RESOLUTION No. 01-01-2011

A RESOLUTION ADOPTING THE 2010 MOUNTAINLAND ASSOCIATION OF GOVERNMENTS PRE-DISASTER HAZARD MITIGATION PLAN AS REQUIRED BY THE FEDERAL DISASTER MITIGATION AND COST REDUCTION ACT OF 2000.

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 pre-disaster funds; and

WHEREAS, Mountainland Association of Governments (MAG) has been contracted by the State of Utah to prepare a Pre-Disaster Mitigation Plan covering all of the jurisdictions in the MAG Area; and

WHEREAS, the MAG Executive Council approved MAG Staff to write the plan; and

WHEREAS, Santaquin City is within the MAG Area; and

WHEREAS, the Santaquin City Council is concerned about mitigating potential losses from natural disasters before they occur; and

WHEREAS, the plan identifies potential hazards, potential loses and potential mitigation measures to limit loses; and

WHEREAS, the Santaquin City Council has determined that it would be in the best interest of the community as a whole to adopt the Pre-Disaster Hazard Mitigation Plan as it pertains to the City;

NOW THEREFORE, BE IT RESOLVED BY THE SANTAQUIN CITY COUNCIL THAT:

1. The attached "Mountainland Association of Governments Pre-Disaster Mitigation Plan" be adopted to meet the requirements of the Disaster Mitigation and Cost Reduction Act of 2000.

2. This Resolution shall take effective on January 6, 2011.

PASSED AND APPROVED THIS 5th DAY OF JANUARY, 2011.

James E. DeGraffenried, Mayor

ATTEST:

Susan B. Farnsworth
Santaquin City Recorder

Mountainland Pre-Disaster Hazard Mitigation Plan 2010

Prepared by

MOUNTAINLAND
ASSOCIATION OF GOVERNMENTS
Serving Summit, Utah and Wasatch Cities & Counties

Executive Summary

Purpose

To fulfill federal, state, and local hazard mitigation planning responsibilities; to promote pre and post disaster mitigation measures, short/long range strategies that minimize suffering, loss of life, and damage to property resulting from hazardous or potentially hazardous conditions to which citizens and institutions within the state are exposed; and to eliminate or minimize conditions which would have an undesirable impact on our citizens, the economy, environment, and the well-being of the state of Utah. This plan is an aid in enhancing city and state officials, agencies, and public awareness to the threat that hazards have on property and life and what can be done to help prevent or reduce the vulnerability and risk of each Utah jurisdiction.

Scope

Utah PDM Planning phase is statewide. The State of Utah will work with all local jurisdictions by means of the seven regional Association of Governments. The Mountainland Association of Governments area, which covers the counties of Summit, Utah and Wasatch, will have a plan completed by March 1, 2010 to give to the Utah Division of Emergency Services. Future monitoring, evaluating, updating and implementing will take place as new incidents occur and or every three to five years and will be included in the local mitigation plans as well.
Natural hazards addressed are: Flooding; Wildland Fire; Landslide; Earthquake; Drought; Severe Weather; and Infestation.

The Counties, Cities and Towns of the three-county Mountainland area are:

Summit County

Coalville, Francis, Henefer, Kamas, Oakley, and Park City.

Utah County

Alpine, American Fork, Cedar Fort, Cedar Hills, Eagle Mountain, Elk Ridge, Genola, Goshen, Highland, Lehi, Lindon, Mapelton, Orem, Payson, Pleasant Grove, Provo, Salem, Santaquin, Saratoga Springs, Spanish Fork, Springville, Vineyard, and Woodland Hills.

Wasatch County

Charleston, Daniel, Heber, Midway, and Wallsburg.

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Introduction

The State of Utah is vulnerable to natural, technological, and man-made hazards that have the possibility of causing serious threat to the health, welfare, and security of our citizens. The cost of response to and recovery from potential disasters can be lessened when attention is turned to mitigating their impacts and effects before they occur or re-occur.

What is Hazard Mitigation

Hazard mitigation is defined as any cost-effective action(s) that have the effect of reducing, limiting, or preventing vulnerability of people, property, and the environment to potentially damaging, harmful, or costly hazards. Hazard mitigation measures, 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. Third; those that do not address the hazard at all but rather reduce the impact of the hazard on the victims such as insurance or grants. This mitigation plan has strategies that fall into all three categories.

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

The primary focus of hazard mitigation actions must be at the point at which capital investment decisions are made and based on vulnerability. Capital investments, whether for homes, roads public utilities, pipelines, power plants, chemical plants or warehouses, or public works, determine to a large extent the nature and degree of hazard vulnerability of a community. Once a capital facility is in place, very 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 restrict development in high vulnerability areas, and building codes, which insure that new buildings are built to withstand the damaging forces of hazards, are the most useful mitigation approaches a city can implement.

Previously, mitigation measures have been the most neglected programs within emergency management. Since the priority to implement mitigation activities is generally low in comparison to the perceived threat, some important mitigation measures take time to implement. 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 eliminating long-term risk to people and property living in Utah from 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.

The State Division of Emergency Services and Homeland Security (DESHS) have identified the following hazards to be analyzed by each county. These hazards include avalanche, dam failure, debris flow, drought, earthquake, flood, flash flooding, infestation, landslide, problem soils, summer storm, tornado, urban and rural fires, and winter storm.

This regional/multi-jurisdictional plan evaluates the impacts, risks and vulnerabilities of natural hazards in a jurisdictional area affected by a disaster. The plan supports, provides assistance, identifies and describes mitigation projects for each annex. The suggestive actions and plan implementation for local and tribal governments could reduce the impact of future disasters. Only through the coordinated partnership with emergency managers, political entities, public works officials, community planners and other dedicated individuals working to implement this program was it accomplished.

Purpose

To fulfill federal, state, and local hazard mitigation planning responsibilities; to promote pre and post disaster mitigation measures, short/long range strategies that minimize suffering, loss of life, and damage to property resulting from hazardous or potentially hazardous conditions to which citizens and institutions within the state are exposed; and to eliminate or minimize conditions which would have an undesirable impact on our citizens, the economy, environment, and the well-being of the state of Utah. This plan is an aid in enhancing city and state officials, agencies, and public awareness to the threat that hazards have on property and life and what can be done to help prevent or reduce the vulnerability and risk of each Utah jurisdiction.

Scope

Mountainland Association of Governments, which covers the counties of Summit, Utah and Wasatch, will have a updated plan completed by August 1, 2010 to give to the Utah Division of Emergency Services. Future monitoring, evaluating, updating and implementing will take place as new incidents occur and or every three to five years and will be included in the local mitigation plans as well. Natural hazards addressed are: Flooding; Wildland Fire; Landslide; Earthquake; Drought; Severe Weather; and Infestation.

The Counties, Cities and Towns of the three county Mountainland area are:

Summit County

Coalville, Francis, Henefer, Kamas, Oakley, and Park City.

Utah County

Alpine, American Fork, Cedar Fort, Cedar Hills, Eagle Mountain, Elk Ridge, Genola, Goshen, Highland, Lehi, Lindon, Mapelton, Orem, Payson, Pleasant Grove, Provo, Salem, Santaquin, Saratoga Springs, Spanish Fork, Springville, Vineyard, and Woodland Hills.

Wasatch County

Charleston, Daniel, Heber, Midway, and Wallsburg.

Authority

Federal: Public Law 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 also 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 a high impact and threat potential.

President Clinton signed the Disaster Mitigation Act of 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 (HMGP), if they submit for approval a mitigation plan, which is a summary of local and/or regional mitigation plans, that identifies natural hazards, risks, vulnerabilities, and describes actions to mitigate the hazards risks and vulnerabilities in that plan.

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

Local: Local governments play an essential role in implementing effective mitigation, both before and after disaster events. Each local government will review all damages, losses and related impacts to determine the need or requirement for mitigation action and planning whenever seriously effected by a disaster, or when applying for state or federal recovery assistance. In the counties and cities making up the MAG Region, the local executive responsible for carrying out plans and policies are the County Commissioners/Council Members and City Mayors. 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.

Association of Governments: The Association of Governments have been duly constituted under the authority of Title XI, Chapter13, Utah Code Annotated, 1953, as amended (The Inter-local Cooperation Act) and pursuant to Section 3 of the Executive Order of the Governor of the State of Utah, dated May 27, 1970, with the authority to conduct planning studies and to provide services to its constituent jurisdictions.

Introduction to Region

Geography

The area's geography is quite varied with desert to the far west and high mountains in the east. The bulk of the population is found in the fertile valleys lying between mountains. Agricultural land supports mainly fruit orchards, some cattle and sheep ranches, grain farms, dairies, hogs, chickens and smaller individual farms. Pine clad slopes and oak brush foothills characterize much of the undeveloped mountain landscape that exists in the area. Development encroaching on hillsides is of real concern to environmentalists, planners, wildlife managers and fire marshals. Only a small percentage of the area's unincorporated land has been developed; however, the potential for new growth is evident. The preservation of open space within urban settings is very crucial to quality of life and community well being.

Population

The Mountainland area is comprised of three counties located in north central Utah having an estimated combined population of 588,003 residents. Over the past few years each of these counties have experienced widespread growth equaling a 30% growth since the 2000 census. While most growth is infill development within urbanized areas, population is continuing to into areas with increase hazard potential.

According to the 2000 Census, the Mountainland area encompasses 5,050 square miles of geography but, as discussed earlier, the population is mostly confined to incorporated areas.

Mountainland Region Population 2000-2060

	Census		Short Range Projection			Long Range Projection		
	2000	2008	2010	2020	2030	2040	2050	2060
MOUNTAINLAND REGION	413,487	588,003	627,571	828,311	1,038,686	1,261,701	1,479,640	1,717,239
SUMMIT COUNTY	29,736	36,100	42,320	64,738	83,252	104,620	131,594	165,029
UTAH COUNTY	368,536	530,837	560,511	727,718	907,210	1,092,450	1,261,653	1,438,300
WASATCH COUNTY	15,215	21,066	24,740	35,855	48,224	64,631	86,393	113,910

Sources: http://www.governor.state.ut.us/projections/EDPT3.pdf;
U.S. Bureau of the Census; Utah Population Estimates Committee;
2002 Baseline Projections, Governor's Office of Planning and Budget, UPED Model System.
Notes: AARC is average annual rate of change. 1980 and 1990 populations are April 1 U.S. Census modified age, race and sex (MARS) populations; 2000 populations are April 1 U.S. Census summary file 1 (SF1) populations; all others are July 1 populations.

Population Origin

Population by Race and Hispanic Origin Mountainland Counties, 2000 (most recent available)						
	White	Black	Amer. Indian Aleut, Eskimo	Asian or Pac. Isle	Hispanic	% Minority Pop
Summit	27,299	72	91	298	2,406	10.5
Utah	340,388	1,096	2,206	6,039	25,791	10.3
Wasatch	14,549	33	65	60	775	6.4
Region	382,236	1,201	2,362	6,397	28,972	10.2

Source: US Census Bureau, Census 2000

The resident population of the Mountainland Area has increased steadily since the last census was taken. The region, in 2000, showed an overall population of 413,487 residents, nearly 90% of which live within the boundaries of Utah County. With an annual growth rate of over 2.5% projected through the year 2020 for the region, the area ranks high in population growth compared to almost anywhere else in the United States. An interesting statistic generated by the State of Utah suggests that annual employment growth for the region hovers right at 3% for the same time period, suggesting a possible decrease in the already low unemployment rate, or a significant increase of in-migrating workers to fill the jobs becoming available. A third scenario could be a change in the mix of those in the workforce to include a number from the ranks of those not currently seeking employment, like the elderly, or possibly spouses not now working. Chances are good that the actual reason for the change will be a combination of all three possibilities.

Economy

The economy of the area could be characterized as moderate in some sectors, but with several real concerns and challenges to be addressed. The first is the fact that the region has a very low per capita income level. Large families and low pay scales make for a somewhat unique situation which forces skilled labor out of the area, or in many cases, a second wage earner (usually the spouse) takes a low paying, low skill job to help make ends meet. There is a sense that underemployment is a related problem, although trying to measure underemployment is difficult and the usual data providers do not disseminate the numbers if they are tracked. The sense of home and community is strong in Utah and many seem willing to find alternate, less fulfilling employment rather than moving out of state for better positions.

Another challenge to the economy is the uneven distribution of businesses within the district. Utah County mostly drives the region's labor statistics, especially within the Provo-Orem geographical area; however, other parts of the district don't share much in this business boom. Smaller outlying communities in Summit and Wasatch County, and even southern Utah County, may be struggling to find new business growth and don't share in the prosperity of the sales activity and tax distribution of their neighbors. In other words, the district may experience a 4.9% unemployment rate, but a small rural town might struggle with a 10% or higher rate, taking little comfort in knowing the region is doing so well! With 57% of all labor force non-agricultural jobs showing up in the service and retail trade sectors, there is plenty of cause for concern in the future when the demand for such services could wane because personal spending is curtailed. The regional economy has moved forward in many important ways since district designation twenty-two years ago, but further diversification and balance in the types of jobs available within the region would certainly better stabilize the economy to some extent so that in a downturn, large layoffs and reductions in lower paying jobs would not affect so many workers.

The University of Utah's Bureau of Economic and Business Research publishes a report summarizing the economies of each of Utah's twenty-nine (29) counties. Excerpts of that study are shown in each county's section of the Plan to direct some focus on the economic growth that each Mountainland county has experienced in recent years. It shows a fairly substantial rise in income and sales in each case although there may be some signs of slowing, especially in Utah County, where new residential construction seems to be tapering off compared to preceding years. Some slowing of the region economy is likely to occur during the following decade, especially with the events of 9/11, the tech stock bust, corporate corruption and war with Iraq.

Part II
Plan Pre-Requisites

Prerequisite–Resolution by each Jurisdiction

The following table denotes the plan adoption status for all jurisdictions within the MAG Region. Following the table is an example of the adoption resolution. The Appendix contains copies of all adopted resolutions.

MOUNTAINLAND AOG

STATUS OF INDIVIDUAL COMMUNITY

PRE-DISASTER HAZARD MITIGATION ADOPTION RESOLUTION

Community	No Action	In Process	Completed / Not yet adopted	Completed and adopted
Alpine				
American Fork				
Cedar Fort				
Cedar Hills				
Charleston				
Coalville				
Daniels				
Eagle Mountain				
Elk Ridge				
Francis				
Genola				
Goshen				
Heber				
Henefer				
Hideout				
Highland				
Independence				
Kamas				
Lehi				
Lindon				
Mapleton				
Midway				
Oakley				
Orem				
Park City				
Payson				
Pleasant Grove				
Provo				
Salem				
Santaquin				
Saratoga Springs				
Spanish Fork				
Springville				
Summit County				
Utah County				
Vineyard				
Wallsburg				
Wasatch County				

Woodland Hills				

RESOLUTION NO. __________

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

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

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 pre-disaster funds,

WHEREAS, Mountainland Association of Governments (MAG) has been contracted by the State of Utah to prepare a Pre-Disaster Mitigation Plan covering all of the jurisdictions in the MAG Area, and

WHEREAS, the MAG Executive Council approved MAG Staff to write the plan on February 21st 2002, and

WHEREAS, ____________________City is within the MAG Area, and

WHEREAS, the ______________________ City Council is concerned about mitigating potential losses from natural disasters before they occur, and

WHEREAS, the plan identifies potential hazards, potential loses and potential mitigation measures to limit loses, and

WHEREAS, the ______________________ City Council has determined that it would be in the best interest of the community as a whole to adopt the Pre-Disaster Hazard Mitigation Plan as it pertains to the City, therefore

BE IT RESOLVED BY THE ________________________ CITY COUNCIL THAT:

The attached "Mountainland Association of Governments Pre-Disaster Mitigation Plan" be adopted to meet the requirements of the Disaster Mitigation and Cost Reduction Act of 2000.

This Resolution shall be effective on the date it is adopted.

DATED this __________ day of ______________________, 2010.

Part III
Planning Process

Introduction

The Pre-Disaster Mitigation Plan process was presented to the MAG Executive Council (with elected officials for every jurisdiction) in early 2002. The Executive Council unanimously approved the process, which designated MAG staff (Andrew K. Jackson, Andrew Wooley, Jill Stark) to prepare a multi-jurisdictional plan for adoption by each community. In 2008 the Executive Council was informed that MAG staff (Robert Allen, Andrew Wooley, Kori Iman) would be updating the current plan. A written invitation was sent to the Mayor of every community requesting participation in the planning process.

An Ad-Hoc Disaster Mitigation Plan Committee (Steering Committee) was created to review the current plan and make additions, corrections and updates, including hazard history, updated maps and projections, review and update mitigation strategies. The committee met several times over the course of the plan update. Letters were sent out to the mayors of each community requesting that they have someone attend the meetings. Officials from resource agencies, land managers and special service districts were also invited to attend and participate in the planning process.

Overall, each of the jurisdictions in the Mountainland Region participated in the creation of this plan. Additionally, individuals from multiple agencies and service districts were also involved in the creation of this plan such as: Utah Department of Transportation, Utah Transit Authority, Central Utah Water Conservancy District, BLM, USFS, Red Cross, BYU, UVU, University of Utah, Utah FFSL, and multiple service districts and emergency services agencies.

Plans and Reports Used

Throughout the plan update process the planning team consulted and coordinated with additional plans and reports that contain hazard information. Below is a list of the primary documents used.

- General Plans for each jurisdiction
- Capital Improvement Plans for each jurisdiction (if available)
- CUWCD Hazard Mitigation Plan
- Utah FFSL WUI Plan
- Utah Dept of Agriculture Insect Reports
- National Drought Policy Commission Reports
- FEMA Mitigation Guidelines
- Utah State Hazard Mitigation Plan
- Corps of Engineers FHIS
- Utah Mitigation Handbook
- A Plan to Reduce Losses from Geologic Hazards (Utah Geological Survey)

Ad-Hoc Disaster Mitigation Plan Participation

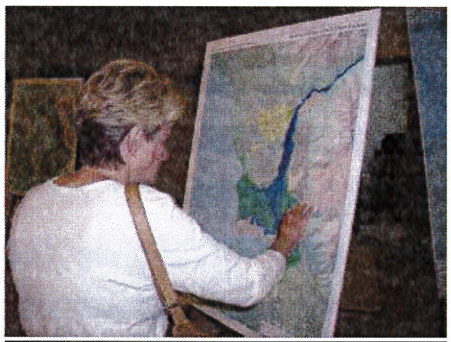
Jurisdiction	Date of a Meeting Attended (*many attended multiple meetings even though only one date is listed*)
Alpine	August 11,2008
American Fork	August 11,2008
Cedar Fort	Individual Participation
Cedar Hills	April 8, 2009
Charleston	August 11,2008
Coalville	January 29, 2010
Daniel	August 11,2008
Draper	August 11,2008
Eagle Mountain	April 8, 2009
Elk Ridge	January 29, 2010
Francis	August 11,2008
Genola	Individual Participation
Goshen	January 29, 2010
Heber	August 11,2008
Henefer	January 29, 2010
Hideout	January 29, 2010
Highland	August 11,2008
Independence	January 29, 2010
Kamas	August 11,2008
Lehi	April 8, 2009
Lindon	August 11,2008
Mapleton	January 29, 2010
Midway	January 29, 2010
Oakley	August 11,2008
Orem	October 19,2009
Park City	August 11,2008
Payson	August 11,2008
Pleasant Grove	August 11,2008
Provo	January 29, 2010
Salem	Individual Participation
Santaquin	October 19,2009
Saratoga Springs	August 11,2008
Spanish Fork	April 8, 2009
Springville	August 11,2008
Summit County	April 9, 2009
Utah County	August 11,2008
Vineyard	January 29, 2010
Wallsburg	January 29, 2010
Wasatch County	August 11,2008
Woodland Hills	August 11,2008

Notice given to smaller communities–Some smaller communities did not have staff available to attend the ad-hoc meetings. These communities were given opportunities to participate by reviewing the draft plan on the web and making comments either in writing, e-mail or over the phone and in individual meetings with the planning staff. These communities are listed above as Individual Participation. Other small communities contract with either the Sheriff's Office or other larger communities for Emergency Services. Since these communities would not be responding to events themselves, they were represented by the agency that actually knows the hazard needs of the community the best.

Public Participation

Public participation is essential to the planning process. Through each step, information on the plan has been posted on the web, and been presented at annual open houses. Additionally, several presentations on this plan have been given to various school and political groups. Public comment was accepted at each of these functions.

Web Site–Information on the plan and the planning process was also available on MAG's web site including an interactive hazard mapping application. Interested parties could e-mail comments on the draft plan from the web site.



A concerned citizen identifies the location of her home as she reviews Dam Failure Map at Open House.

Open Houses–Open Houses were held on the following dates in conjunction with a Transportation Open House. Over 1000 people attended the Open Houses.
October 15th, 16th, and 22nd 2008
October 14th, 21st, and 28th 2009

Continued Participation

Most of the public participation elements listed above will continue throughout the lifespan of this plan. Open houses and presentations are annual events. Most importantly the plan will be readily available on the web along with much of the background information used to create it.

