earth's crust.

Sunny-day failure –

Surface fault rupture (surface faulting) – propagation of an earthquake-generated fault rupture to the ground surface, displacing the surface and forming a scarp.

Tectonic subsidence – subsidence (down dropping) and tilting of a basin on the down dropped side of a fault during an earthquake.

Toe (landslide) – the margin of disturbed material most distant from the main scarp.
Track (avalanche) – the slope or channel down which a snow avalanche moves at a fairly uniform speed.

Unconsolidated basin fill – un-cemented and non-indurated sediment, chiefly clay, silt, sand, and gravel, deposited in basins.

Urban area – a geographical area, usually of incorporated land, covered predominately by engineered structures including homes, schools, commercial buildings, service facilities, and recreational facilities.

Velocity (ground motion) – the rate of displacement of an earth particle caused by passage of a seismic wave.

Wasatch fault – a normal fault that extends over 200 miles from Malad City, Idaho to Fayette, Utah, and trends along the western front of the Wasatch Range.

Watershed – the area of land above a reference point on a stream or river, which contributes runoff to that stream.

Weathering – a group of processes (such as the chemical action of air, rain water, plants, and bacteria and the mechanical action of temperature changes) whereby rocks on exposure to the weather change in character, decay, and finally crumble into soil.

Wildfire – uncontrolled fire burning in vegetation.

Wildland area – a geographical area of unincorporated land covered predominately by natural vegetation.

Wildland Urban Interface (WUI) – Wildland vegetation and forested areas adjacent to or intermingled with residential developments.

Zone of deformation (earthquake) – the width of the area of surface faulting over which earth materials have been disturbed by fault rupture, tilting, or subsidence.

List of Acronyms and Recognized Abbreviations

AARC	Average Annual Rate of Change
AGRC	Automated Geographic Reference Center
APHIS	Animal and Plant Health Inspection Service
BCEGS	Building Code Effectiveness Grading System
BOR	Bureau of Reclamation
CDBG	Community Development Block Grant
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CERT	Community Emergency Response Team
CFR	Code of Federal Regulations
CFS	Cubic Feet per Second
CRS	Community Rating System
DB	Detention Basin
DFIRM	Digital Flood Insurance Rate Map
DEM	Division of Emergency Management
DMA 2000	Disaster Mitigation Act of 2000
EAP	Emergency Action Plan
EM	Emergency Management
EOC	Emergency Operations Center
EOP	Emergency Operations Plan
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FMA	Flood Mitigation Assistance
G	Gravity
GIS	Geographic Information Systems
GOPB	Governor's Office of Planning and Budget
GPS	Geographic Positioning System
GSL	Great Salt Lake
HAM	Handheld Amateur Radio
HAZMAT	Hazardous Materials
HAZUS-MH	Hazards United States – Multi-Hazards
HMGP	Hazard Mitigation Grant Program
LEPC	Local Emergency Planning Committee
LUST	Leaking Underground Storage Tank
M	Magnitude
MSL	Mean Sea Level
MOU	Memoranda of Understanding
NCDC	National Climatic Data Center
NFIP	National Flood Insurance Program
NIMS	National Incident Management System

NWS	National Weather Service
PDM	Pre-Disaster Mitigation
PDSI	Palmer Drought Severity Index
piC/L	picoCuries per Liter
PL	Public Law
PSC	Public Safety Communications
RCRA	Resource Conservation and Recovery Act
SA	Spectral Acceleration
SBA	Small Business Administration
SHELDUS	Spatial Hazard Events and Losses Database for the United States
SLC	Salt Lake City
SPI	Standardized Precipitation Index
SR	State Route
STAPLEE	Social, Technical, Administrative, Political, Legal, Economic, Environmental
SWSI	Surface Water Supply Index
TAZ	Transportation Analysis Zone
TRAX	Transit Express
TRI	Toxic Release Inventory
UCAN	Utah Communication Agency Networks
UDAF	Utah Department of Agriculture and Food
UDOT	Utah Department of Transportation
UEDV	Utah Economic Data Viewer
UFFSL	Utah Division of Forestry, Fire, and State Lands
UGS	Utah Geological Survey
USGS	United States Geological Survey
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USFS	United States Forestry Service
USU	Utah State University
UUSS	University of Utah Seismic Stations
WFZ	Wasatch Fault Zone
WUI	Wildland-Urban Interface

Appendix F. Works Cited

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