Identifying Hazards–Mountainland Association of Governments identified several hazards that are addressed in the Hazard Mitigation Plan. The hazards were identified through a process that included input from the Plan Steering Committee, public input, researching past disasters and Geographic Information System (GIS) data.

The original hazard mitigation plan identified several potential hazards for the region. The list was reviewed by the Plan Steering Committee to ensure no additional hazards should be included. Mountainland AOG also has a very sophisticated GIS that was used to overlay current and future development with hazard data. This data was used to identify which hazards had the greatest risk within the MAG area. These hazards were then presented in greater detail in the following county portions of this plan.

Regional Mitigation Goals

To coordinate with each participating local government to develop a regional planning process meeting each plan component identified in the FEMA Region VIII Crosswalk document and any additional State planning expectation, both regionally and specifically, as needed, by gathering local input. And to also meet the need of reducing risk from natural hazards in Utah, through the implementation of and updating of regional plans.

These goals form the basis for the development of the PDM Plan and are shown from highest priority, at the top of the list, to those of lesser importance nearer the bottom. The goals were approved early in the planning process by the Planning Committee.

Local Goals

- Protection of life before, during, and after the occurrence of a disaster.
- Preventing loss of life and reducing the impact of damage where problems cannot be eliminated.
- Protection of emergency response capabilities (critical infrastructure)
    - Communication and warning systems
    - Emergency medical services and medical facilities
    - Mobile resources
    - Critical facilities
    - Government continuity
- Protection of developed property, homes and businesses, industry, education opportunities and the cultural fabric of a community, by combining hazard loss reduction with the community's environmental, social and economic needs.
- Protection of natural resources and the environment, when considering mitigation measures.
- Promoting public awareness through education of community hazards and mitigation measures.
- Preserving and/or restoring natural features that provide mitigation such as floodplains.

Long Term Goals

- Eliminate or reduce the long-term risk to human life and property from identified natural and technologic hazards.
- Aid both the private and public sectors in understanding the risks they may be exposed to and finding mitigation strategies to reduce those risks.
- Avoid risk of exposure to identified hazards.
- Minimize the impacts of those risks when they cannot be avoided
- Mitigate the impacts of damage as a result of identified hazards.
- Accomplish mitigation strategies in such a way that negative environmental impacts are minimized.
- Provide a basis for funding of projects outlined as hazard mitigation strategies.
- Establish a regional platform to enable the community to take advantage of shared goals, resources, and the availability of outside resources. If an earthquake occurs outside of Utah County it will still affect Utah County Communities this is similar to many natural hazards.

Objectives

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

- Identification of persons, agencies or organizations responsible for implementation of the goals.
- Projecting a time frame for implementation.
- Explanation of how the project will be financed including the conditions for financing and implementing as information is available.
- Identifying alternative measures, should financing not be available.
- Be consistent with, support, and help implement the goals and objectives or hazard mitigation plans already in place for surrounding counties.
- Be based on the Utah Vulnerability Analysis.
- Have significant potential to reduce damages to public and/or private property and/or reduce the cost of, state, and federal recovery for future disasters.
- Be the most practical, cost-effective, and environmentally sound alternative after consideration of the options.
- Address a repetitive problem, or one that has the potential to have a major impact on an area, reducing the potential for loss of life, loss of essential services and personal property, damage to critical facilities, economic loss, and hardship or human suffering.
- Meet applicable permit requirements.
- Not encourage development in hazardous areas.
- Contribute to both the short and long term solutions to the hazard vulnerability risk problem.
- Assuring the benefits of a mitigation measure is equal to or exceeds the cost of implementation.
- Have manageable maintenance and modification costs.
- When possible, be designed to accomplish multiple objectives including improvement of life-safety risk, damage reduction, restoration of essential services, protection or critical facilities, security or economic development, recovery, and environmental enhancement.
- Whenever possible, use existing resources, agencies and programs to implement the project

Updating the 2004 Plan

The primary task for the planning committee was to update the existing Mountainlands Pre-Disaster Hazard Mitigation Plan. These updates are scattered throughout this plan and are focused in several key areas.

Background Information- The Mountainlands Region has grown and changed since the last plan and regional information has been updated to reflect it.

Hazard Data- All mapping, profiling data for each hazard was updated using the latest and best available sources.

Population and Housing Stock- Great effort was expended in compiling the most recent demographic and assessors data. A new aspect of the plan was to include future populations, buildings and growth into the plan. This is further discussed in the next chapter.

Mitigation Strategies- An increased emphasis was put on each community to increase their mitigation strategies included in the plan. Specifically, each jurisdiction has incorporated multiple strategies per hazard as required.

Plan Maintenance- A weakness of the previous plan was monitoring the progress of mitigation actions taken by individual jurisdictions. A significant change for this plan was to hold at minimum a yearly Plan Steering Committee meeting to review progress and address needed updates to this plan.

While many portions of the plan may seem to look similar to the 2004 plan, each portion has been reviewed and updated to reflect the most current information possible.

Part IV
Risk Assessment

Hazard Identification

Identifying Hazards–Mountainland Association of Governments identified several hazards that are addressed in the Hazard Mitigation Plan. The hazards were identified through an extensive process that included input from the Plan Steering Committee, public input, researching past disasters and Geographic Information System (GIS) data.

Identified Hazards

Hazard	How Identified	Why Identified
Flood	• Review of Past Disasters • Review of FIRMs • Analysis of NSFHA by Army Corps of Engineers • Steering Committee Input • State database • GIS • Public Input	• Most Frequent Hazard • Historically Highest Cost • Readily available data • Successful Mitigation
Wildland Fire	• Review of Past Disasters • Steering Committee Input • State database • GIS • Public Input	• Ever-present Danger • Current Development Patterns Increase likelihood • Historic Data • Potential Loss of Life • 90% Human Caused
Landslide	• Review of Past Disasters • Steering Committee Input • State database • GIS • Public Input	• Ever-present Danger • Current Development Patterns Increase likelihood • Historic Data • Recent Losses
Earthquake	• Review of Past Disasters • Steering Committee Input • State database • GIS • Public Input	• High Potential • Public Awareness • Need for Preparation • Possible High Cost • Potential Increases with Time
Drought	• Review of Past Disasters • Steering Committee Input • State database • GIS • Public Input	• High Potential • Public Awareness • Historic Data • Recent Losses
Severe Weather	• Review of Past Disasters • Steering Committee Input • State database • GIS • Public Input	• High Frequency • Public Awareness • Successful Mitigation • Historic Data • Recent Losses

Infestation	• Review of Past Disasters • Steering Committee Input • State database • GIS • Public Input	• Historic Data • Public Awareness • Recent Events with crickets and West Nile Virus

Profiling Hazard Events

To provide more specific detailed information, the plan has been broken down into separate sections by county. These separate sections deal with *Profiling Hazard Events,* and *Assessing Vulnerability* in greater detail.

Hazard Definitions and Analysis Methodologies

MAG collected data and compiled research on nine hazards: dam failure, earthquake, infestation, flooding, landslide, severe weather, drought, and wildfire. Research materials came from a variety of agencies including DES, AGRC, USGS, USACE, UGS, UFFSL, county GIS, city GIS, County Assessors, and County Emergency Managers. Historical data used to define historic disasters was researched through local newspapers, interviewing residents, local knowledge derived through committee meetings, historic state publications, Utah Museum of Natural History, and recent and historic scientific documents and studies.

Vulnerability Methodology

Geographic Information Systems (GIS) were used as the basic analysis tool to complete the hazard analysis for this plan. The goal of the vulnerability study is to estimate the number of structures and infrastructure vulnerable to each hazard and assign a dollar value to this built environment. For most hazards a comparison was made between digital hazard data and the Regional Inventory.

Regional Inventory

In order to determine the possible extent of damage caused by potential events, a regional inventory was developed. This regional inventory is a compilation of residential, commercial, and critical facilities, their locations and their values. In addition, future development was identified and included in the analysis using general plans and demographic projections.

Residential-Residential data provided with HAZUS (2000 census) was used as a basis for residential inventory. Parcel, assessor, and building permit data from each of the three counties were analyzed and added to determine current numbers, locations, and values of housing units.

Commercial – As with residential, HAZUS (2000 census) data was used as a basis for commercial inventory. Parcel, assessor, and building permit data from each of the three counties were analyzed and added to determine current numbers, locations, and values.

Critical Facilities* – GIS data, local knowledge and parcel data were used to identify Critical Facilities within the region. Critical Facilities for the purpose of this plan are defined as Schools, Fire, Police, and Ambulance stations, Hospitals, and Emergency Operation Centers.

Roads and Bridges – Local GIS Data was provided by the Utah Department of Transportation, counties, local communities and HAZUS to determine locations and replacement costs.

Costs

Item	Cost per Mile
Local Roads	2,000,000
State Highways	2,413,500
US Highways	2,413,500
US Interstates	3,600,000
Power Lines	48,280
Gas Lines	241,390

Future Development – An important aspect of this plan is the addition of future development into the risk analysis. For each of the above categories, general plans, development agreements and community master plans were used to identify the location, number and value (in 2007 dollars).Future jobs affected were determined using Department of Workforce Services Data in combination with plans cited above.

*It was determined by the planning committee that critical infrastructure facilities such as water sewer and power structures be left out of this plan in order to minimize their vulnerability to outside threats (terrorism). Most of the jurisdictions have been advised by security experts to limit the public exposure of these facilities. However, each jurisdiction has been given the option, if they so choose, to have a separate vulnerability assessment of these structures done. The results would not be made available for public consumption or included in this plan for security reasons. At the publication date of this document, no jurisdiction or entity has requested such an assessment.

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 the regional inventory to extract the desired information. However some of the hazards identified are not isolated to specific locations within the region or spatial data is unavailable and are therefore discussed at a regional level. Each hazard and its' specific analysis methodology is defined below.

In terms of hazard mapping presentation in this document, simple, letter size maps were created to provide a graphical illustration of location. Larger maps can be plotted out upon request. A web based data manipulation and maps application was also created as a planning tool, to allow interested persons within Utah, Wasatch and Summit Counties in Utah select a certain jurisdiction and view the various hazards on maps as well as the assessment data. The application has been available on the Mountainland Website since the creation of the data.

This information should not take the place of accurate field verified mapping from which ordinances need to be based off of. Owners of critical facilities should, and in most cases do, have detailed pre-hazard mitigation plans for their specific facilities.

The following table identifies the recurrence and frequency of hazards in Utah. Hazard profiles for each of the counties are in each specific county annex.

Probability

Hazard	Number of Events	Years in Record	Recurrence Interval (years)	Hazard Frequency and Probability/Year
Droughts	17	103	6.06	0.17
Earthquakes	30	133	4.43	0.23
Landslides	1	26	26.00	0.04
Floods	275	53	0.19	5.19
Tornadoes (all)	529	120	0.23	4.41
High wind	50	30	0.60	1.67
Windstorms	839	53	0.06	15.83
Severe Winter Storms	40	41	1.03	0.98
Wildfires	1,102	10	0.01	110.20
Urban Interface Fires	Unknown	Unknown	Unknown	Unknown
Volcanoes	700	5,000,000	7142.86	0.00
Thunderstorms and Lightning (fatalities)	53	19	0.36	2.79

Earthquakes

An earthquake is the abrupt shaking of the earth caused by the sudden breaking of rocks when they can no longer withstand the stresses, which build up deep beneath the earth's surface. The rocks tend to rupture along weak zones referred to as faults. When rocks break they produce seismic waves that are transmitted through the rock outward producing ground shaking. Earthquakes are unique multi-hazard events, with the potential to cause huge amounts of damage and loss. Secondary effects of a sudden release of seismic energy (earthquake) include: ground shaking, surface fault rupture, liquefaction, tectonic subsidence, slope failure, and various types of flooding.

The Intermountain Seismic Belt

The Intermountain Seismic Belt (ISB), which Mountainland is part of, is a zone of pronounced earthquake activity up to 120 miles wide extending in a north south direction 800 miles from Montana to northern Arizona. The Utah portion of the ISB trends from the Tremonton Cache Valley area south through the center of the state, along the Wasatch Front, and the southwest through Richfield and Cedar City concluding in St. George. "The zone generally coincides with the boundary between the Basin and Range physiographic province to the west and the Middle Rocky Mountains and Colorado Plateau physiographic provinces to the east" (Eldredge 6).

Secondary Earthquake Threats

The major secondary effects of earthquakes include: ground shaking, surface fault rupture, liquefaction, tectonic subsidence, avalanches, rock fall, slope failure, and various types of flooding. Other sections discuss landslides, and flooding therefore they will not be discussed under secondary effects of earthquakes yet importance needs to be given to the fact that earthquakes can increase the likelihood of flooding and landslides.

Ground Shaking

Ground shaking causes the most impact during an earthquake because it affects large areas and is the origin of many secondary effects associated with earthquakes. Ground shaking, which generally lasts 10 to 30 seconds in large earthquakes, is caused by the passage of seismic waves generated by earthquakes. Earthquake waves vary in both frequency and amplitude. High frequency low amplitude waves cause more damage to short stiff structures, were as low frequency high amplitude waves have a greater effect on tall (high-rise) structures. Ground shaking is measured using Peak Ground Acceleration (PGA). The PGA measures the rate in change of motion relative to the established rate of acceleration due to gravity.

Local geologic conditions such as depth of sediment and sediment make up, affect earthquake waves. Deep valley sediments increase the frequency of seismic waves relative to bedrock. In general, ground shaking increases with increased thickness of sediments" (Eldredge 8). Findings in recent geologic research done by Ivan Wong indicate and earthquake in Salt Lake County would produce higher PGA values than previously expected near faults and areas of near surface bedrock.

Surface Fault Rupture

During a large earthquake fault movement may propagate along a fault plain to the surface, resulting in surface rupture along the fault plain. The Wasatch fault is a normal (mountain building) fault with regards to movement, meaning the footwall of the fault moves upward and the hanging wall moves in a down direction. Thus faulting is on a vertical plain, which results in the formation of large fault scarps. Surface fault rupture along the Wasatch fault is expected for earthquakes with magnitudes of 6.5 or larger.

The largest probable earthquake that could strike the Mountainland region is an earthquake with an estimated magnitude between 7.0 and 7.5; an earthquake of this magnitude, based on current research, would create "surface fault rupture with a displacement of between 16 to 20 feet in height with break segments 12 to 44 miles long" (Eldredge 10). In historic time surface fault rupture has only occurred once in Utah; the 1934 Hansel Valley earthquake with a magnitude 6.6 produced 1.6 feet of vertical offset.

Surface fault rupture presents several hazards, anything built on top of the fault or crossing the fault has a high potential to be destroyed in the event of displacement. Foundations will be cracked, building torn apart, damage to roads, utility lines, pipelines, or any other utility line crossing the fault. It is almost impossible to design anything within reasonable cost parameters to withstand an estimated displacement of 16 to 20 feet.

Picture 4.1 Displacement in excavation near Downtown Salt Lake.

Various Flooding Issues Related to Earthquakes

Earthquakes could cause flooding due to the tilting of the valley floor, dam failure and seiches in lakes and reservoirs. Flooding can also result from the disruption of rivers and streams. Water tanks, pipelines, and aqueducts may be ruptured, or canals and streams altered by ground shaking, surface faulting, ground tilting, and landsliding.

Seiches

Standing bodies of water are susceptible to earthquake ground motion. Water in lakes and reservoirs may be set in motion and slosh from one end to the other, much like in a bathtub. This motion is called a seiche (pronounced "saysh"). A seiche may lead to dam failure or damage along shorelines.

Analysis - HAZUS

HAZUS MH shorthand for Hazards United States Multi-Hazard was used to determine vulnerability as it relates to seismic hazards for the study area. 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 so that locally developed inventories and other data that more accurately reflect the local environment can be substituted, resulting in increased accuracy.

For this plan, the software flexibility was extensively utilized to augment the analysis results. As discussed in the regional inventory section above, local, up to date data was added to the embedded inventory data including residential, commercial and critical facilities data. Future development data was also added to reflect potential growth and development patterns within the analysis. For earthquakes, seismologists from the University of Utah Seismology Department provided a shake map and expert advice on probable locations and magnitudes for each of the three counties. The HAZUS model was then run for each individual county to simulate a likely seismic even. This analysis was used to formulate loss estimates.

As a function of the HAZUS model, all of the damaging effects of a potential earthquake are analyzed and incorporated into the loss estimates. This is especially important to the Mountainland Region considering the large areas of potential liquefaction in the valley floors. The addition of local liquefaction potential areas to the model is another example augmenting the existing data in the model to increase the accuracy of the results.

Accuracy

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 and augmented data, 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.

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.

Limited availability of digital data represented a problem in completing the vulnerability assessment. Additional limitations to the above described analysis method includes:

Limited data sets.
Lack of digital parcels data from the Wasatch County Assessor's offices.
HASUZ MH is not designed for small population counties.
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.

Potential Mitigation Strategies

The following mitigation strategies are provided so that communities may be aware of measures that could be used to limit the exposure to earthquake related damage.

Prevention

- Planning and Zoning
- Building construction regulation
- Regulation of other facilities (critical)

Property Protection

- Non-structural methods
- Retrofit upgrades
- Earthquake Insurance

Natural Resource Protection

- Identify Fault Rupture zones
- Identify secondary impact

Emergency Services

- Earthquake threat recognition
- Emergency Planning for Secondary Impact
- Emergency response (Mutual Aid, CERT)
- Critical Facilities Protection
- Health and safety maintenance
- Post-Disaster recovery and mitigation

Structural Projects

- Rebuild or retrofit critical facilities to higher seismic code
- Rebuild or retrofit infrastructure to higher seismic code

Public information

- Seismic maps; liquefaction, fault zones
- Map Information
- Outreach projects
- Real estate disclosures
- Library
- Technical Assistance
- Education

Flooding

Flooding is a temporary overflow of water onto lands not normally inundated by water producing measurable property damage or forcing evacuation of people and vital resources. Floods frequently cause loss of life; property damage and destruction; damage and disruption of communications, transportation, electric service, and community services; crop and livestock damage and loss, and interruption of business. Floods also increase the likelihood of hazard such as transportation accidents, contamination of water supplies, and health risk increase after a flooding event.

Several factors determine the severity of floods including rainfall intensity, duration and rapid snow melt. A large amount of rainfall over a short time span can result in flash flood conditions. Small amounts of rain can also result in flooding at locations where the soil has been previously saturated or if rain concentrates in an area having, impermeable surfaces such as large parking lots, paved roadways, or post burned areas with hydrophobic soils. Topography and ground cover are also contributing factors for floods. Water runoff is greater in areas with steep slopes and little or no vegetative ground cover.

Frequency of inundation depends on the climate, soil, and channel slope. In regions where substantial precipitation occurs during a particular season or in regions where annual flooding is due to spring melting of winter snow pack, areas at risk may be inundated nearly every year.

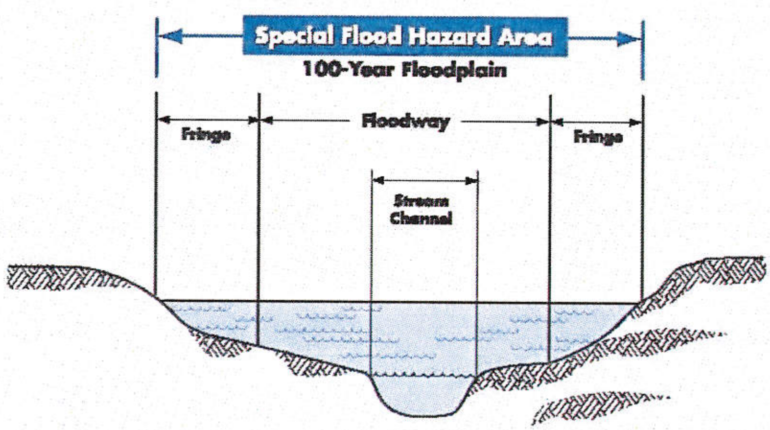
Conditions which may exacerbate floods:

Impermeable surfaces
Steeply sloped watersheds
Constrictions
Obstructions
Debris
Contamination
Soil saturation
Velocity

Explanation of Common Flood Terms

FIRM: Flood Insurance Rate Map

100-year flood: Applies to an area that has a 1 percent chance, on average, of flooding in any given year. However, a 100-year flood could occur two years in a row, or once every 10 years. The 100 year-flood is also referred to as the base flood.



Base Flood: Is the standard that has been adopted for the NFIP. It is a national standard that represents a compromise between minor floods and the greatest flood likely to occur in a given area and provides a useful benchmark.

Base Flood Elevation (BFE): As shown on the FIRM, is the elevation of the water surface resulting from a flood that has a 1% chance of occurring in any given year. The BFE is the height of the base flood, usually in feet, in relation to the National Geodetic Vertical Datum (NGVD) or 1929, the North American Vertical Datum (NAVD) of 1988, or other datum referenced in the FIS report.

National Flood Insurance Program (NFIP): The NFIP is a Federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages. Participation in the VFIP is based on an agreement between communities and the Federal Government. If a community adopts and enforces a floodplain management ordinance to reduce future flood risk to new construction in floodplains, the Federal Government will make flood insurance available within the community as a financial protection against flood losses. This insurance is designed to provide an insurance alternative to disaster assistance to reduce the escalating costs of repairing damage to buildings and their contents caused by floods.

Special Flood Hazard Area (SFHA): Is the shaded area on a FIRM that identifies an area that has a 1% chance of being flooded in any given year (100-year floodplain).

Floodway: Is the stream channel and that portion of the adjacent floodplain that must remain open to permit passage of the base flood without raising that water surface elevation by more than one foot.

Method of Analysis

The flooding analysis methodology is a hybrid of both HAZUS and spatial forms. HAZUS software has the capability of creating its own potential flood areas separate from the local flood plain data. These new flood areas were combined with the most accurate and current flood plain data to form the hazard spatial data which was overlaid with the regional inventory data to produce loss estimates.

Potential Mitigation Strategies

The following mitigation strategies are provided so that communities may be aware of measures that could be used to limit the exposure to flood related damage.

Prevention

- Planning and Zoning
- Floodplain open space preservation
- Building construction regulation
- Regulation of other facilities (critical)
- Stormwater management

Property Protection

- Relocation
- Acquisition
- Building elevation
- Flood proofing
- Lifeline protection
- Flood Insurance

Natural Resource Protection

- Wetlands protection
- Erosion and sediment control

Emergency Services

- Flood threat recognition
- Warning dissemination
- Flood response
- Critical Facilities Protection
- Health and safety maintenance
- Post-Disaster recovery and mitigation

Structural Projects

- Reservoirs/impounds
- Levees
- Diversions
- Channel and drainage modifications
- Channel and basin maintenance

Public information

- Flood Hazard maps
- Map Information
- Outreach projects
- Real estate disclosures
- Library
- Technical Assistance
- Environmental education

Dam Failure

Dam failures result from the failure of a man made water impoundment structure, which often results in catastrophic down grade flooding. Dam failures are caused by one or a combination of the following: "breach from flooding or overtopping, ground shaking from earthquakes, settlement from liquefaction, slope failure, internal erosion from piping, failure of foundations and abutments, outlet leaks or failures, vegetation and rodents, poor construction, lack of maintenance and repair, misuse, improper operation, terrorism, or a combination of any of these" (Eldredge 46). The Utah State Engineer has been charged with regulating non-federal dams in the State since 1919. "In the late 1970's Utah started its own Dam Safety Section within the State of Utah Engineers Office to administer all non-federal dams in response to the Federal Dam Safety Act (PL-92-367)" (Eldredge 46).

The State Dam Safety Section has developed a hazard rating system for all non-federal dams in Utah. Downstream uses, the size, height, volume, and incremental risk/damage assessments of dams are all variables used to assign dam hazard ratings in the Dam Safety classification system. Using the hazard ratings systems developed by the Dam Safety Section, dams are placed into one of three classifications high, moderate, and low. Dams receiving a low rating would have insignificant property loss do to dam failure. Moderate hazard dams would cause significant property loss in the event of a breach. High hazard dams would cause a possible loss of life in the event of a rupture. The frequency of dam inspection is designated based on hazard rating with the Division of Water Rights inspecting high-hazard dams annually, moderate hazard dams biannually and low-hazard dams every five years. There are 151 dams within the Mountainland Region of those 43 have received a high hazard rating by Dam Safety.

The following information regarding a failure of both Jordenelle and Deer Creek Dams and resulting loss was prepared by the United States Department of the Interior Bureau of Reclamation entitled "Dam Failure and Maximum Operational Release, Inundation Study: Deer Creek Dam" completed, February 2002.

Introduction and Purpose

On February 27, 1995, the Commissioner of the Bureau of Reclamation (Reclamation) issued a policy statement regarding establishing an Emergency Management Program at Reclamation dams. This policy stated that Reclamation would offer technical support and assistance to communities and jurisdictions downstream of Reclamation dams to ensure that adequate dam-specific emergency operation plans are in place. Directives for the emergency management program state that Emergency Actions Plans (EAP) shall be developed and are to contain descriptions of potentially affected areas in the flood plain with inundation maps wherever appropriate. This dam failure study was prepared to meet the goals and objectives of the Commissioner's directives.

The purpose of this study is to identify potential flood hazard areas resulting from the unlikely events of "sunny day" failure of Deer Creek Dam, the maximum operational release of Deer Creek Dam and the "sunny day" failure of Jordanelle Dam resulting in the failure of Deer Creek Dam due to overtopping.

These studies are standard practice within Reclamation and therefore do not reflect in any way upon the integrity of either Jordanelle or Deer Creek Dams.

Previous Studies

The Denver Office completed a previous Flood Inundation Study in June of 1990. It addressed two conditions, 1) a PMF (Probable Maximum Flood) causing the failure of Deer Creek Dam; and 2) a PMF (Probable Maximum Flood) causing the failure of Jordanelle Dam, which then results in the failure of Deer Creek Dam. Both scenarios were accomplished using the National Weather Service (NWS) DAMBRK model. Cross sections and some dam breach parameters were obtained from these studies for use in this report.

Description of Jordanelle Dam

Jordanelle Dam and reservoir is located on the Provo River in Wasatch County in north central Utah about 5 miles north of Heber City, Utah. Jordanelle Dam is a rolled earthfill structure with a fuse plug emergency spillway and outlet works. The reservoir has a storage capacity of 311,000 acre-feet at active conservation, which is elevation 6,166.4 feet. The total reservoir storage capacity is 361,500 acre-feet at elevation 6,182.0.

The rolled earth embankment section of Jordanelle Dam has a structural height of 300 feet and a crest length of 3820 feet at elevation 6185.0 feet.

The emergency fuse plug spillway is located near the left abutment and consists of an unlined inlet channel, a concrete lined trapezoidal channel, an earthen plug section, a concrete chute, and a 9.5-foot by 10-foot concrete double box conduit. The design flow of the spillway is 5,510 cfs at elevation 6182.0 feet.

The outlet works is located within the left abutment and consists of two primary outlet works intake structures one (LLOW) Low level outlet works and one (SLOW) selective level outlet works merging into a common outlet pipe and a bypass system. The capacities for the outlet works are 3,269 cfs and 2,153 cfs respectively at elevation 6,086.7. The bypass system taps into both the SLOW and LLOW upstream of the emergency gates with a capacity of 300 cfs at elevation 6,166.0 feet.

The primary purpose of the reservoir is to provide M&I water for use in Salt Lake City and northern Utah County. Additional project purposes include flood control, recreation, Heber Valley irrigation water, and fish and wildlife enhancement.

Description of Deer Creek Dam

Deer Creek Dam and reservoir are located on the Provo River about 16 miles northeast of Provo, Utah and about 10 miles southwest of Heber City, Utah. Deer Creek Dam consists of a zoned earthfill structure, spillway and outlet works. The reservoir has a storage capacity of 152,570 acre-feet at the top of the gates, which is elevation 5,417 feet.

Deer Creek Dam has a structural height of 235 feet and a crest length of 1,304 feet at elevation 5,425 feet. There is a parapet wall, which extends 3.5 feet above the crest to elevation 5,428.5 feet.

The concrete chute spillway, located on the right abutment of the dam, is controlled by two 21- by 20-foot high radial gates. The spillway crest elevation is 5,397.0 feet and has a capacity of 12,000 cfs at elevation 5,420.1 feet.

The outlet works, located in the left abutment of the dam consists of: a drop type trashrack structure, a 12-foot-diameter circular tunnel, a gate chamber with two 5-foot by 6-foot high-pressure emergency gates side by side, an 11-foot 6-inch by 17-foot access tunnel which holds two 72-inch-diameter steel penstocks that carry water into the power plant. The capacity of the outlet works is 1,500 cfs at elevation 5,420 feet.

Deer Creek Reservoir is part of a collection system, which stores and releases water from the Duchesne River, Weber River, and also the Provo River drainage. The primary recipients of the water are cities and farms along the Wasatch Front. It also provides year-round power generation and is used heavily for recreational purposes.

Method of Analysis

The primary purpose of the inundation maps is for warning and evacuation in the event of a dam failure or a large reservoir release. Values chosen to approximate physical characteristics such as dam failure breach parameters, channel roughness coefficients, etc., are based on assumptions and are used to produce best estimates of the downstream inundation. Thus, actual inundation were it to occur, could be greater or less than that indicated on the inundation maps.

For this study, the results of the one dimensional National Weather Service (NWS) DAMBRK model performed by the Denver Office was used to obtain the dam break flows from both Jordanelle Dam to Deer Creek Dam and from Deer Creek Dam to the mouth of Provo Canyon. However, the terrain beyond the mouth of Provo canyon is an alluvial fan, which unlike the narrow confined canyon, is a broad, flat plain. A two dimensional model is more appropriate for this type of terrain. It provides a more accurate depiction of the topography and allows for the water to spread and follow multiple drainage paths. The modeling tools used for the Orem/Provo areas utilized the Danish Hydraulic Institute's MIKE 21 two-dimensional hydrodynamic flow model. MIKE 21 is a 2-D finite difference model that simulates unsteady 2-D flows in (vertically homogeneous) fluids using the Saint Venant equations. ARCINFO GIS software is used as both a pre and post processor for the MIKE 21 model. Data used for the Deer Creek Dam models came from 7.5 minute, 10-meter resolution, digital elevation models (DEM) prepared by Land Info Inc., of Aurora, Colorado. The 10-meter data was then resampled at 30-meter cell size for use in the MIKE 21 models. The 10-meter elevation data appeared to be satisfactory for this study however for a more detailed study of the metropolitan area a better resolution of elevation data is recommended.

Study Details

Sunny Day Failure of Jordanelle Dam resulting in the failure of Deer Creek Dam due to overtopping.

The model using the National Weather Service DAMBRK program, with BOSS Corporation software enhancements, was used in the routing from Jordanelle Dam thru Deer Creek Reservoir and then to the mouth of the Provo canyon. The MIKE 21 two-dimensional (2-D) computer model was used in routing the releases from the mouth Provo canyon to Utah Lake.

Cross sections of the downstream areas of both Jordanelle and Deer Creek Dams that were used in the DAMBRK model were obtained from the 1990 study performed by the Denver Office.

The storage capacity for Jordanelle Reservoir was taken from the 1993 area capacity tables. Jordanelle reservoir water surface is assumed to be at active conservation, elevation 6166.4 feet, at the beginning of the piping failure simulation. The failure of Jordanelle Dam was assumed to develop in 2.0 hours, with piping beginning at elevation 6,000 feet. A bottom breach width of 500 feet was assumed, with side slopes of 1: 0.50, which resulted in a peak flow of 3,542,000 cfs.

Table 4.5 indicates the sensitivity of breach parameters by varying the time of dam breach formation and leaving the other parameters the same. The 2-hour breach time was assumed conservative considering the design and construction criteria of the dam.

Breach Parameters of Jordanelle Dam

Time of Breach Formation (hours)	Bottom Breach Width (feet)	Breach Side Slopes	Maximum Flow at Jordanelle Dam (CFS)
1.0	500	1: 0.50	5,020,000
*2.0	500	1: 0.50	3,542,000
3.0	500	1: 0.50	2,806,000

The storage capacity for Deer Creek Reservoir was taken from the 1962 area capacity tables. Deer Creek reservoir water surface is assumed to be at top of conservation, elevation 5417 feet at the beginning of Jordanelle Dam Failure. Deer Creek Dam is assumed to fail when the water surface reaches 1 foot over the top of the parapet wall at elevation 5428.5 feet. The breach develops in 1 hour and achieves a bottom breach width of 300 feet. A DAMBRK hydrograph, was taken at the mouth of Provo Canyon at river mile 10.0, and used as input data for the MIKE 21 model. The MIKE 21 input parameters used in this routing are listed in Table 4.6.

MIKE 21 input parameters

Flooding parameter*	0.15 meters
Drying parameter*	0.1 meters
Time step interval	1 second
Mannings "n" value	0.04

* The flooding parameter sets the minimum water depth required in a given cell in order for water to begin flowing into adjacent model cells. Conversely, the drying parameter sets a depth requirement below which the cell begins to dry out.

Sunny Day Failure of Deer Creek Dam due to piping

The model using the National Weather Service DAMBRK program, with BOSS Corporation software enhancements were used in the routing to the mouth of Provo canyon. The MIKE 21 two-dimensional (2-D) computer model was used in routing the releases from the mouth Provo canyon to Utah Lake. Cross sections of the downstream areas of both Jordanelle and Deer Creek Dams used in the DAMBRK model were obtained from the 1990 study performed by the Denver Office.

Deer Creek reservoir water surface is assumed to be at top of conservation, elevation 5417 feet at the beginning of the piping failure. The breach is assumed to develop in 1 hour and achieve a bottom breach width of 500 feet, which resulted in a peak flow of 1,550,000 cfs. Table 4.7 indicates the sensitivity of breach parameters by varying the time of dam breach formation and leaving the other parameters the same. The 1-hour breach time was assumed conservative considering the design and construction criteria of the dam.

Breach Parameters of Deer Creek Dam

Time of Breach Formation (hours)	Bottom Breach Width (feet)	Breach Side Slopes	Maximum Flow at Deer Creek Dam (CFS)
0.5	500	1: 0.50	1,826,000
1.0	500	1: 0.50	1,550,000
2.0	500	1: 0.50	1,275,000

A DAMBRK hydrograph, was taken at the mouth of Provo Canyon at river mile 10.0, and used as input data for the MIKE 21 model. The MIKE 21 input parameters used in this routing are listed in Table 4.8.

MIKE 21 input parameters

Flooding parameter*	0.3 meters
Drying parameter*	0.2 meters
Time step interval	1 second
Mannings "n" value	0.04

* The flooding parameter sets the minimum water depth required in a given cell in order for water to begin flowing into adjacent model cells. Conversely, the drying parameter sets a depth requirement below which the cell begins to dry out.

Deer Creek Dam Maximum Operational Release

The maximum operational release from Deer Creek Dam was modeled using a constant outflow of 13,500 cfs. The 13,500 cfs release was based on the maximum release from the dam and was used to indicate maximum water depths at each cross section using a constant flow. This was considered a conservative estimate based on the assumption that the flow would not generally maintain this volume at each cross section, but instead would decrease in depth as the reservoir emptied. The same constant flow of 13,500 cfs was used as input data for the MIKE 21 model, which begins at the mouth of Provo Canyon. MIKE 21 input parameters are listed in Table 4.9.

MIKE 21 input parameters

Flooding parameter*	0.3 meters
Drying parameter*	0.2 meters
Time step interval	1 second
Mannings "n" value	0.04

* The flooding parameter sets the minimum water depth required in a given cell in order for water to begin flowing into adjacent model cells. Conversely, the drying parameter sets a depth requirement below which the cell begins to dry out.

Downstream routing and description

The study begins at Jordanelle Dam located on the Provo River about 5 miles north of Heber City, Utah, and extends through Deer Creek Reservoir and Dam to Utah Lake near Provo, Utah. Seven cross sections from the study performed in 1991 were used to identify the area below Jordanelle Dam. The cross sections extended along the Provo River approximately 9.0 river miles to Deer Creek Reservoir. Six cross sections from the study performed in 1991 were used to identify the area below Deer Creek Dam. The cross sections extended along the Provo River approximately 10 river miles to the mouth of Provo Canyon. The cross sections were obtained using U.S. Geological Survey Quadrangle maps (Scale 1:24000) consisting of 40-foot contours. The Manning's n value used to represent the roughness coefficient of the downstream channel to the mouth of the canyon was 0.04. Some minor adjustments were made to some of the cross sections in order to obtain numerical stability in the DAMBRK model. Beyond the mouth of the canyon, it flows through some of Orem and Provo, Utah and then into Utah Lake.

Study Results

The results indicate that flooding resulting from the sunny day failures of either Jordanelle or Deer Creek Dams will inundate the residential areas along the Provo Canyon corridor and in Orem and Provo, which could result in the loss of life. In addition, parts of Springville located within the flood plain south of Provo, Utah as well as major highways and road crossings would be heavily impacted by the floodwaters.

The routings of the floods were terminated at approximately 10 hours for the sunny day failure of Jordanelle and Deer Creek Dams. About 10 hours after flooding begins, most of the floodwaters are safely contained by Utah Lake. The results of the flood routing are listed in the attached tables.

Sunny day failure of Jordanelle Dam resulting in the failure of Deer Creek Dam due to overtopping, identifies results obtained from the sunny day failure of Jordanelle Dam modeled as a piping failure. The table includes the maximum water surface, peak flows, and flood arrival times from the beginning of the failure of Jordanelle Dam to the flood arrival at the mouth of Provo Canyon.

Sunny day failure of Jordanelle Dam

River Miles Downstream of Deer Creek Dam	Maximum Water Surface Elev (Feet)	Depth Above Streambed (Feet)	Arrival Time of Leading Edge (Hrs)	Arrival Time of Peak Flow (Hrs)	Maximum Flow (CFS)	Location
0.0	5439	165	River Miles Downstream of Deer Creek Dam	2.5	3,573,000	Deer Creek Dam
10.0	4926	104	2.0	2.9	3,124,000	Mouth of Provo Canyon

*Arrival times are from the beginning of Jordanelle Dam failure
*Mile 0.0 is at the downstream toe of Deer Creek Dam

Sunny day failure of Jordanelle Dam resulting in the failure of Deer Creek Dam identifies results obtained from the sunny day failure of Jordanelle Dam. The table covers the area from the mouth of Provo Canyon to Utah Lake. Maximum discharge and times, at Provo City, were extracted from the MIKE21 model output file for use in the table.

Sunny day failure of Jordanelle Dam

River Miles Downstream of Deer Creek Dam	Estimated Time to Leading Edge (Hrs)	Time to Maximum Discharge (Hrs)	Calculated Maximum Discharge (CFS)	Location
14.5	2.5	3.0	3,085,000	Provo City

*Times to discharges are from the beginning of Jordanelle Dam failure

Sunny day failure of failure of Deer Creek Dam identifies results obtained from the sunny day failure of Deer Creek Dam modeled as a piping failure. The table includes the maximum water surface, peak flows, and flood arrival times from the beginning of the failure of Deer Creek Dam to the flood arrival at the mouth of Provo Canyon.

Sunny day failure of Deer Creek Dam

River Miles Downstream of Deer Creek Dam	Maximum Water Surface Elev (Feet)	Depth Above Streambed (Feet)	Arrival Time of Leading Edge (Hrs)	Arrival Time of Peak Flow (Hrs)	Maximum Flow (CFS)	Location
0.0	5381	107	0.1	0.7	1,550,000	Deer Creek Dam
10.0	4915	93	0.8	1.1	1,397,000	Mouth of Provo Canyon

*Arrival times are from the beginning of Deer Creek Dam failure
*Mile 0.0 is at the downstream toe of Deer Creek Dam

Sunny day failure of Deer Creek Dam, identifies results obtained from the sunny day failure of Deer Creek Dam. The table covers the area from the mouth of Provo Canyon to Utah Lake. Maximum discharge and times, at Provo City, were extracted from the MIKE21 model output file for use in the table.

Sunny day failure of Deer Creek Dam

River Miles Downstream of Deer Creek Dam	Estimated Time to Leading Edge (Hrs)	Time to Maximum Discharge (Hrs)	Calculated Maximum Discharge (CFS)	Location
14.5	0.9	1.2	1,386,000	Provo City

*Times to Maximum discharge are from the beginning of Deer Creek Dam failure

Maximum operational release of Deer Creek Dam identifies the results of the maximum operational release from Deer Creek Dam to the mouth of Provo Canyon, based on the maximum release of 13,500 cfs. The table includes the maximum water surface, depth above streambed, and peak flows obtained at the cross sections modeled.

Maximum operational releases of Deer Creek Dam (Releases are based on continuous flow of 13,500 cfs)

River Miles Downstream of Deer Creek Dam	Maximum Water Surface (Elev)	Depth Above Streambed (Feet)	Maximum Flow (CFS)
0.0	5289	15	13,500
10.0	4836	14	13,500

*Mile 0.0 is at the downstream toe of Deer Creek Dam

Inundation Maps

Inundation maps produced from this study are shown on U.S. Geological Survey Quadrangle maps (Scale 1:24,000). They combine flood inundation boundaries from both the National Weather Service's (NWS) DAMBRK one dimensional model, which was used to route flows between Deer Creek Dam and the mouth of Provo Canyon, and MIKE 21, the two dimensional model which terminates at Utah Lake. The flood inundation boundaries shown on the maps for each scenario were taken from the 1993 study and are depicted in red from the dam to the mouth of Provo Canyon. The flood boundaries from the mouth of Provo Canyon to Utah Lake are color coded according to water depth. The water depths shown on the map represent an estimate of the maximum water depth that could occur at various locations within the inundated area. Also shown are colored lines that indicate the progression of the leading edge of the flooding at various time intervals. These time-sequenced flood-progression lines do not correlate directly to the water depths of the maximum inundation boundary. The inundation boundary for the 1-D operational release from Deer Creek Dam to the mouth of Provo canyon was not included on the maps due to the coarse topography indicated on the 1:24000 scale quadrangles.

The maps are located in the county annexes.

General Methodology

In addition to the above study and inundation maps, the Utah Dam Safety Section provided inundation maps for other dams in the Mountainland Region. This spatial data was again overlaid with the regional inventory to create loss estimates.

Wildland Fire

Identifying Hazards

A wildfire is an uncontrolled fire spreading through vegetative fuel often exposing or consuming structures. Wildfires often begin unnoticed and spread quickly and are usually sighted by dense smoke. Wildfires are placed into two classifications Wildland and Urban-Wildland Interface. Wildland fires are those occurring in an area where development is essentially nonexistent, except for roads, railroads, or power lines. Urban-Wildland Interface fire is a wildfire in a geographical area where structures and other human development meet or intermingle with wildland or vegetative fuels. URWIN areas are divided into three subclasses, each evident in counties within Mountainland:

Occluded

Occluded interface, are areas of wildlands within an urban area for example a park bordered by urban development such as homes.

Intermixed

Mixed or intermixed interface areas contain structures scattered throughout rural areas covered predominately by native flammable vegetation.

Classic

Classic interface areas are those areas where homes press against wildland vegetation along a broad front.

When discussing wildfires it is important to remember that fires are part of a natural process and are needed to maintain a healthy ecosystem. Three basic elements are needed for a fire to occur (1) a heat source (2) oxygen and (3) fuel. Two of the three sources are readily available in the counties making up the Mountainland region. Major ignition sources for wildfire are lightning and human causes such as arson, prescribed burns, recreational activities, burning debris, and carelessness with fireworks. On average, 65 percent of all wild fires started in Utah can be attributed to human activities. Once a wildfire has started, vegetation, topography and weather are all conditions having an affect wildfire behavior.

Methodology

Spatial data for potential wildfire areas were obtained from the Utah Department of Forestry, Fires and State Lands and the National Forest Service. As with other hazards, the simple and effective spatial methodology was to overlay these data sets with the regional inventory within GIS to produce loss estimates.

Potential Mitigation Strategies

The following mitigation strategies have been provided so that communities may be aware of measures that could be used to limit the exposure to Wildland Fire related damage.

Prevention

- Zoning ordinances to reflect fire risk zones

- Regulate development areas near fire protection and water resources
- Planning to include: spacing of buildings, firebreaks, on-site water storage, wide roads, multiple access
- Code standards for roof materials and fire protection systems
- Maintenance programs to clear dead and dry brush
- Regulations on open fires
- Open space around structures

Property Protection

- Retrofitting roofs, add spark arrestors
- Create and maintain defensible space
- Insurance
- Eliminate ladder fuels
- Install sprinkler systems
- Develop fire resistant plans
- Have home addresses clearly displayed
- Clean out rain gutters

Natural Resource Protection

- Require mitigation of development in high-risk areas
- Understand impact of non-native vegetation
- Promote tread soft ATV use
- Develop watershed management plans
- Maintain watersheds
- Establish and promote fuel reduction

Emergency Services

- Mutual aid agreement for fire fighting
- Participate in State Wildfire Suppression Fund
- Develop and exercise local wildfire response plan and evacuation plans

Structural Projects

- Construct wildfire fuel breaks
- Install Heliport water stations
- Tree and underbrush thinning in critical areas
- Increase the number of fire hydrants
- Install water tanks

Public information

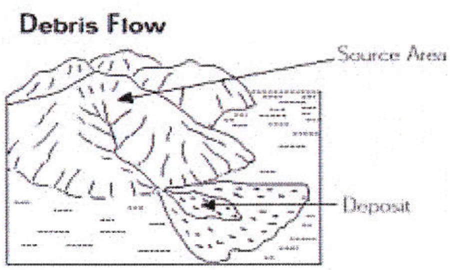
- Develop maps for wildfire hazard areas
- Mail wildfire information to owners high-risk structures
- Develop urban wildfire "How to protect your home from Wildfires" book
- Publish newspaper articles on wildfires

- Presentations on wildfires at community meetings
- Develop displays for public buildings and events
- Real estate disclosure of high hazard wildland fire area

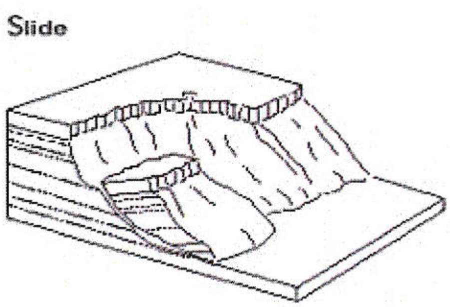
Landslides

Landslides are a "down slope movement of a mass of rock, earth, or debris". Landslides, often referred to as mass wasting or slope failures, are one of the most common natural disasters (Cruden 36). Slope failures can vary considerably in shape, rate of movement, extent, and effect on surrounding areas. Slope failures are classified by their type of movement, and type of material. The types of movement are classified as falls, slides, topples, and flows. "The types of material include rock, debris (coarse grained soil) and earth (fine grained soil)" (Eldredge 17). "Types of slope failures then are identified as rock falls, rock slides, debris flows, debris slides, and so on" (Eldredge 17). Slope failures occur because of either an increases in the driving forces (weight of slope and slope gradient) or a decrease in the resisting forces (friction, or the strength of the material making up a slope). "Geology (rock type and structure), topography (slope gradient), water content, vegetative cover, and slope aspect are important factors of slope stability" (Eldredge 18).

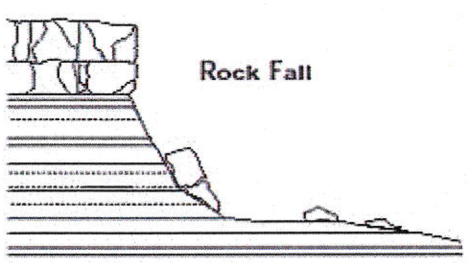
Three Common Types of Landslides in Utah



Debris flows consist of sediment-water mixtures that flow down a streambed or hillside, commonly depositing sediment at canyon mouths in fan like deposits know as alluvial fans.



Slides are down slope movements of soil or rock on slopes.



Rock falls consist of rock(s) falling from a cliff or cut slope and are very common in the canyon country of southern Utah.

Conditions That Make Slopes More Susceptible to Landslides

- Discontinuities: faults, joints, bedding surfaces.
- Massive Materials over soft materials.
- Orientations of dip slope: bedding plans that dip out of slope.
- Loose structure and roundness.
- Adding weight to the head of a slide area: rain, snow, landslides, mine waste piles, buildings, leaks from pipes, sewers, and canals, construction materials fill materials.
- Ground shaking: earthquakes or vibrations.
- Increase in lateral spread caused by mechanical weathering.
- Removal of lateral support.
- Human activities: cut and fill practices, quarries, mine pits, road cuts, lowering of reservoirs.
- Removing underlying support: under cutting of banks in a river.
- Increase in pore water pressure: snow melt, rain, and irrigation.
- Loss of cohesion.

Methodology

Spatial data for potential landslide areas were obtained from the Utah Geological Survey. Unfortunately, such data does not exist for Summit County. Therefore topographical data was analyzed within GIS software to create areas of potential landslides. While this may be a simple method of producing such data, ignoring the potential within this study is ineffective. As with all hazard data and analyses within this plan, additional study by experienced professionals should be done to determine definitive information on the location of hazards and the extent of potential damages. As with other hazard methodologies, the simple and effective spatial methodology was to overlay these data sets with the regional inventory within GIS to produce loss estimates.

Potential Mitigation Strategies

The following mitigation strategies are provided so that communities may be aware of methods that could be used to limit the exposure to landslide/Problem Soils related damage.

Prevention

- Planning and zoning restrictions and regulations
- Open Space
- Building Codes
- Drainage system maintenance
- Monitor and evaluate areas after wildfire
- Install ground monitoring instruments on landslide-prone areas
- Establish codes (grading, construction, excavation) in landslide prone areas

Property Protection

- Insurance
- Remove soil
- Ensure rain gutters and sprinklers are directed away from structures
- Control and monitor surface and ground water drainage
- Control building in areas of landslides
- Evaluate property maintenance in areas of landslides (over watering)
- Plan proper valving of waterlines to ensure quick turn off in the event of a waterline break

Natural Resource Protection

- Leave area as open space
- Identify structures impacted by problem soils
- Complete a watershed management plan
- Limit use of ATVs in areas off landslides to manage erosion
- Evaluate impact of wildfire in areas of landslides
- Mitigate development in landslide-prone areas
- Maintain natural vegetation

Emergency Services

- Identify structures impacted by problem soils
- Monitor and warning systems
- Evacuation plans and exercises
- Critical Facilities Protection
- Equip emergency crews with water valve shut-off keys

Structural Projects

- Pre-soak and/or compact soils
- Install drain fields
- Bring in structural fill
- Build buttress, retaining walls and other engineered structures
- Install subsurface drainage materials
- Remove potential landslide debris

Public information

- Develop information on problem soils
- Outreach information on problem soil mitigation
- Map soils and landslide areas
- Real estate disclosure
- Notice to homeowners in landslide areas detailing hazard
- Library
- Technical Assistance
- Education

Part V
Regional Hazards

Introduction

Hazards such as severe weather, infestations, and drought have been recognized as regional hazards for this plan. Mountainlands is such a small area that identifying one portion of the region being more prone to these hazards than another is impossible due to the lack of data and their widespread nature. Each individual jurisdiction has the opportunity to address these hazards on an individual mitigation level however limited data dictates that the risk assessment and profile data be at a regional level.

Severe Weather

For the purpose of this mitigation plan the term "severe weather" is used to represent downbursts, lightening, heavy snowstorms, blizzards, avalanches, hail, and tornados.

Downbursts

A downburst is a severe localized wind, blasting from a thunderstorm. Depending on the size and location of these events, the destruction to property may be devastating. Downbursts fall into two categories by size: microbursts, which cover an area less than 2.5 miles in diameter, and macrobursts, which cover an area with a diameter larger 2.5 miles.

Lightening

During the development of a thunderstorm, the rapidly rising air within the cloud, combined with the movement of the precipitation within the cloud, causes electrical charges to build. Generally, positive charges build up near the top of the cloud, while negative charges build up near the bottom. Normally, the earth's surface has a slight negative charge. However, as the negative charges build up near the base of the cloud, the ground beneath the cloud and the area surrounding the cloud becomes positively charged. As the cloud moves, these induced positive charges on the ground follow the cloud like a shadow. Lightening is a giant spark of electricity that occurs between the positive and negative charges within the atmosphere or between the atmosphere and the ground. In the initial stages of development, air acts as an insulator between the positive and negative charges. When the potential between the positive and negative charges becomes to great, there is a discharge of electricity that we know as lightning.

Heavy Snowstorms

A severe winter storm deposits four or more inches of snow during a 12-hour period or six inches of snow during a 24-hour period. According to the official definition given by the U.S. Weather Service, the winds must exceed 35 miles per hour and the temperature must drop to twenty degrees Fahrenheit 20° F or lower. All winter storms make driving extremely dangerous.

Blizzards

A blizzard is a snowstorm with sustained winds of 40 miles per hour (mph) or more or gusting winds up to at least 50 mph with heavy falling or blowing snow, persisting for one hour or more, temperatures of ten degrees Fahrenheit (10° F) or colder and potentially life-threatening travel conditions. The definition includes the conditions under which dry snow, which has previously fallen, is whipped into the air and creates a diminution of visual range.

Avalanches

Avalanches are a rapid down-slope movement of snow, ice, and debris. Snow avalanches are a significant mountain hazard in Utah, and nationally account for more deaths each year than earthquakes. Avalanches are the result of snow accumulation on a step slope and can be triggered by ground shaking, sound, or a person. Avalanches consist of a starting zone, a track, and a run-out zone. The starting zone is where the ice or snow breaks loose and starts to slide. The Track is the grade or channel down which an avalanche travels. The run-out zone is where an avalanche stops and deposits the snow.

The two main factors affecting avalanche activity include weather and terrain, large frequent storms combined with steep slopes result in avalanche danger. Additional factors that contributing to slope stability are amount of snow, rate of accumulation, moisture content, snow crystal types and the wind speed and direction. In Utah, the months of January through April have the highest avalanche risk.

Topography plays a vital role avalanche dynamics. Slope angles between 30 to 45 degrees are optimum for avalanches with 38 degrees being the bulls-eye. Slopes with an angle above 45 degrees continually slough eliminating large accumulation. The risk of avalanches decreases on slope angles below 30 degrees.

Types of Avalanches Common in Utah:

Dry or slab avalanches: occur when a cohesive slab of snow fractures as a unit and slides on top of weaker snow, breaking apart as it slides. Slab avalanches occur when additional weight is added quickly to the snow pack, overloading a buried weaker layer. Dry snow avalanches usually travel between 60-80 miles per hour, reaching this speed within 5 seconds of the fracture, resulting in the deadliest form of snow avalanche.

Wet avalanches: occur when percolating water dissolves the bonds between the snow grains in a pre-existing snow pack, this 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.

Hail Storms

Hailstones are large pieces of ice that fall from powerful thunderstorms. Hail forms when strong updrafts within the convection cell of a cumulonimbus cloud carry water droplets upward causing them to freeze. Once the droplet freezes, it collides with other liquid droplets that freeze on contact. These rise and fall cycles continue until the hailstone becomes too heavy and falls from the cloud.

Tornados

A tornado is a violently rotating column of air extending from a thunderstorm to the ground. Tornados often occur at the edge of an updraft or within the air coming down from a thunderstorm. Tornadoes can have wind speeds of 250 miles per hour or more, causing a damage zone of 50 miles in length and 1 mile wide. Most tornados have winds less than 112 miles per hour and zones of damage less than 100 feet wide.

Waterspout

Waterspouts are simply tornadoes that form over warm water. This typically occurs in Utah during a cold fall or late winter storm.

Scale

Tornadoes are classified by wind damage using the Fujita Scale. The National Weather Service has used the Fujita Scale since 1973. This scale uses numbers from 0 through 5 with higher numbers assigned based on the amount and type of wind damage.

Fujita Scale

Category F0	Gale tornado (40-72 mph)	Light damage. Some damage to chimneys; break branches off trees; push over shallow-rooted trees; damage to sign boards.
Category F1	Moderate tornado (73-112 mph)	Moderate damage. The lowers limit is the beginning of hurricane wind speed; peel surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off roads.
Category F2	Significant tornado (113-157 mph)	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.
Category F3	Severe tornado (158-206 mph)	Severe damage. Roofs and some walls torn off well constructed houses; trains overturned; most trees in forest uprooted; cars lifted off ground and thrown.
Category F4	Devastating tornado (207-260 mph)	Devastating damage. Well-constructed houses leveled; structure with weak foundation blown off some distance; cars thrown and large missiles generated.
Category F5	Incredible tornado (261-318 mph)	Incredible damage. Strong frame houses lifted off foundations and carried considerable distance to disintegrate; automobiles-size missiles fly through the air in excess of 100 yards; trees debarked; incredible phenomena will occur.

Methodology

Due to the random nature of severe weather events, designating areas that are more susceptible verses the rest of the region is nearly impossible. With the exception of avalanches, it is impossible to spatially designate areas of potential events without either covering the entire map. To that end only hazard profiles have been done and are discussed further in the county annexes portion of this plan. Great effort was made to obtain both historical and spatial data for avalanches. Unfortunately, none was made available for this plan and is therefore also dealt with on a regional level.

Potential Mitigation Strategies

The following mitigation strategies are provided so that communities may be aware of methods that could be used to limit the exposure to Severe Weather/Avalanche related damage.

Prevention

- Early warning and notification systems
- Building codes to address wind shear and snow load
- Properly ground structures for lightning
- Public education for severe weather conditions
- Restrict development in avalanche prone areas

Property Protection

- Structural tie downs of roofs in high wind areas
- Mitigate development in areas of avalanche potential
- Monitor NWS weather warnings and watches

Natural Resource Protection

- Evaluate the impacts of severe weather
- Mitigate development in areas of avalanche

Emergency Services

- Monitor NWS weather warnings and watches
- Develop plans and exercises for severe weather

Structural Projects

- Install sheds over roads below avalanche terrain
- Install drift fences along snow drift areas
- Install avalanche fencing along ridgelines for wind blown snow
- Promote Weatherization programs

Public information

- Develop outreach document on avalanche safety
- Become a NWS Storm Ready Community
- Promote Lighting Safety Week

- Develop cold weather safety materials
- Ensure that at risk groups, such as the elderly, are checked on during severe weather

Assessing Vulnerability

Severe weather can be a regular part of living in the Mountainland Region. Fortunately the intensity of severe weather in the region has been limited to moderate levels.

Development Trends

In some instances, growth in certain areas such as mountainsides and canyons can increase the possibility of microclimates and avalanche danger. Development higher on mountainsides in some instances can lead to greater susceptibility. Communities should develop education requirements as part of the development process.

Profile

Frequency	Frequent Multiple events happen each year.
Severity	Moderate
Location	Region wide with some locations more frequent due to geography.
Seasonal Pattern	All year depending upon the type of event.
Duration	Seconds to Days
Speed of Onset	Immediate
Probability of Future Occurrences	11 (average) events per year. There have been 507 recorded events since 1960.

History

Due to the large number of incidents that have been recorded the history table was omitted from this section of the plan and inserted into the annex section.

Drought

Drought is a normal recurrent feature of climate, although many people in Utah erroneously consider it a rare and random event. It occurs in virtually all-climatic zones, while its characteristics vary significantly from one region to another. Droughts, simply put, are cumulative hazards, which result from long periods of below normal precipitation. Drought is a temporary aberration and differs from aridity since the latter is restricted to low rainfall regions and is a permanent feature of climate.

The State or Utah, uses the Palmer Drought Severity Index or (PDSI) to quantify the existence of a drought. Using the PDSI, drought is expressed as a negative number. Much of the basis, used by the State, to determine drought years, or drought periods, comes from the PDSI. In addition, the State Climatologist, the National Geophysical Data Center of NOAA, and the National Drought Mitigation Center use the PDSI.

For the most part droughts no longer affect the availability of drinking water, thus they no longer place peoples' lives at risk, the same cannot be said for a person's livelihood. Numerous water projects throughout the state have placed enough water in storage to insure drinking water. Prolonged droughts have a significant effect on agricultural and agribusinesses, within the states dependent on irrigation water. Droughts also stress wildlife, and heighten the risk of wildfire.

Potential Mitigation Strategies

The following mitigation strategies are provided so that communities may be aware of measures that could be used to limit the exposure to drought related damage.

Prevention

- Establish economic incentives for water conservation
- Encourage water conservation
- Develop early warning system, monitoring programs
- Implement water metering and leak detection programs

Property Protection

- Identify potential for wildfire due to drought
- Identify secondary effects from drought
- Drought Insurance

Natural Resource Protection

- Legislation to protect stream flows
- Protect water aquifers
- Alert procedures for water quality issues
- Create inventory of pumps, filters and other equipment

Emergency Services

- Establish water hauling programs
- List livestock watering locations
- Establish hay hotline
- Fund water system improvements (wells, systems, reservoir)
- Lower well intakes
- Develop drought contingency plans
- Issue emergency permits for water use

Structural Projects

- Redesign or create new reservoir storage
- Provide pumps and piping for distribution

Public information

- Develop drought education material
- Water conservation outreach material
- Other outreach for awareness

Assessing Vulnerability

Drought is a condition that affects every corner of the Mountainland Region. As most of the agriculture in the region is irrigated, low water levels can have the greatest effect on rural communities where farming is still prominent. As growth occurs, water will continue to be converted to non agricultural uses and therefore increasing remaining farmer's vulnerability to drought. Each of the three counties have rural communities that could be effected.

Development Trends

As the state and region continue to grow, drought will become a more pronounced threat. Existing water storage such as reservoirs has been able to minimize the effects of drought on people and agriculture to this point. Both future and current water users will need to develop more sustainable practices to ensure the will continue to have only moderate effects on the region.

Profile

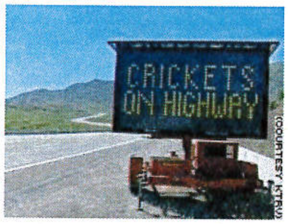
Frequency	Frequent
Severity	Severe primarily to agriculture
Location	Region wide
Seasonal Pattern	Summer.
Duration	Up to 10 years.
Speed of Onset	Incremental with impact increasing.
Probability of Future Occurrences	Mild - .1 Moderate – .064 Severe - .027

History

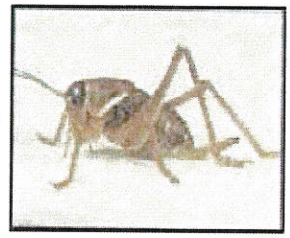
Palmer Drought Index Periods of drought for Region 3 (Utah County)	Palmer Drought Index Periods of drought for Region 5 (Wasatch and Summit Counties)
2000 to 2003	2000 to 2002
1987 to 1990	1992 to 1994
1976 to 1977	1987 to 1990
1959 to 1961	1976 to 1979
1952 to 1954	1931 to 1935
1939 to 1940	1900 to 1905
1933 to 1935	
1900 to 1905	

Infestation

Infestation normally deals with insect infestations; however; infestations may also include rodent or other



animal invasion. To infest means to spread or swarm over in a troublesome manner. The Mountainland Region has had two recent infestations. The most devastating invasion, in relation to cost, has been the Mormon Cricket. In June of 2003, Utah Governor Mike Leavitt declared a State of Emergency in 18 of Utah's 29 counties, where crickets and grasshoppers had eaten 1.5 million acres. Problems associated with cricket infestations usually deal with crop loss as well as loss of rangeland for cattle and sheep. Consumption of residential landscaping is also a problem and more homes are built in western Utah County in which is in the path of crickets. The crickets usually travel from west to east, starting in Nevada. In some instances the cricket mass is so large and dense that cars and trucks lose traction on roads. Vehicles sliding off of roads can cause property damage and personal injury.



The Mormon cricket has reached legendary status in the State of Utah. This devastating insect plagued the early pioneers. Today, 150 years later, the Mormon cricket still economically devastates some parts of Utah.

Economic Damage

The Mormon cricket is not a true cricket. The insect resembles more a lifestyle of a grasshopper. Mormon crickets are of economic importance in the fact that they destroy plants on rangeland, cropland, and vegetable gardens. Male and female Mormon crickets are large insects and can reach lengths of two and

one-half inches during the adult stage. The female Mormon cricket is distinguished by the long ovipositor that also looks like a type of "stinger" located at the end of the abdomen. The male lacks this ovipositor. The Mormon cricket can be economically devastating. It has been calculated that a Mormon cricket at a density of one per square yard can consume 38 pounds of dry weight rangeland forage per acre. In Utah, the Mormon cricket destroys sagebrush, alfalfa, small grains, seeds, grasses, and vegetable crops.

Life Cycle and Characteristics

Mormon crickets hatch during the spring, and depending on elevation usually around the first few weeks of April. Young Mormon crickets are called nymphs. These nymphs develop during the spring months. They undergo seven stages of development called in-stars. It takes 60 to 90 days for the Mormon cricket to pass through these seven stages and obtain the adult stage. The female Mormon cricket lays its eggs during the summer months. The incubation of the eggs occurs during the fall and winter months. The eggs start hatching when soil temperatures reach 40 degrees Fahrenheit. The Mormon cricket cannot fly, but is still an extremely mobile insect. When the crickets are young, they do not migrate long distances. After about the fourth in-star and during the adult stage the Mormon crickets become ravenous and start banding together. Once the crickets have banded together, they begin migrating. During their migrations they destroy everything in their path. Mormon crickets are usually found migrating when skies are clear and temperatures are around 60 to 90 degrees Fahrenheit. In Utah, the crickets migrate under favorable conditions around 10:00 a.m. until about 2:00 p.m. Mormon crickets in the adult stage can cover a mile a day and up to 50 miles in a single season. During the night and during cold, wet weather, Mormon crickets clump together and can be seen clinging together on grasses and brush. They will also burrow underneath grass and brush to keep warm. The Mormon cricket is a hearty insect. They have been seen feeding when temperatures were less than 35 degrees Fahrenheit.

Potential Mitigation Strategies

The most effective way to reduce Mormon cricket populations is to use carbaryl bait. The trade name is Sevin bait. This is usually oatmeal coated with the chemical insecticide carbaryl. The recommended application rate is 10 pounds to the acre. Using hand-held fertilizer spreaders can spread the bait or large machines that blow the poisoned grain a long distance. The idea is to apply a barrier of bait around or in front of a band of migrating crickets. Once the first wave consumes the bait they will die within a few minutes. The crickets coming from behind will eat the dead crickets causing a chain reaction of crickets being killed by the bait. Mormon crickets do not fly so they will almost always hit the barrier of poisoned bait. Many ranchers and farmers will apply the bait around the perimeter of their fields to reduce the number of crickets invading. Bait is also applied along roadsides to reduce the risk of car accidents from large numbers of crickets crossing highways. It is best to apply the bait when the crickets are still young or in the developing stages. Insecticide sprays such as Malathion could be effective against the Mormon cricket if they were sprayed during the nymphal stage. These insecticide sprays usually aren't recommended. Sevin bait is the preferred control method at this time in Utah.

Costs vary but usually average about $5 an acre for a minimum of 5,000 acres being sprayed. Some years there are government cost share programs to help spray large acres of rangeland. Usually, the land needs to border Federal or State lands to qualify for government aid. The insecticide most commonly used on rangelands is Malathion ULV applied at 8 oz. to the acre. It is important that spraying takes place early in the grasshopper's life. The younger the grasshoppers are the better the kill rate. The best time to usually spray rangeland is the first three weeks in June. This is referred to as the "window of opportunity."

Cropland

The most profitable crops in Utah are alfalfa, corn, oats, wheat, rye, and barley. Grasshoppers concentrate in these croplands and destroy all vegetation present. This can be economically devastating for a farmer. Control on agricultural croplands is essential. As with rangelands you must determine whether there is an infestation of eight or more grasshoppers per square yard. If there is, then the two most effective control methods are ground spraying or aerial spraying. Ground spraying is usually more expensive per acre, but there is less chance of killing non-target insects (bees). Aerial spraying is quick, usually less expensive, and has a high kill rate. The disadvantage is the potential damage to non-target insects. Usually, aerial spray applications are used when there are a higher number of acres to be sprayed. Malathion ULV and Dursban are two common insecticides used for grasshopper control on agricultural croplands. Justification for control depends on the crop, the crop's stage of growth, additional migration, and the type of damages being done to the crop. Grasshoppers hatch and migrate off bordering lands, and at times this is extremely frustrating to an agriculture grower trying to control grasshopper infestation. This is where the importance of communities pulling together to do a countywide spray program comes into play. The importance of government spraying of public lands bordering cropland cannot be stressed enough.

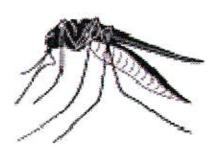
Lawns, Gardens, and Landscaping

Homes are being built on lands that have produced grasshopper populations for many years. This causes problems for the homeowner. Grasshoppers are hatching and laying eggs in the lawns and gardens. This makes it possible for the grasshoppers to hatch on the same lawn year after year. Grasshoppers are migrating out of vacant fields and low hills into the green, lawns and gardens. This results in thousands of dollars in damage to newly planted landscapes. It is very important that communities work together in controlling grasshopper outbreaks. If one person is spraying, and neighbors are not, then the grasshoppers will just continue migrating from adjacent property. Vacant lots and fields need to be tilled in late fall to expose the eggs. Eggs are destroyed when they are exposed to the cold environment. Lawns need to be raked to also expose the eggs. Flower gardens usually have a population of eggs, so the soil should be turned over to expose the eggs. If there is an outbreak of grasshoppers on your landscape during the summer, start spraying early. Once you see that grasshoppers have invaded, even the little ones, start spraying with Dursban (chlorpyrifos) for use on turf and ornamentals, Malathion for use on turf, ornamentals and vegetables, or liquid Sevin (carbaryl) for use on turf, vegetables, and ornamentals.

Insecticide baits that use insecticide such as Sevin have not been an effective barrier against the grasshoppers in Utah. Grasshoppers fly and jump great distances and more than likely will miss the barrier of bait completely. This bait is very effective for the Mormon crickets, common to the southern end of the county. READ AND FOLLOW THE INSTRUCTIONS ON PESTICIDE LABELS FOR REGISTERED USES, RATES, RESTRICTIONS, AND SAFETY PRECAUTIONS.
Conclusions

Grasshoppers are a recognized problem for Utah. The extreme infestations do not occur every year, but there are grasshoppers to some extent each year. Extreme infestations seem to come in cycles of seven years and last approximately three years. Everyone needs to recognize there is a problem, and take the steps each year to combat the insects. Expose the eggs as often as possible, start spraying late spring and early summer to kill the immature grasshoppers, make your spraying programs a community effort, and keep informed on government spray programs for your area. If everyone does their part we can greatly reduce the grasshopper populations, and strive for a county free of these devastating insects.

WEST NILE VIRUS



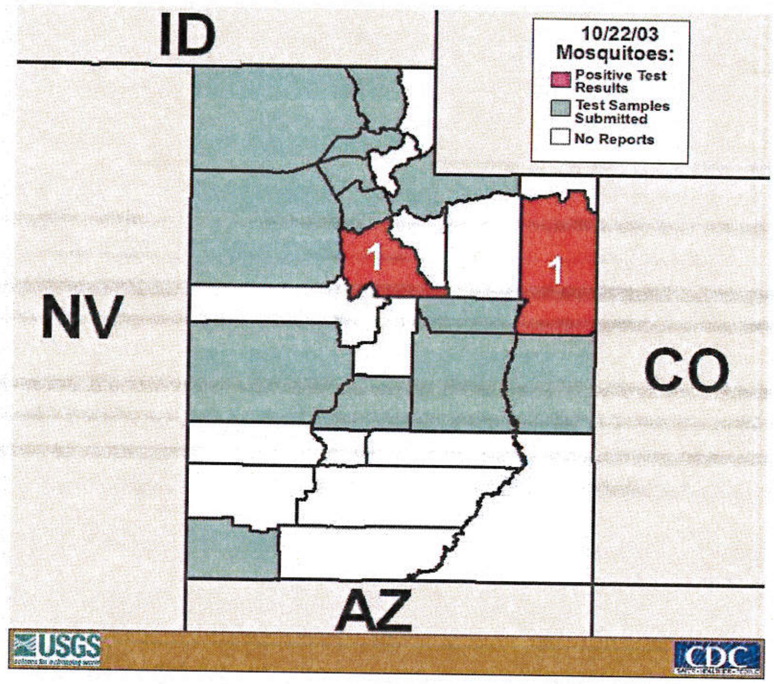
A second type of insect infestation is mosquito borne diseases. Most recently there has been significant news coverage of the West Nile Virus, although mosquitoes also carry other diseases. Other diseases carried by mosquitoes include various forms of encephalitis and dengue fever. The West Nile Virus and various forms of encephalitis may affect humans and animals.

Since West Nile virus (WNV) was first isolated in 1937, it has been known to cause asymptomatic infection and fevers in humans in Africa, West Asia, and the Middle East. Human and animal infections were not documented in the Western Hemisphere until 1999. In 1999 and 2000, outbreaks of WNV encephalitis (inflammation of the brain) were reported in persons living in the New York City metropolitan area, New Jersey, and Connecticut. In these two years, 83 human cases of West Nile illness were reported; 9 died. In 2001, human infection with WNV occurred in 10 states with 66 cases and 9 deaths. In 2002, WNV activity spread to 44 states, with 4,156 human cases and 284 deaths.

WNV is transmitted to humans through mosquito bites. Mosquitoes become infected when they feed on infected birds that have high levels of WNV in their blood. Infected mosquitoes can then transmit WNV when they feed on humans or other animals.

WNV is not transmitted from person to person and there is no evidence that handling live or dead infected birds can infect a person. But, to add a further level of safety, if birds or other potentially infected animals must be handled, a protective barrier (e.g., gloves, inverted plastic bags) should be used.

Most WNV infected humans have no symptoms. A small proportion develops mild symptoms that include fever, headache, body aches, skin rash and swollen lymph glands. Less than 1% of infected people develop more severe illness that includes meningitis (inflammation of one of the membranes covering the brain and spinal cord) or encephalitis. The symptoms of these illnesses can include headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, and paralysis. Of the few people that develop encephalitis, a small proportion die but, overall, this is estimated to occur in less than 1 out of 1000 infections.



There is no specific treatment for WNV infection or vaccine to prevent it. Treatment of severe illnesses includes hospitalization, use of intravenous fluids and nutrition, respiratory support, prevention of secondary infections, and good nursing care. Medical care should be sought as soon as possible for persons who have symptoms suggesting severe illness.

Individuals can reduce their contacts with mosquitoes by taking these actions:

When outdoors, wear clothing that covers the skin such as long sleeve shirts and pants, apply effective insect repellent to clothing and exposed skin, and curb outside activity during the hours that mosquitoes are feeding which often includes dawn and dusk. In addition, screens should be applied to doors and windows and regularly maintained to keep mosquitoes from entering the home.

Assessing Vulnerability

As with drought, rural areas of all three counties remain the most vulnerable to infestation. Additionally, new growth and the demand for landscaping can lead to the transference of invasive species such as the Japanese Beetle.

Profile

Frequency	Frequent
Severity	Severe primarily to agriculture.
Location	Region Wide - especially agricultural areas and around lakes and reservoirs.
Seasonal Pattern	Spring and Summer
Duration	Days to Years
Speed of Onset	Incremental.
Probability of Future Occurrences	Very High – Crop damage due to infestations is reported nearly every year. Multiple West Nile Virus cases are reported every year.

Hisory

Mormon Cricket Infested Acreage By Year							
County	2001	2002	2003	2004	2005	2006	2007
Utah	5,650	74,600	116,200	123,800	3,780	1,280	
Summit				2,530			

Utah Department of Agriculture 2007Insect Report

Grasshopper Infested Acreage By Year							
County	2001	2002	2003	2004	2005	2006	2007
Utah	56,400	8,500	15,150	16,440		1,289	2,558
Summit	3,600	2,550	12,630	33,870		1,280	2,136
Wasatch	65,600	7,000	17,540	25,250			1,279

Utah Department of Agriculture 2007Insect Report

Utah West Nile Virus Positives by Year						
	2008	2007	2006	2005	2004	2003
Human	27	70	158	52	11	1
Horse	8	18	59	68	5	35
Bird	3	19	76	22	8	2
Mosquito	140	225	466	80	181	3
Chicken	16	74	107	19	38	9

WEST NILE VIRUS SUMMARY REPORT 2008 SEASON
UTAH DEPARTMENT OF HEALTH

Mitigation Strategies

The following table is a list of mitigation strategies that the planning committee determined to be appropriate for the regional hazards described above. The committee reviewed several possibilities for these hazards and determined theses to be the highest priority. Each jurisdiction was also given the opportunity to identify additional strategies for these hazards within their own communities. They will be listed in the county sections of this plan with the individual mitigation strategies.

These strategies were assigned a priority of high, medium, or low by communities according to the following criteria:

- Number of people affected by the project
- Technical feasibility
- Political support
- Available funding and priorities
- Environmental impact

Regional Hazards Mitigation Strategies

	Protecting Current Residents and Structures					
Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Drought	Promote water conservation programs "Slow the Flow".	Medium	Ongoing	Minimal	Local cash, Grants, UDWR, CUWCU	Local Government, UDWR
Severe Weather	Public preparedness campaign.	Medium	Ongoing	Minimal	Local Cash, Grants	Local Government, UDPS
Infestation	Public education on eradication programs.	Medium	Ongoing	Minimal	Local Cash, Grants, UDAF	Local Government, USDA

	Protecting Future Residents and Structures					
Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Drought	Consider the enactment of water wise landscaping ordinances.	High	1 year	Minimal	Local Cash, Grants	City, County, DEQ, ULCT
Severe Weather	Increase the number of weather stations.	Medium	5 years	TBD	Grants, FEMA, NOAA, UDOT	Local Government, NOAA, UDOT
Infestation	Public education on eradication programs.	Medium	Ongoing	Minimal	Local Cash, Grants, UDAF	Local Government, USDA

Part VI
Summit County
Profiles and Mitigation

Background

Area: 1,849 square miles; *county seat:* Coalville; *origin of county name*: the county includes high mountain summits that form the divides of the Weber, Bear, and Green River drainage areas; *points of interest*: Park City area ski resorts, Park City Historic District, Rockport State Park, Echo Reservoir, High Uinta Wilderness Area; *economy*: skiing, tourism, lumbering, livestock.

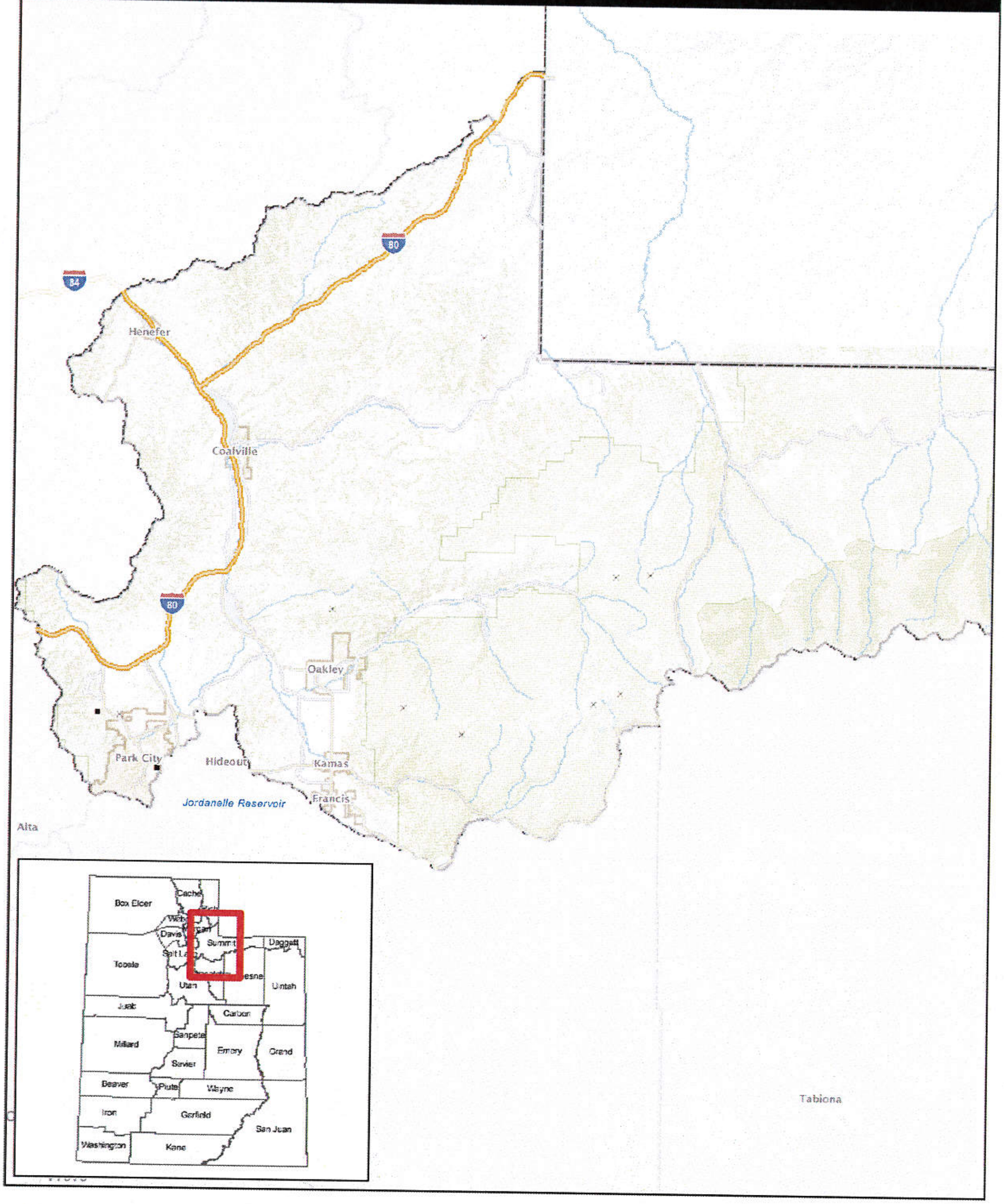
Summit County was created in 1854 from Green River and Great Salt Lake counties. The Uinta Mountains dominate the eastern portion of the county, and the western section is a high back valley of the Wasatch Mountains.

The first white men to visit the area were fur trappers and traders in the 1820s and 1830s. Until the arrival of the Mormons in 1847, Summit County was hunting grounds for Northern Shoshone Indians. In 1846 Lansford W. Hastings, a California promoter, announced a new cutoff on the California Trail that would eliminate several hundred miles and many days of travel. The cutoff turned southwest from Fort Bridger, Wyoming, and entered Utah and the northeastern corner of Summit County through Echo Canyon. It followed the Weber River to Salt Lake Valley, went around the south shore of the Great Salt Lake, and then west into Nevada. The first group to take this new cutoff was the Donner-Reed party in 1846. Blazing a road through the Wasatch Mountains cost them many days, and when they reached the Sierra they ran into early snow, with well-known tragic results. Many lost their lives. A year later, the pioneering Mormons adopted part of the Hastings Cutoff, but when they reached the Weber River they turned southwest to Emigration Canyon. This became the main trail for the immigration of the Mormons to Utah. In 1869 the Union Pacific Railroad, builder of the eastern portion of the transcontinental railroad, followed the Hastings Cutoff, and today part of Interstate 80 follows the Hastings and Mormon trails and the Union Pacific route through northern Summit County.

The first settlers in Summit County arrived at Parley's Park in 1850. Wanship was settled in 1854, followed by Coalville, Hoytsville, and Henefer in 1859. When coal was discovered near Coalville, the Mormons established a mission there. During the 1860s, wagons hauled tons of coal from Coalville to the Salt Lake Valley settlements. In 1873 the Utah Eastern Railroad built a line from Echo Junction to Coalville to haul coal. This line eventually became part of the Union Pacific Railroad.

The discovery of silver, lead, and zinc in the Wasatch Mountains in the 1870s soon overshadowed the settlement and economic activities of the rest of the county. Park City, a mining town founded in 1872, continued to expand into the twentieth century. Many individuals made fortunes from the Park City mines. Mansions on South Temple in Salt Lake City reflect some of this wealth. Mining continued until the 1950s, at which time it no longer was profitable. For several decades Park City was on the verge of becoming a ghost town, but the area's rugged terrain and deep snow led to its rebirth as a winter sports center. Skiing currently is a major economic activity in western Summit County, while the rest of the county is still noted for its farming and ranching. Other recreational opportunities, including boating, fishing, and tourism add to the county's diversified economy. (Source: Utah Historical Encyclopedia, Craig Fuller, author)

SUMMIT COUNTY



Population

The following table shows historic population data:

	1930	1940	1950	1960	1970	1980	1990	2000	2007
Wasatch	5,636	5,754	5,574	5,308	5,863	8,523	10,089	15,215	19,609

Table S-1

	1930	1940	1950	1960	1970	1980	1990	2000	2007
Summit	9,527	8,714	6,745	5,673	5,879	10,198	15,518	29,736	38,412

Economy

Summit County has been the recipient of many new businesses, much residential and commercial development, and a thriving ski and tourism economy that defines its character and atmosphere. Summit County's local economy is largely driven by the activities of Park City and the Snyderville Basin. Its population has more than doubled since the initial OEDP was drafted. Eastern Summit County and its cities also face numerous growth and development pressures, although not exhibiting anywhere near the level of investment that is pushing the western half of the county. With numerous venues of the 2002 Winter Olympics within the Mountainland Region, economic growth should continue in the future.

Economy

						% Change
Summit County	2002	2003	2004	2005	2006	2005-06
Population	32,236	34,073	35,090	36,283	36,871	1.6
Employment:						
Average civilian labor force	19,393	19,880	20,453	21,311	22,068	3.6
Average employment	16,438	16,419	17,511	18,892	20,632	9.2
Income:						
Average annual wage ($)	26,740	26,528	27,725	29,427	30,882	4.9
Total payroll wages ($ thousands)	439,539	435,550	485,503	555,926	637,150	14.6
Total personal income ($ thousands)	1,421,656	1,466,851	1,652,404	1,774,974	1,927,700	8.6
Per capita personal income ($)	44,604	44,713	48,675	50,542	54,347	7.5
Taxes:						

Total assessed valuation ($ thousands)	7,287,845	7,737,208	8,290,921	8,527,688	10,490,552	23.0
Property taxes charged, by all taxing units ($ thousands)	75,027	79,812	92,014	90,405	101,052	11.8
Gross taxable sales ($ thousands)	862,282	854,703	972,492	1,099,535	1,251,296	13.8
Net local sales tax allocations ($ thousands)	6,866	6,638	7,212	8,188	9,413	15.0
Construction (permit-authorized):						
New dwelling units (number)	424	624	657	899	869	-3.3
Value of new residential construction ($ thousands)	92,371	123,077	153,466	211,065	242,309	14.8
Value of new nonresidential construction ($ thousands)	22,575	22,594	22,726	36,044	49,329	36.9
Value of total construction ($ thousands)	131,297	173,960	202,994	282,268	339,215	20.2
Miscellaneous:						
Payment in Lieu of Taxes Act ($ thousands)	567	617	620	652	664	1.9
New car and truck registrations by owners county (number)	1,947	2,027	2,053	2,384	2244	-5.9

Summit County, has seen a significant economic growth as a result of the 2002 Winter Olyimpics and population growth.

Social Characteristics	Estimate	Percent	U.S.
Average household size	2.98	(X)	2.6
Average family size	3.34	(X)	3.19
Population 25 years and over	22,213		
High school graduate or higher	(X)	93.7	84.00%
Bachelor's degree or higher	(X)	48.1	27.00%
Disability status (population 5 years and over)	2,116	6.5	15.10%
Foreign born	3,110	8.9	12.50%
Speak a language other than English at home (population 5 years and over)	N	N	19.50%
Household population	35,020		
Economic Characteristics	Estimate	Percent	U.S.
In labor force (population 16 years and over)	20,490	75.2	64.70%
Mean travel time to work in minutes (workers 16 years and over)	24.2	(X)	25.1
Median household income	83,167	(X)	50,007
Median family income	93,190	(X)	60,374
Per capita income	36,761	(X)	26,178
Families below poverty level	(X)	3.7	9.80%
Individuals below poverty level	(X)	6	13.30%
Housing Characteristics	Estimate	Percent	U.S.
Total housing units	21,307		
Occupied housing units	11,740	55.1	88.40%
Owner-occupied housing units	9,250	78.8	67.30%
Renter-occupied housing units	2,490	21.2	32.70%
Vacant housing units	9,567	44.9	11.60%
Owner-occupied homes	9,250		
Median value (dollars)	448,900	(X)	181,800

Median of selected monthly owner costs			
With a mortgage (dollars)	2,012	(X)	1,427
Male	10,063	51	49.20%
Female	9,684	49	50.80%
Median age (years)	29.6	(X)	36.4
Under 5 years	1,835	9.3	6.90%
18 years and over	13,621	69	75.30%
65 years and over	1,817	9.2	12.50%
One race	N	N	97.90%
White	N	N	74.10%
Black or African American	N	N	12.40%
American Indian and Alaska Native	N	N	0.80%
Asian	N	N	4.30%
Native Hawaiian and Other Pacific Islander	N	N	0.10%
Some other race	N	N	6.20%
Hispanic or Latino (of any race)	N	N	14.70%

Source: U.S. Census Bureau, 2005-2007 American Community Survey

Flooding/Dam Failure

Overview

Although Utah is considered a dry desert state, flooding does occur. Ranging from Most floods have occurred either from snow melt or severe thunderstorms. Often times flooding is increased by soils that are more impervious due to either wildfire or drying out. Floods occur on a regular basis in Summit County. Most of the communities within the county are built around or near a stream or river such as the Provo or Weber. Each of these communities share a similar susceptibility to flooding.

Development Trends

As development occurs on the mountainous terrain and along the shores of reservoirs, or along river and stream corridors more homes will be in danger of floods. Communities need to make developers and homeowners aware of the danger as well as contribute to mitigation actions. Cities should review every development that it is in compliance with NFIP guidelines.

The following table identifies the communities in Utah County with their NFIP Status.
Table S-3

COUNTY	CITY/TOWN	POPULATION	STATE MAP LOCATION	NFIP STATUS	THREAT (or NSFHA-eligible)
Summit	Unincorporated	17379		490134 - 7/17/86(M)	Weber and Provo Rivers & Tributaries
Summit	Coalville	1382	D5	490135 - (NSFHA)	Chalk Creek
Summit	Francis	698	D5	Not Participating**	Provo River
Summit	Henefer	684	C5	490136 - 5/20/80(M)	Weber
Summit	Kamas	1274	D5	490137 - (NSFHA)	
Summit	Oakley	948	D5	490138 - 9/24/84(M)	Weber
Summit	Park City	7371	D5	490139 - 7/16/87	Mcleod & Others

Source: FEMA Utah State Department of Homeland Security

The primary goal for non participating communities is to become a participating member.

Assessing Vulnerability: Addressing Repetitive Loss Properties

There are no repetitive loss properties in Summit County (FEMA, 2008).

Profile

Frequency	Flooding happens within Summit County on almost a regular basis.
Severity	Moderate
Location	Primarily along streams, rivers and bodies of water.
Seasonal Pattern	Spring time due to snow melt. Isolated events throughout the year due to severe weather (microburst).
Duration	A few hours to a few weeks depending upon conditions
Speed of Onset	Sudden to 12 hours
Probability of Future Occurrences	High - for delineated floodplains there is a 1% chance of flooding in any given year.

History

Hazards	Date	Location	Critical Facility or Area Impacted	Comments
Flood Summit	September 8, 1940	Echo/Henefer	Damage to Weber Canyon Highway and railroad tracks	
Flood Summit	August 11, 1941	Echo	Highway and railroad tracks	Landslides cover highway and railroad in five locations
Flood Summit	August 6, 1945	Hoytsville	Extensive damage to roads, buildings, farmlands, and crops	
Flood Summit	August 16, 1950	Heneger	Damage to ranches in vicinity of town	
Flood Summit	August 12,1961	Hoytsville/Echo	Damage to highways 189 and 30, and railroad tracks	Source Cottonwood Creek and Echo Cliff Wash
Flood Summit Presidential	Spring 1983	County Wide	Damage to roads, bridges, and culverts.	Source Chalk Creek Several landslides
		Coalville	City park, roads, sewage pump station, and drainage ditches.	12 private homes damaged
		Kamas	Roads, bridges, and sewer systems compromised.	
		Park City	Daly Avenue damaged flooding in Thaynes Canyon Subdivisions.	
Flood Summit Presidential	Spring 1984	County wide	$368,850 in damage. Wooden Shoe Road and Chalk Creek Road washed out.	

(All dollar values for given are for year of disaster)

Source: Flood Hazard Identification Study: Mountainland Association of Governments, US Army Corps of Engineers, September 3, 2003.

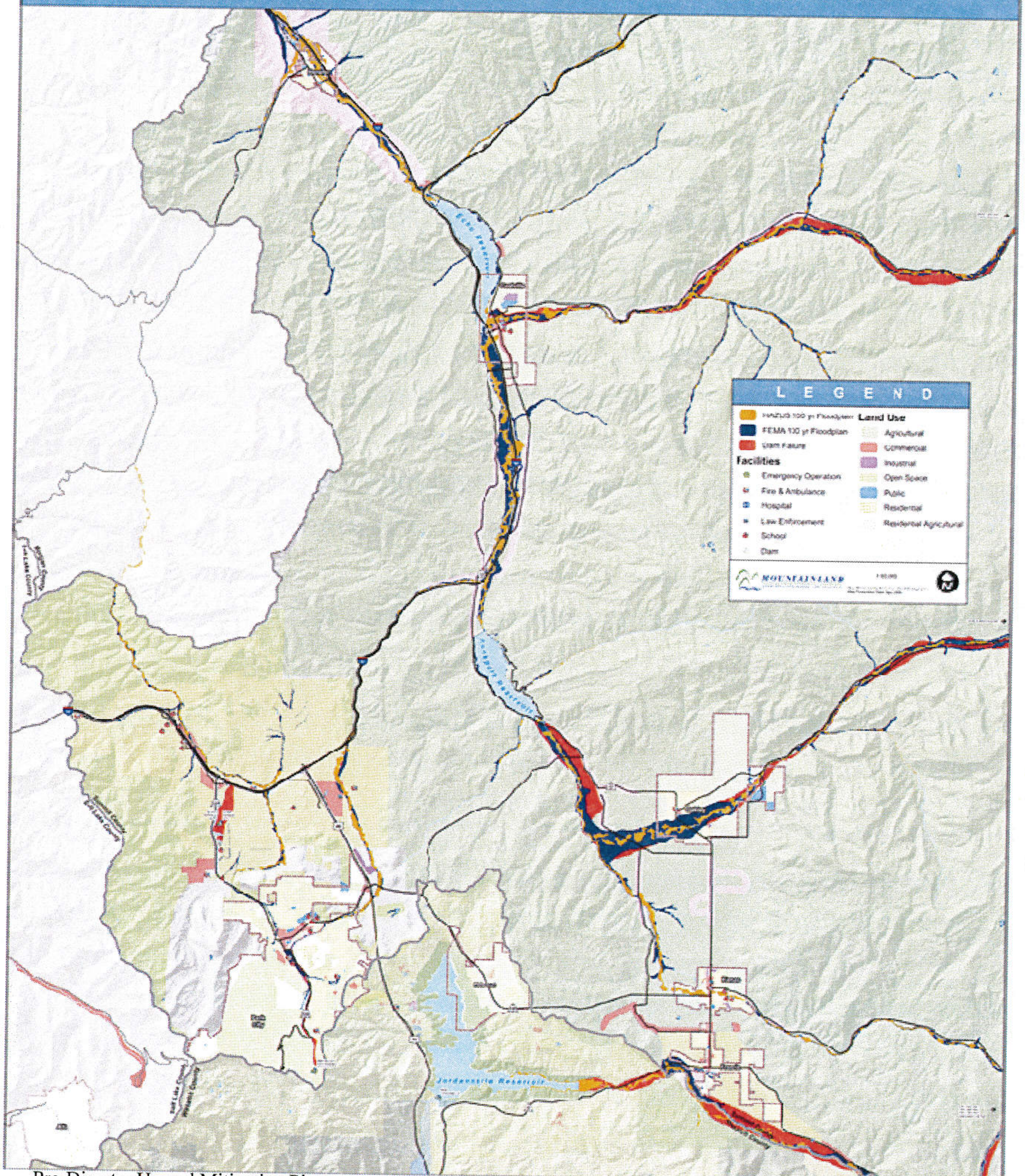
SHELDUS Data for Summit County

DATE	TYPE	NAME	INJURIES	FATALITIES	PROPERTY DAMAGE 2007	CROP DAMAGE 2007
5/1/1983	Flooding	Summit	0	0	4960317.46	4960317.46
2/17/1986	Flooding	Summit	0	0.09	85763.21	0
2/19/1986	Flooding	Summit	0	0	55493.96	0
6/7/1986	Flooding	Summit	0	0	94339.62	0
12/26/1998	Flooding	Summit	0	0	421.94	0
9/5/1965	Flooding -Severe Storm	Summit	0.71	0	22222.2	2222.2

Within the community of Coalville the US Army Corps of Engineers has identified additional flooding potential areas outside of the FEMA FIRM maps. This information was compared to the potential flood area maps that were completed for this plan. It was determined that those areas coincide with the Corps map and that all of these flooding areas have been incorporated into the hazard assessments and loss estimates.

SUMMIT COUNTY

100 YEAR FLOODPLAIN AND DAM FAILURE MAP



Wildland Fire

Overview

Wildfire is the most frequently occurring natural hazard within the Summit County area. It can also pose the most eminent danger to current and future residents. Each jurisdiction is surrounded by mountains and have structures abutting forested areas.

Development Trends

As development occurs on the bench areas of Summit County more homes will be in danger of wildfire. Communities need to make developers and homeowners aware of the danger. Cities and the county should also require firebreaks and access roads along urban/wildland interfaces. Although development brings homes closer to areas of potential wildfire, it also brings water and access for firefighters closer to the urban fringe. Firewise community development principles, such as not storing firewood near homes, installing fire resistant roofing and cleaning debris from rain gutters will reduce potential loses.

Profile

Frequency	Multiple wildland fires occur in Utah County Every year.
Severity	Moderate
Location	Hillsides and mountainous areas, open grass and range lands.
Seasonal Pattern	Summer and fall depending on weather conditions.
Duration	A few hours to a few weeks depending upon conditions
Speed of Onset	1 to 48 hours
Probability of Future Occurrences	High Major Fires – .28fires per year (FFSL) All Fires – 27.8 per year (USFM)

History

Forestry Fires and State Lands

NIFMID	NAME	DAY	MONTH	YEAR	ACRES
	1918 Fire			1918	0
	Gold Hill Burn	7	9	1956	0
	Cedar Hollow			1957	25
	1964 Fire	11	10	1964	263
	Washington Lake			1965	13
	North Fork Provo			1967	0
	Haystack Mountain			1972	70
	Lily Lake	23	6	1980	0
	Deer Creek Fire			1980	0

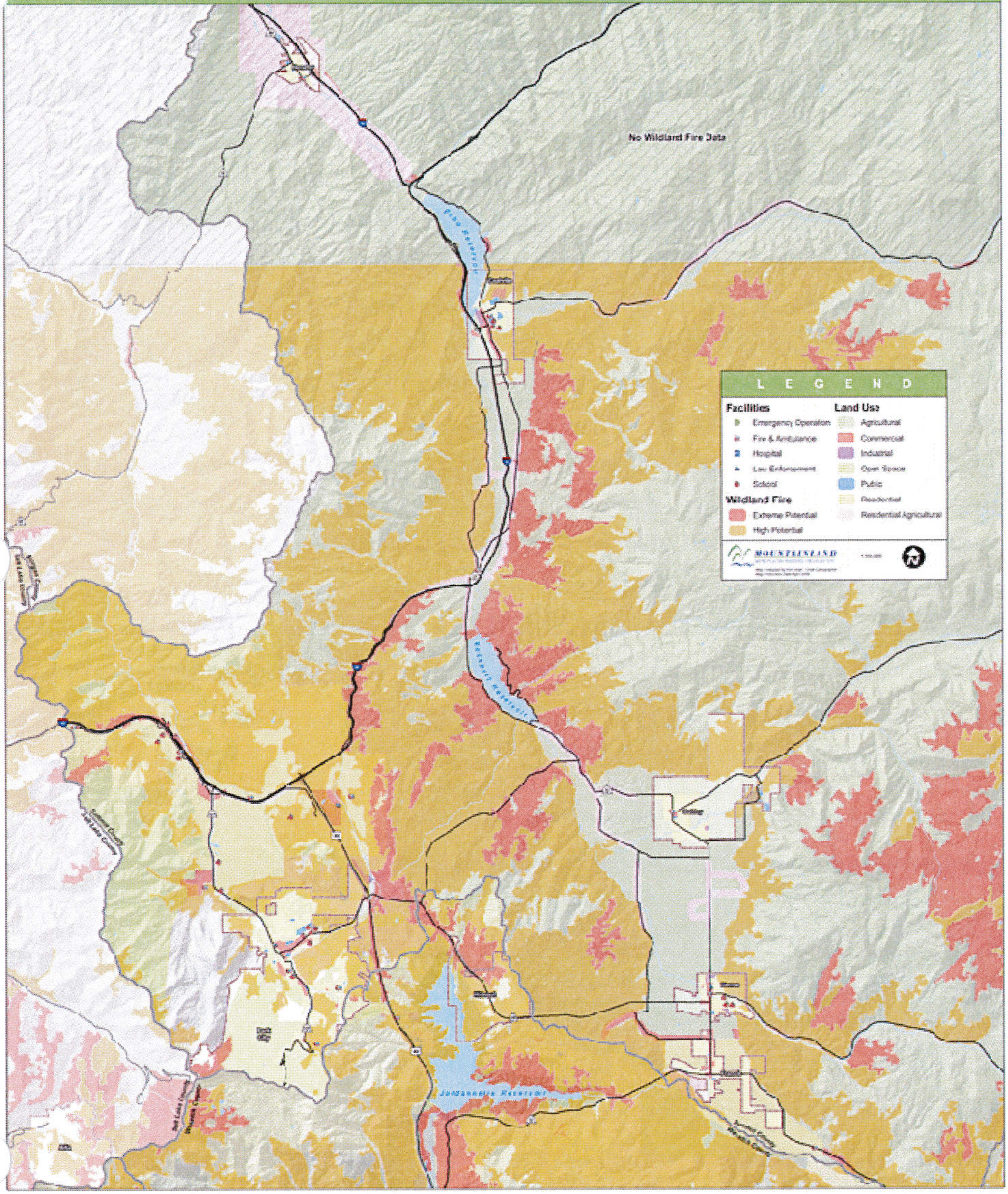
	Mud Lake			1985	35
217451	1988 Fire	29	8	1988	60
294531	Boy Scout	27	6	1994	450
354421	Dry Fork	6	9	2000	250
381940	East Fork	28	6	2002	14208
1438670	Coal Mine	12	6	2006	99

Utah Division of Forestry Fires and State Lands 2009

State Fire Marshal's Office
Due to the high number of events, yearly reports for the previous 5 years are included in the annex portion of the is plan.

SUMMIT COUNTY

WILDLAND FIRE MAP



Landslide/Problem Soils

Overview

The area around Park City is known for its destination resort quality views. Much of the economy of the area is based on the snow ski industry. Future development will most assuredly be related to scenic views and resort development. Any areas of potential landslide or problem soils should be addressed in a site-specific geo-technical study.

No electronic data is currently available to determine the vulnerability for problem soils within the Summit County area based on a GIS analysis. It is assumed that the resort communities of Park City and the Snyderville basin will have potential problems with landslides. Due to the high value of much of the development occurring in the area, measures should be taken to reduce the potential for loss. In order to develop data, slope analysis was performed within GIS to identify areas that may have potential for landslides. While this method is not ideal, it does create a basis for additional study in the future.

Development Trends

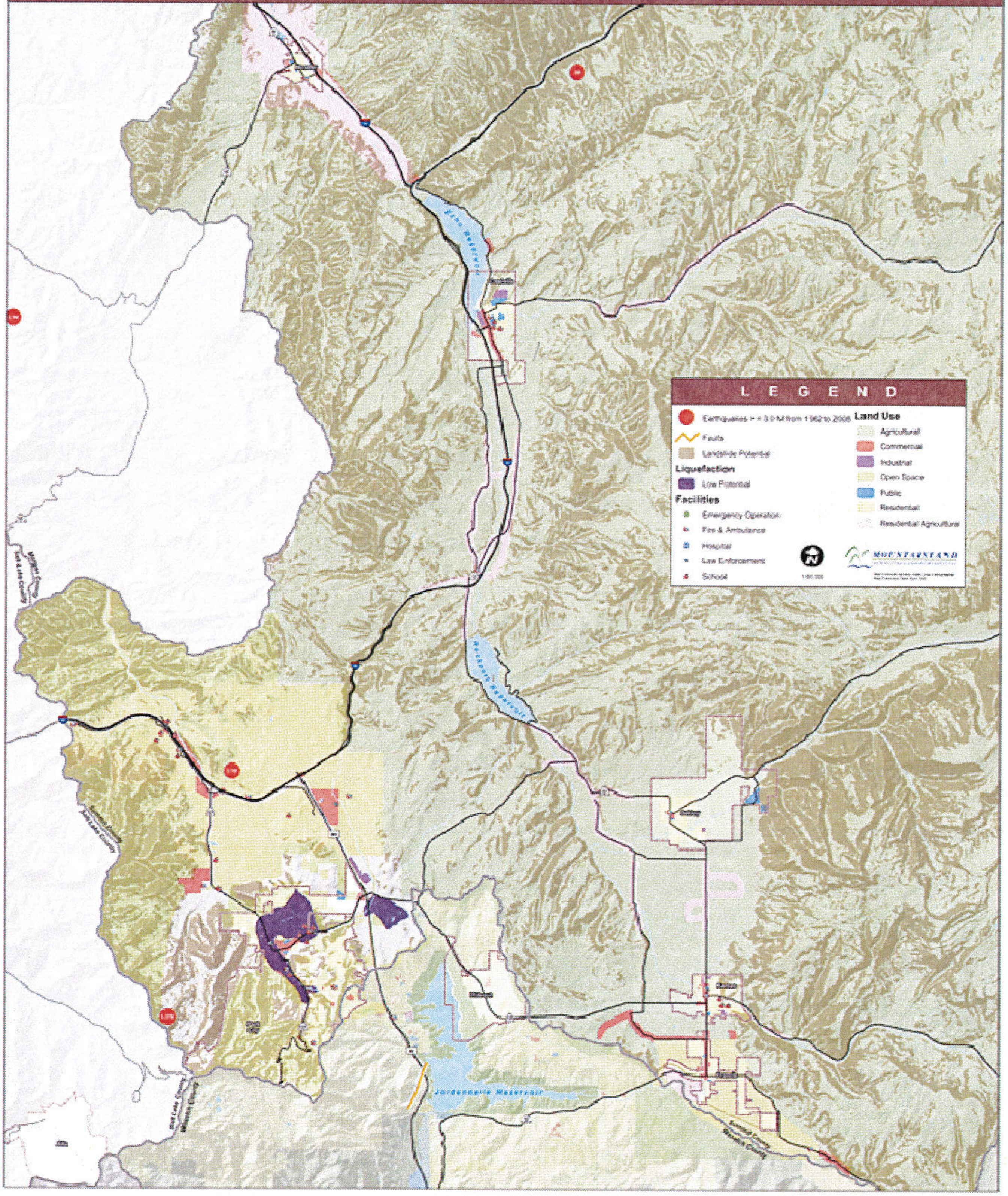
As development continues on the mountains of Summit County, more structures may be in danger of landslides. Increased analysis and geotechnical reports should become an integral part of the development and building process. Careful consideration should be given to ensure cutting and filling for any project is minimized.

Profile

Frequency	Movement likely occurs nearly every year.
Severity	Moderate several structures have been condemned.
Location	Along most mountains and hillsides.
Seasonal Pattern	Spring when ground saturation is at its peak.
Duration	Minutes to years.
Speed of Onset	Seconds to days.
Probability of Future Occurrences	High – Due to terrain and construction within sloped areas.

SUMMIT COUNTY

EARTHQUAKE, LIQUEFACTION AND LANDSLIDE HAZARD MAP



Earthquake

Overview

As development occurs in Summit County, more buildings and people will be in danger from earthquakes. However, newer buildings will be built to better standards, which will actually decrease the risk of damage. It is interesting to note that when most residential structures are engineered, out the three categories of design criteria; seismic zone, wind shear and snow load; the design criteria for wind shear over-rules the other criteria.

Please see the Summit County HAZUS Report in the appendix of this document for full details of vulnerability.

Development Trends

Due to Summit County being outside of the Wasatch Fault zone the severity of a potential earthquake is thought to be lower. Recent development trends have been to build on steeper slopes and benches which can lessen the potential for liquefaction but increase susceptibility to earthquake triggered landslides. Ultimately, new construction in the area equals more structures that are susceptible to earthquakes. Each construction project should be thoroughly review for resistance to ground shake and other earthquake related hazards.

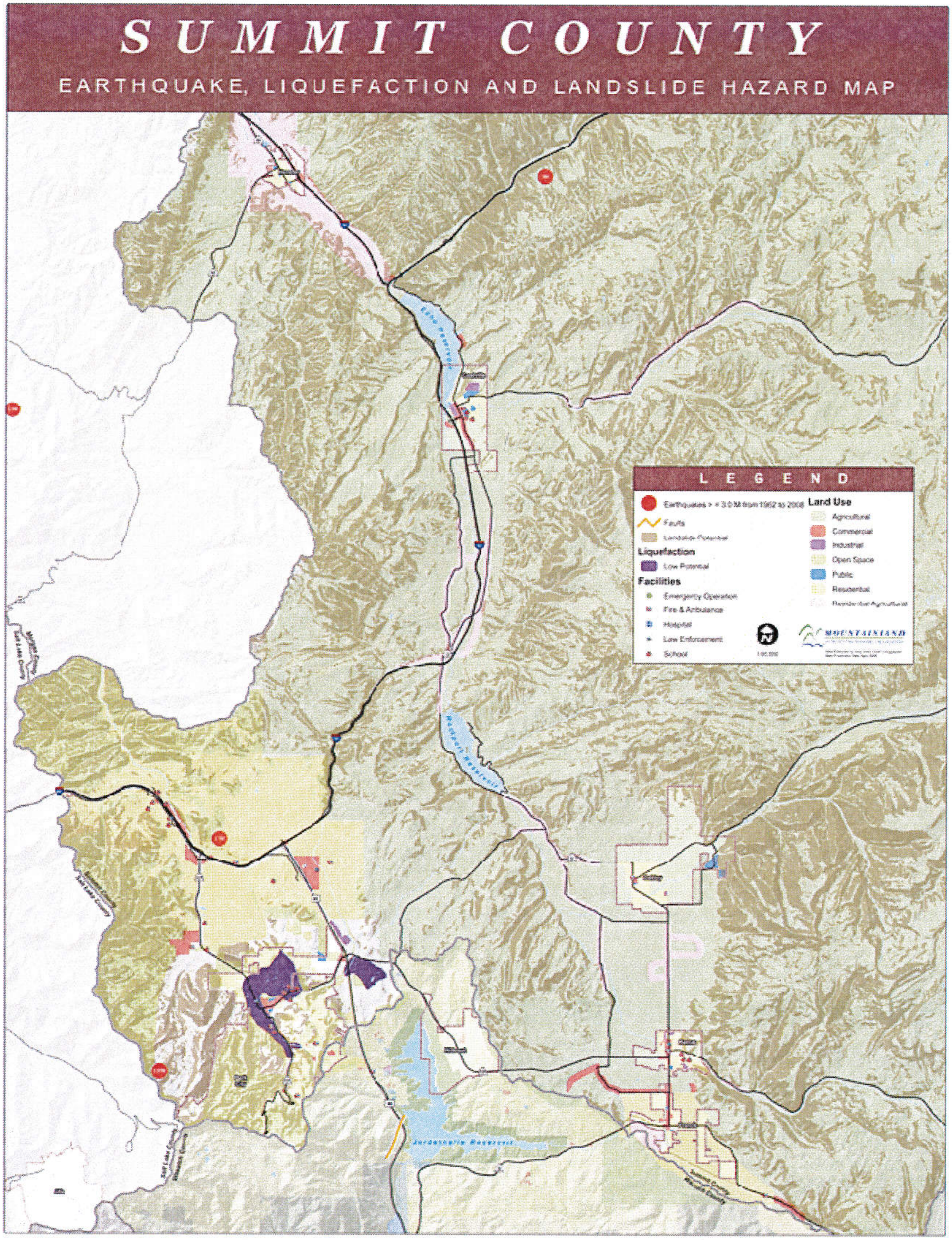
Profile

Frequency	Low -Events above 3.0 on the Richter scale are rare. Minor events (below 3.0) occur every month.
Severity	High (up to 5.0)
Location	Some faults throughout the county.
Seasonal Pattern	None
Duration	1 to 6 minutes excluding aftershocks.
Speed of Onset	Seconds
Probability of Future Occurrences	Low- .03 (events above 3.0)

History

Recorded Earthquakes magnitude 3.0 or greater since 1950: Utah County		
Date	Richter Magnitude	Epicenter
July 27, 1965	3.7	East of Park City
February 7, 1972	3.1	Near Kimball Junction

University of Utah Seismology Department 2009


SUMMIT COUNTY
EARTHQUAKE, LIQUEFACTION AND LANDSLIDE HAZARD MAP
LEGEND
Earthquakes > = 3.0 M from 1962 to 2008
Faults
Liquefaction
Low Potential
Facilities
Emergency Operation
Fire & Ambulance
Hospital
Law Enforcement
School
Land Use
Agricultural
Commercial
Industrial
Open Space
Public
Residential
MOUNTAINLAND

Review of 2004 Plan Mitigation Strategies

For the previous(2004) Mountainland Hazard Mitigation Plan, each participating jurisdiction prioritized there mitigation efforts and identified a single project. Below is a list of those projects and an update on the status of each project.

Summit County Communities
PRIORITIZATION OF INDIVIDUAL COMMUNITY
MITIGATION STRATEGIES

Community	Hazard	Mitigation	Status	Comments
Coalville	Wildfire	Educate Homeowners on Firewise practices	Ongoing	Community is partnering with various fire prevention agencies to educate. New standards in International Building Code.
Francis	Wildfire	Educate Homeowners on Firewise practices	Ongoing	Community is partnering with various fire prevention agencies to educate. New standards in International Building Code.
Henefer	Wildfire	Educate Homeowners on Firewise practices	Ongoing	Community is partnering with various fire prevention agencies to educate. New standards in International Building Code.
Kamas	Wildfire	Educate Homeowners on Firewise practices	Ongoing	Community is partnering with various fire prevention agencies to educate. New standards in International Building Code.
Oakley	Wildfire	Educate Homeowners on Firewise practices	Ongoing	Community is partnering with various fire prevention agencies to educate. New standards in International Building Code.
Park City	Wildfire	Educate Homeowners on Firewise practices	Ongoing	Community is partnering with various fire prevention agencies to educate. New standards in International Building Code.
Summit County	Wildfire	Educate Homeowners on Firewise practices	Ongoing	Community is partnering with various fire prevention agencies to educate. New standards in International Building Code.

Damage Assessment and Mitigation

Each jurisdiction represented by this plan has participated in the creation of its contents and given local input into their individual mitigation goals and priorities. Early in the process the planning team determined that creating a list of basic mitigation strategies would stimulate each jurisdiction by acting as a beginning point for additional mitigation planning as well as helping to fulfill the requirements of this plan. Each jurisdiction has accepted and or made changes to the mitigation table to reflect their needs.

Listed below are the damage assessments for each of the participating jurisdiction followed by that community's mitigation strategies. Damage assessments were calculated using the methodologies mentioned earlier in this plan. Strategies were developed by the planning committee and then modified, if desired, by the individual community and listed in two tables. One for current residents and structures and the second for future residents and structures.

These strategies were assigned a priority of high, medium, or low by communities according to the following criteria:

- Number of people affected by the project
- Technical feasibility
- Political support
- Available funding and priorities
- Environmental impact
- Cost to benefit ratio

Earthquake (county wide)

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Earthquake	69	$ 23,479,099.42		3	$ 5,328,515.66		0	0	0	0	0

Coalville

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	153	$14,875,000	155	5	$1,203,900	0	2	$387,000	2	$8,646,300	-
FEMA Flood Plain	111	$10,484,400	119	3	$362,500	0	2	$387,000	5	$30,079,300	-
HAZUS Flood	98	$10,328,400	95	17	$6,795,200	0	2	$387,000	5	$29,685,700	-
Steep Slopes	11	$1,103,200	0	2	$922,300	0	-	-	-	-	-
Wild Fire	67	$7,044,300	11	11	$2,618,700	0	-	-	6	$37,454,500	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and	High	1 year	Minimal	Local Cash,	Local Government,

	preparation.				Grants	UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Francis

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	3	$173,700	1	0	$0	0	-	-	2	$9,901,100	-
FEMA Flood Plain	5	$390,100	8	1	$18,800	0	-	-	2	$8,760,400	-
Steep Slopes	4	$355,400	0	1	$26,500	0	-	-	-	-	-
Wild Fire	5	$477,400	1	1	$20,200	0	-	-	1	$5,677,500	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding	Responsible Party

					Sources	
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Flooding/Dam Failure	Canal safety program.	High	3 years	TBD	Local Cash, Grants	Local Government
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Henefer

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	-	-	-	-	-	-	-	-	-	-	-
FEMA Flood Plain	27	$2,735,900	146	3	$273,700	10	-	-	3	$13,964,900	-
HAZUS Flood	38	$3,888,400	188	3	$365,400	0	-	-	6	$36,381,600	-
Steep Slopes	1	$65,300	0	0	$0	0	-	-	-	-	-
Wild Fire	-	-	-	-	-	-	-	-	-	-	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government

Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Kamas

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
FEMA Flood Plain	0	$0	10	1	$400	0	-	-	1	$3,236,900	-
HAZUS Flood	42	$3,852,400	45	8	$2,684,300	230	-	-	1	$6,570,800	-
Steep Slopes	3	$256,700	0	1	$128,100	0	-	-	-	-	-
Wild Fire	13	$972,300	72	4	$502,300	10	-	-	6	$32,263,900	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding	Responsible Party

					Sources	
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Oakley

	Residential			Commercial			Bridges		Roads		Critical Facilities
Hazard	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	121	$13,914,400	600	7	$1,589,300	110	6	$1,006,000	-	-	-
FEMA Flood Plain	137	$16,046,700	787	7	$1,854,900	100	1	$115,000	-	-	-

HAZUS Flood	21	$2,300,000	125	2	$275,600	0	1	$115,000	-	-	-
Steep Slopes	17	$2,034,400	0	2	$184,400	0	-	-	-	-	-
Wild Fire	39	$4,394,100	20	4	$699,400	0	-	-	-	-	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Park City

Hazard	Residential	Commercial	Bridges	Roads	Critical

											Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	105	$27,577,000	52	15	$8,854,100	70	-	-	4	$21,381,400	-
FEMA Flood Plain	499	$97,333,300	173	47	$24,999,500	120	-	-	6	$34,008,500	2
HAZUS Flood	1	$95,700	19	1	$39,900	0	-	-	0	0	-
Debris	2	$407,700	67	1	$69,400	30	-	-	3	$13,314,200	-
Steep Slopes	823	$148,659,400	0	48	$19,201,800	0	2	-	-	-	-
Wild Fire	1,246	$226,347,200	1731	78	$29,485,100	570	-	-	43	$206,743,500	1

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	FEMA Firm was integrated into Park City's Environmental GIS system for Building/Planning Dept.	High	2 years	10,000	Park City	Park City
Flooding/Dam Failure	PCMC implemented a WebGIS allowing the public to research local flood plane issues on the Web.	High	2 years	15,000	319 CWA Grant	Park City
Flooding/Dam Failure	http://dagrc.utah.gov/ParkCityGIS/				319 CWA Grant	Park City

Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Snyderville

	Residential			Commercial			Bridges		Roads		Critical Facilities
Hazard	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	197	$52,865,300	0	55	$20,575,400	0	-	-	-	-	-
FEMA Flood Plain	169	$35,771,200	0	23	$8,319,900	0	-	-	-	-	-
HAZUS Flood	75	$15,080,700	0	13	$4,136,600	0	-	-	-	-	-
Steep Slopes	848	$168,280,500	0	63	$20,370,800	0	-	-	-	-	-
Wild Fire	2,309	$425,242,600	0	238	$69,860,100	0	7	$6,773,000	-	-	1

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering	Medium	1 year	TBD	Local Cash,	Local Government,

	practices and retaining measures in susceptible areas.				Grants	UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Summit County (unincorporated)

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	377	$40,699,000	59	28	$6,211,300	110	16	$4,664,000	-	-	-
FEMA Flood Plain	388	$39,934,400	78	22	$4,587,900	10	23	$6,835,000	-	-	-
HAZUS Flood	135	$13,423,900	38	13	$2,008,000	0	18	$7,852,000	-	-	-
Debris	0	$0	0	1	$0	0	-	-	-	-	-
Steep Slopes	1,170	$155,482,000	0	60	$24,642,200	0	1	$120,000	-	-	-
Wild Fire	1,570	$165,207,300	761	116	$29,433,400	1360	16	$7,148,000	-	-	3

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Part VII
Utah County
Profiles and Mitigation

Background

Area: 2,014 square miles; *county seat*: Provo; *origin of county name*: after the Ute Indians; *economy*: technology industry, light manufacturing, agriculture; *points of interest*: Fairfield Stagecoach Inn, historic downtown Provo, Brigham Young University (Monte L. Bean Life Sciences Museum, Museum of People and Culture, Harris Fine Arts Center), Utah Lake, Timpanogos Cave National Monument, Springville Museum of Art, Hutchings Museum of Natural History in Lehi, McCurdy Historical Doll Museum in Provo, Bridal Veil Falls, Sundance ski resort.

The most striking geographical features of Utah County are the Wasatch Mountains along the eastern boundary, and Utah Lake, the state's largest fresh-water lake. The high mountains, rising over 11,000 feet, receive heavy snowfall which feeds the numerous rivers and creeks that flow into the lake. Though large in surface area, Utah Lake is very shallow--18 feet at its deepest point.

Before the valley was settled by Mormon pioneers in the 1840s and 1850s it was the home of the Ute Indians. They lived along the eastern shore of the lake and used fish from the lake as their main food source. The Spanish Catholic priests Dominguez and Escalante, who observed them in 1776, described these Indians as peaceful and kind. Dominguez and Escalante were trying to find a route between Santa Fe, New Mexico, and what is now southern California. When they came down Spanish Fork Canyon in the summer of 1776 they were the first non-Indians to enter Utah Valley.

Mormon pioneers began settling Utah Valley in 1849. Like the Indians before them, they chose to settle on the fertile, well-watered strip of land between the mountains and Utah Lake. More than a dozen towns were established between Lehi on the north and Santaquin on the south. Provo, named for the French fur trapper Etienne Provost, has always been the largest town and the county seat.

In March 1849 thirty-three families, composed of about 150 people, were called to go to Utah Valley under the leadership of John S. Higbee to fish, farm, and teach the Indians. During the next two years - 1850 and 1851 - communities were established at Lehi, Alpine, American Fork, Pleasant Grove, Springville, Spanish Fork, Salem, and Payson.

Farming was the most important early industry in the county, with fruit growing and the processing of sugar beets being especially important. The first large-scale sugar beet factory in Utah was built in Lehi in 1890. In recent years, the center of the fruit industry in the county has shifted from Orem to the south end of the valley, where orchards are not threatened by housing developments.

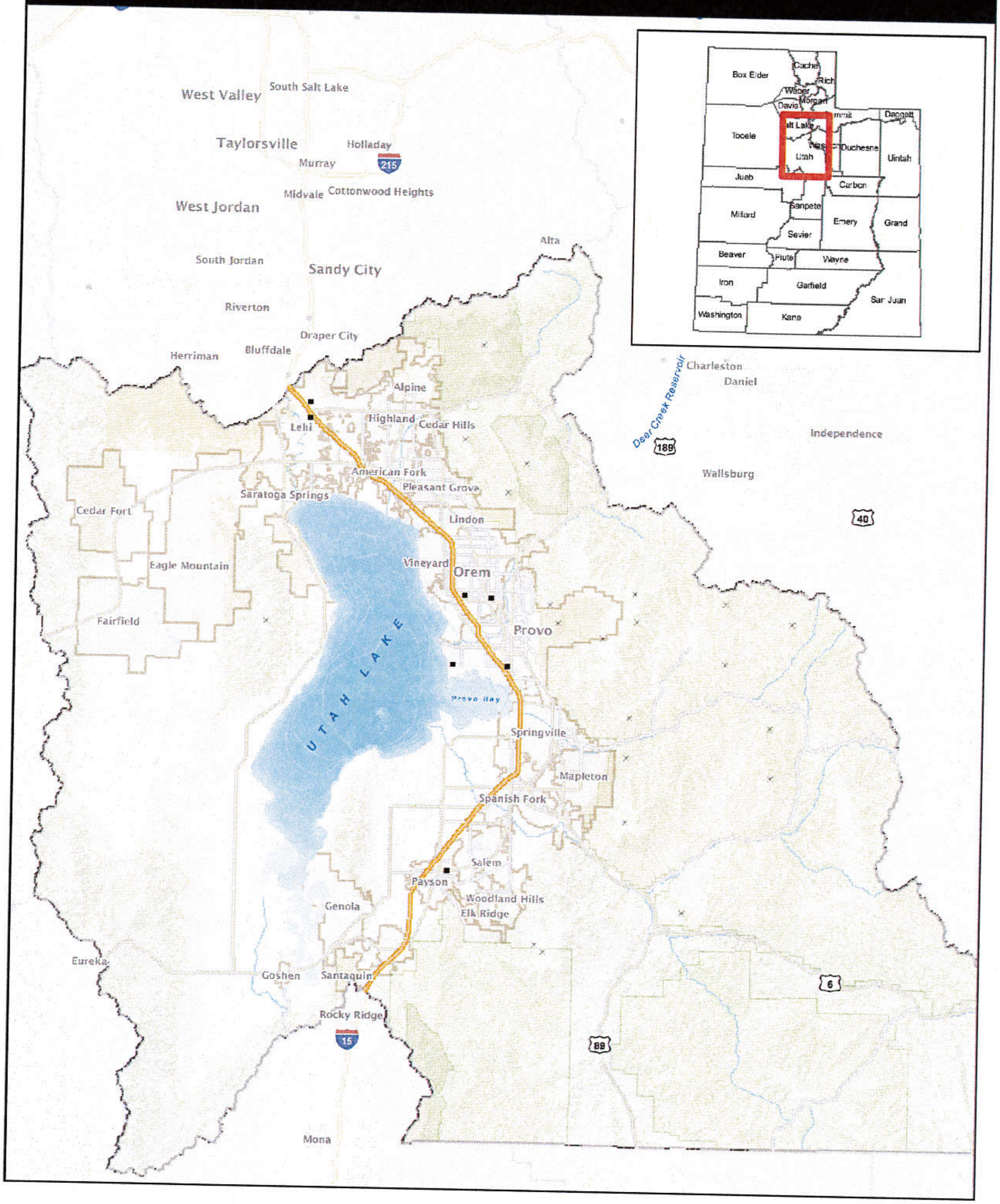
Mining was also an important industry in Utah County. In the late 1800s and early 1900s there were many successful mines in American Fork Canyon and in the Tintic mining district centered near Eureka, Juab County but included part of western Utah County. Many of the fine homes and business buildings in Provo were constructed with mining money.

Today, Utah County is best known as the home of Brigham Young University. BYU was established in 1875 as a small high-school level "academy," but it has grown to become a major university with 27,000 students. The Utah Valley University at Orem has grown rapidly to nearly 27,000 students as well. Other major Utah County employers include Omniture Corporation and Novell, two companies that began in Utah County and have become international leaders in the computer software industry.

Each of the major communities in the county have high schools and libraries. A culturally active area, the county has its own symphony--the Utah Valley Symphony, and one of the state's finest art museums: the

Springville Art Museum. Provo's Fourth of July Celebration is the largest in the state and other special community celebrations include Pleasant Grove Strawberry Days, the Lehi Round-up, Steel Days in American Fork, Fiesta Days in Spanish Fork, Golden Onion Days in Payson, Pony Express Days in Eagle Mountain and the World Folkfest in Springville.

UTAH COUNTY


West Valley
South Salt Lake
Taylorsville
Holladay
Murray
215
West Jordan
Midvale
Cottonwood Heights
South Jordan
Sandy City
Alta
Riverton
Draper City
Herriman
Bluffdale
Alpine
Lehi
Highland
Cedar Hills
American Fork
Pleasant Grove
Saratoga Springs
Cedar Fort
Lindon
Eagle Mountain
Vineyard
Orem
Fairfield
Provo
UTAH LAKE
Provo Bay
Springville
Mapleton
Spanish Fork
Salem
Payson
Woodland Hills
Elk Ridge
Genola
Eureka
Goshen
Santaquin
Rocky Ridge
15
Mona
Charleston
Daniel
Deer Creek Reservoir
189
Independence
Wallsburg
40
6
89
Box Elder
Cache
Rich
Weber
Davis
Morgan
Tooele
Salt Lake
Summit
Daggett
Wasatch
Utah
Duchesne
Uintah
Juab
Carbon
Millard
Sanpete
Emery
Grand
Sevier
Beaver
Piute
Wayne
Iron
Garfield
San Juan
Washington
Kane

Population

Table U-1

	1930	1940	1950	1960	1970	1980	1990	2000	2007
Utah	49,021	57,382	81,912	106,991	137,776	218,106	263,590	368,536	495,205

Economy

Table U-2

						% Change
Utah County	2002	2003	2004	2005	2006	2005-06
Population	405,977	423,286	437,627	456,073	475,425	4.2
Employment:						
Average civilian labor force	185,637	188,853	196,983	203,741	212,422	4.3
Average employment	140,704	141,961	149,311	156,990	165,687	5.5
Income:						
Average annual wage ($)	28,416	29,078	29,601	30,474	32,346	6.1
Total payroll wages ($ thousands)	3,998,216	4,127,922	4,419,724	4,784,093	5,359,318	12.0
Total personal income ($ thousands)	7,910,414	8,136,649	8,703,328	9,365,270	10,208,200	9.0
Per capita personal income ($)	20,178	20,377	20,048	20,726	21,964	6.0
Taxes:						
Total assessed valuation ($ thousands)	17,242,353	17,494,368	18,046,928	19,035,934	21,805,279	14.5
Property taxes charged, by all taxing units ($ thousands)	193,769	204,929	218,789	231,465	245,760	6.2
Gross taxable sales ($ thousands)	4,394,333	4,433,228	4,791,033	5,341,570	6,316,735	18.3
Net local sales tax allocations ($ thousands)	46,609	46,255	48,553	53,486	62,435	16.7
Construction (permit-authorized):						
New dwelling units (number)	4,326	4,677	4,728	5,819	6,902	18.6
Value of new residential construction ($ thousands)	623,777	706,068	770,583	1,074,621	1,420,653	32.2
Value of new nonresidential construction ($ thousands)	237,069	118,168	196,739	186,287	286,489	53.8
Value of total construction ($ thousands)	925,347	889,518	1,042,802	1,369,824	1,854,104	35.4
Miscellaneous:						
Payment in Lieu of Taxes Act ($ thousands)	787	916	935	929	944	1.6
New car and truck registrations by owners county (number)	8,916	8,427	9,209	9,849	10829	10.0

Source: Bureau of Economic and Business Research, University of Utah.

Population Characteristics

Social Characteristics	Estimate	Percent	U.S.
Average household size	3.63	(X)	2.6
Average family size	3.95	(X)	3.19
Population 25 years and over	225,309		
High school graduate or higher	(X)	92.8	84.00%
Bachelor's degree or higher	(X)	35.1	27.00%
Disability status (population 5 years and over)	40,384	9.8	15.10%
Foreign born	31,615	6.7	12.50%
Speak a language other than English at home (population 5 years and over)	50,943	12.3	19.50%
Household population	457,089		
Economic Characteristics	Estimate	Percent	U.S.
In labor force (population 16 years and over)	218,300	67.5	64.70%
Mean travel time to work in minutes (workers 16 years and over)	19.8	(X)	25.1
Median household income	53,692	(X)	50,007
Median family income	59,415	(X)	60,374
Per capita income	18,567	(X)	26,178
Families below poverty level	(X)	8.2	9.80%
Individuals below poverty level	(X)	12.5	13.30%
Housing Characteristics	Estimate	Percent	U.S.
Total housing units	132,344		
Occupied housing units	125,843	95.1	88.40%
Owner-occupied housing units	87,004	69.1	67.30%
Renter-occupied housing units	38,839	30.9	32.70%
Vacant housing units	6,501	4.9	11.60%
Owner-occupied homes	87,004		
Median value (dollars)	209,400	(X)	181,800
Median of selected monthly owner costs			
With a mortgage (dollars)	1,372	(X)	1,427
Not mortgaged (dollars)	357	(X)	402

Demographic Estimates	Estimate	Percent	U.S.
Total population	470,154		
Male	234,413	49.9	49.20%
Female	235,741	50.1	50.80%
Median age (years)	24.2	(X)	36.4
Under 5 years	54,905	11.7	6.90%
18 years and over	309,039	65.7	75.30%
65 years and over	29,732	6.3	12.50%
One race	461,439	98.1	97.90%
White	431,184	91.7	74.10%
Black or African American	2,367	0.5	12.40%
American Indian and Alaska Native	2,587	0.6	0.80%
Asian	6,442	1.4	4.30%
Native Hawaiian and Other Pacific Islander	2,484	0.5	0.10%
Some other race	16,375	3.5	6.20%
Two or more races	8,715	1.9	2.10%
Hispanic or Latino (of any race)	41,365	8.8	14.70%

Source: U.S. Census Bureau, 2005-2007 American Community Survey

Flooding/Dam Failure

Overview

Although Utah is considered a dry desert state, flooding does occur. Ranging from Most floods are occurring either from snow melt or severe thunderstorms. Often times flooding is increased by soils that are more impervious due to either wildfire or drying out. Floods occur on a regular basis in Utah County.

Development Trends

As development occurs on the bench areas of Utah Valley, along the shore of Utah Lake, or along river and stream corridors, more homes will be in danger of floods. Communities need to make developers and homeowners aware of the danger as well as contribute to mitigation actions. Cities should review every development that it is in compliance with NFIP guidelines.

The following table identifies the communities in Utah County with their NFIP Status.

COUNTY	CITY/TOWN	POPULATION	STATE MAP LOCATION	NFIP STATUS*	THREAT (or NSFHA-eligible)
Utah	Unincorporated	17638		490517 - 12/15/94	Utah Lake & Tributaries
Utah	Alpine	7146	E5	490228 - 4/4/83	
Utah	American Fork	21941	E5	490152 - 11/25/80(M)	
Utah	Cedar Fort	341	E4	490153 - (NSFHA)	
Utah	Cedar Hills	3094	D5	Not Participating	Heisett's Hollow & Other drainages
Utah	Eagle Mountain	2157	D4	Not Participating	Tickville Gulch &Tributaries
Utah	Elk Ridge	1838	E5	Not Participating	Loafer Canyon & Others drainages
Utah	Genola	965	E5	490154 - (NSFHA)	
Utah	Goshen	874	F4	Not Participating	City Ditch (minor)
Utah	Highland	8172	D5	490254 - 2/4/02	
Utah	Lehi	19028	E5	490209 - 3/1/83	
Utah	Lindon	8363	E5	490210 - 2/19/86(M)	
Utah	Mapleton	5809	E5	490156 - 12/16/80(M)	
Utah	Orem	84324	E5	490216 - 9/24/84(M)	
Utah	Payson	12716	E5	490157 - 1/6/81	

COUNTY	CITY/TOWN	POPULATION	STATE MAP LOCATION	NFIP STATUS*	THREAT (or NSFHA-eligible)
Utah	Pleasant Grove	23468	E5	490235 - (NSFHA)	
Utah	Provo	105166	E5	490159 - 9/30/88	
Utah	Salem	4372	E5	490160 - 7/16/79	
Utah	Santaquin	4834	E5	490250 - **(NSFHA)**	Tributaries 4, 5, & 6
Utah	Saratoga Springs	1003	D4	490227 - **(NSFHA)**	
Utah	Spanish Fork	20246	E5	490241 - 2/19/86(M)	
Utah	Springville	13950	E5	490163 - 2/15/85	
Utah	Vineyard	150	E5	Not Participating	Utah Lake
Utah	Woodland Hills	941	E5	Not Participating	Broad and Snell Hollows

Source: FEMA Utah State Department of Homeland Security

The primary goal for non participating communities is to become a participating member of the NFIP.

Profile

Frequency	Some flooding happens within Utah County on almost a yearly basis.
Severity	Moderate
Location	Primarily along streams, rivers and along the shores of Utah Lake
Seasonal Pattern	Spring time due to snow melt. Isolated events throughout the year due to severe weather (microburst).
Duration	A few hours to a few weeks depending upon conditions
Speed of Onset	1 to 12 hours
Probability of Future Occurrences	High - for delineated floodplains there is a 1% chance of flooding in any given year.

Assessing Vulnerability: Addressing Repetitive Loss Properties

There are no repetitive loss properties in Utah County (FEMA, 2008).

Utah County Flood and Dam Failure History

Hazards	Date	Location	Critical Facility or Area Impacted	Comments
Flood Utah	May 30, 1939	Thistle	Damage to homes, farmlands, and crops. Highways 50 and 89 received considerable damage	
Flood Utah	July 22, 1943	American Fork	Damage to crops and poultry	
Flood Utah	August 3, 1951	Lehi/Alpine/ American Fork	Damage to homes, farmlands, and crops. Utah Power generator plant damaged as well as 75 feet of pipeline. Dam in	Source Box Elder and American Fork Canyons

			upper American Fork Canyon washed out causing debris flow.	
Flood Utah	August 26, 1952	Lehi	City water lines flooded with mud, National Guard Headquarters flooded	
Flood Utah	July 30, 1953	American Fork	Bridges and roads damaged. Utah Power and Light stations and substations received $10,000 in damage.	Source American Fork Canyon
Flood Utah	September 27, 1962	Provo	Buildings and business establishments in downtown business district flooded	
Flood Utah	May 21, 1973	Payson	Payson Dam washed out causing several hundred thousand dollars in damage to city and roads	
Flood Utah Presidential	Spring 1983	County wide	Damage to county, state, and federal roads, rail lines, homes, and businesses. Damage by municipality below.	Creek Thistle landslide movement Utah Lake elevation reached 4,494.34 causing substantial flooding.
		Alpine	Alpine flooded,	Source Dry Creek Fort Creek
		American Fork	Extensive damage	Source American Fork Canyon
		Covered Bridge Property Owners Association	Bridge washed out forcing use of a swinging footbridge. Without phones for two weeks	
		Elk Ridge	Road damage	Source Loafer Creek
		Genola	Damage to state roads, and public right-of-ways.	
		Goshen	Several thousand dollars in damage.	Culinary water supply contaminated
		Highland	Public park and few road were damaged	Source American Fork Canyon
		Lehi	Damage to roads, bridges, channels, stream banks, and private property	Three families relocated.
		Lindon	Lindon roads damaged	
		Mapleton	$200,000 in damage to all sectors. Five culvert bridges washed out, loss of city culinary water supply.	Source Maple Canyon

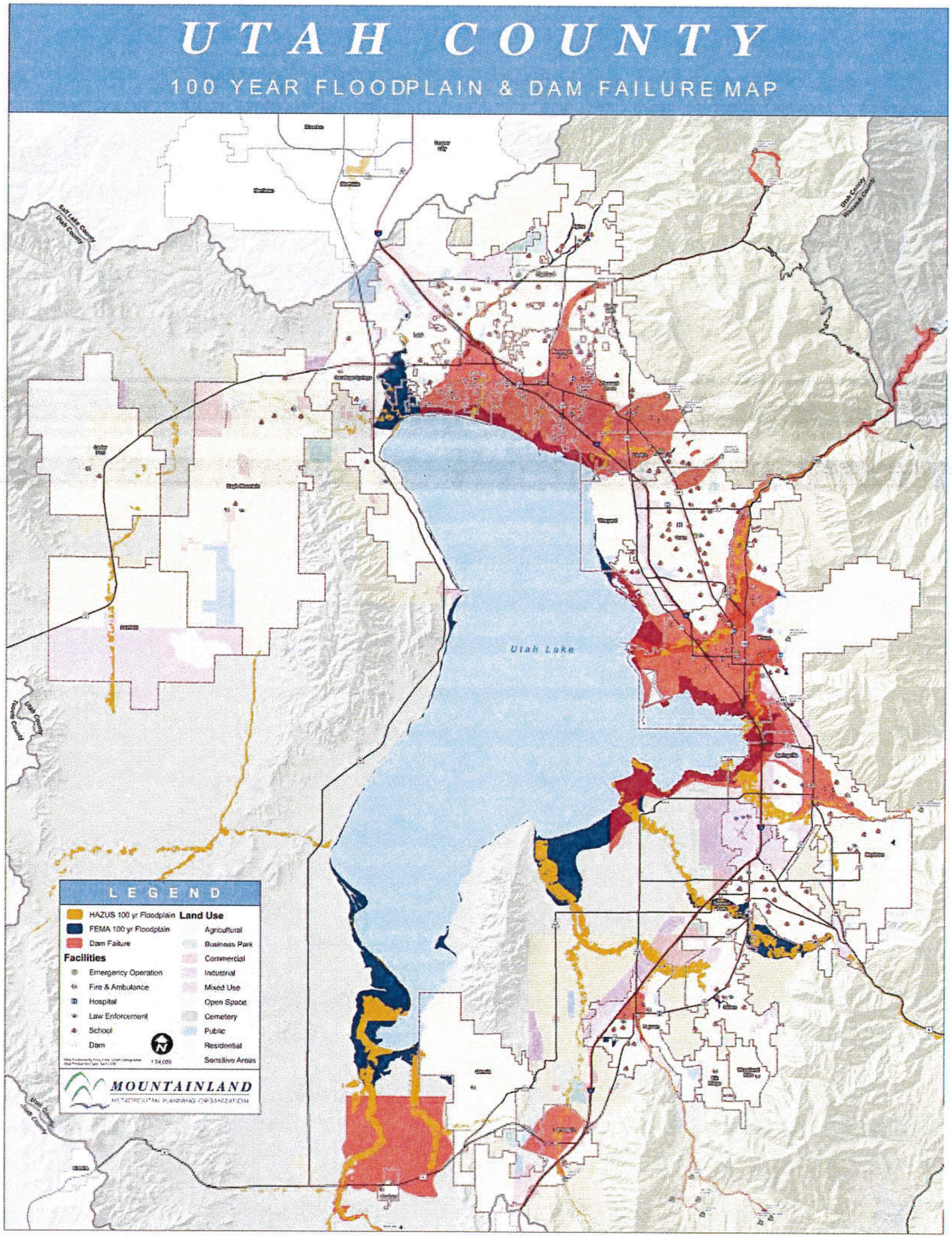
		Orem	Minor damage to city other than along Provo River	
		Payson	Damage to water diversion structures in the canyon	Source Payson Canyon
		Pleasant Grove	Damage to streets and homes.	Source Battle Creek Grove Creek
		Provo	Damage to culverts, streets, public property, farmlands, and homes.	Minor landsliding along foothills. High groundwater
		Salem	Damage to streets, private yards, and city park	Not eligible for federal funding because damage occurred after the incident period was closed. Sinkholes appeared.
		Santaquin	Damage to roads and loss of culinary water source for six weeks.	
		Spanish Fork	Damage to all sectors	Source Spanish Fork River
		Springville	Damage to riverbanks, bridges, public property, private property, and farmland.	Source Hobble Creek $400,000 in damages
		Strawberry Water Users Association	$216, 777 in damage to improvements owned by the Water Assoc.	Rock diversion dam washed out 2,100 feet of canals, roads, and culverts damaged.
Flooding Utah Presidential	Spring 1984	County Wide	Estate of damage $5, 467,000	

SHELDUS Data for Utah County

DATE	HAZARD	INJURIES	FATALITIES	PROPERTY DAMAGE (Adjusted to 2008)	CROP DAMAGE (Adjusted to 2008)
7/18/1965	Flooding	0	0	333333.33	3333.33
9/5/1965	Flooding	0.71	0	22222.2	2222.2
8/28/1971	Flooding	0	1	31250	312.5
5/1/1983	Flooding	0	0	4960317.46	4960317.46
8/18/1983	Flooding	0	0	26041.67	0
5/14/1984	Flooding	0	0	33333.4	0
2/17/1986	Flooding	0	0.09	85763.21	0
2/19/1986	Flooding	0	0	55493.96	0
8/20/1986	Flooding	0	0	18867.92	0

8/26/2000	Flooding	0	0	12048.19	0
9/6/2002	Flooding	0	0	229885.06	0
9/12/2002	Flooding	0	0	3448275.86	114942.53
7/16/2004	Flooding	0	0	439560.44	0
7/17/2004	Flooding	0	0	384615.38	0
5/21/2005	Flooding	0	0	2659.57	0
4/15/2006	Flooding	0	0	25773.2	0

SHELDUS University of South Carolina 2009


UTAH COUNTY
100 YEAR FLOODPLAIN & DAM FAILURE MAP
Utah Lake
LEGEND
HAZUS 100 yr Floodplain
FEMA 100 yr Floodplain
Dam Failure
Land Use
Agricultural
Business Park
Commercial
Industrial
Mixed Use
Open Space
Cemetery
Public
Residential
Sensitive Areas
Facilities
Emergency Operation
Fire & Ambulance
Hospital
Law Enforcement
School
Dam
MOUNTAINLAND

Wildfire

Overview

Wildfires occur on a regular basis in Utah County. Most fires occur in the late summer to early fall. Although many fires occur from natural causes such as lightning, humans cause most fires. Sparks from trains traveling on the railroad cause many small fires in south Utah County. People riding ATV's, using fireworks and campfires also start a number of fires in the area.

Development Trends

As development occurs on the bench areas of Utah Valley more homes will be in danger of wildfire. Communities need to make developers and homeowners aware of the danger. Cities should also require firebreaks and access roads along urban/wildland interfaces. Although development brings homes closer to areas of potential wildfire, it also brings water and access for firefighters closer to the urban fringe. Firewise community development principles, such as not storing firewood near homes, installing fire resistant roofing and cleaning debris from rain gutters will reduce potential loses.

Profile

Frequency	Multiple wildland fires occur in Utah County Every year.
Severity	Moderate
Location	Hillsides and mountainous areas, open grass and range lands.
Seasonal Pattern	Summer and fall depending on weather conditions.
Duration	A few hours to a few weeks depending upon conditions
Speed of Onset	1 to 48 hours
Probability of Future Occurrences	High Major Fires – 1.43 fires per year (FFSL) All Fires – 152 per year (USFM)

History

Forestry Fires and State Lands

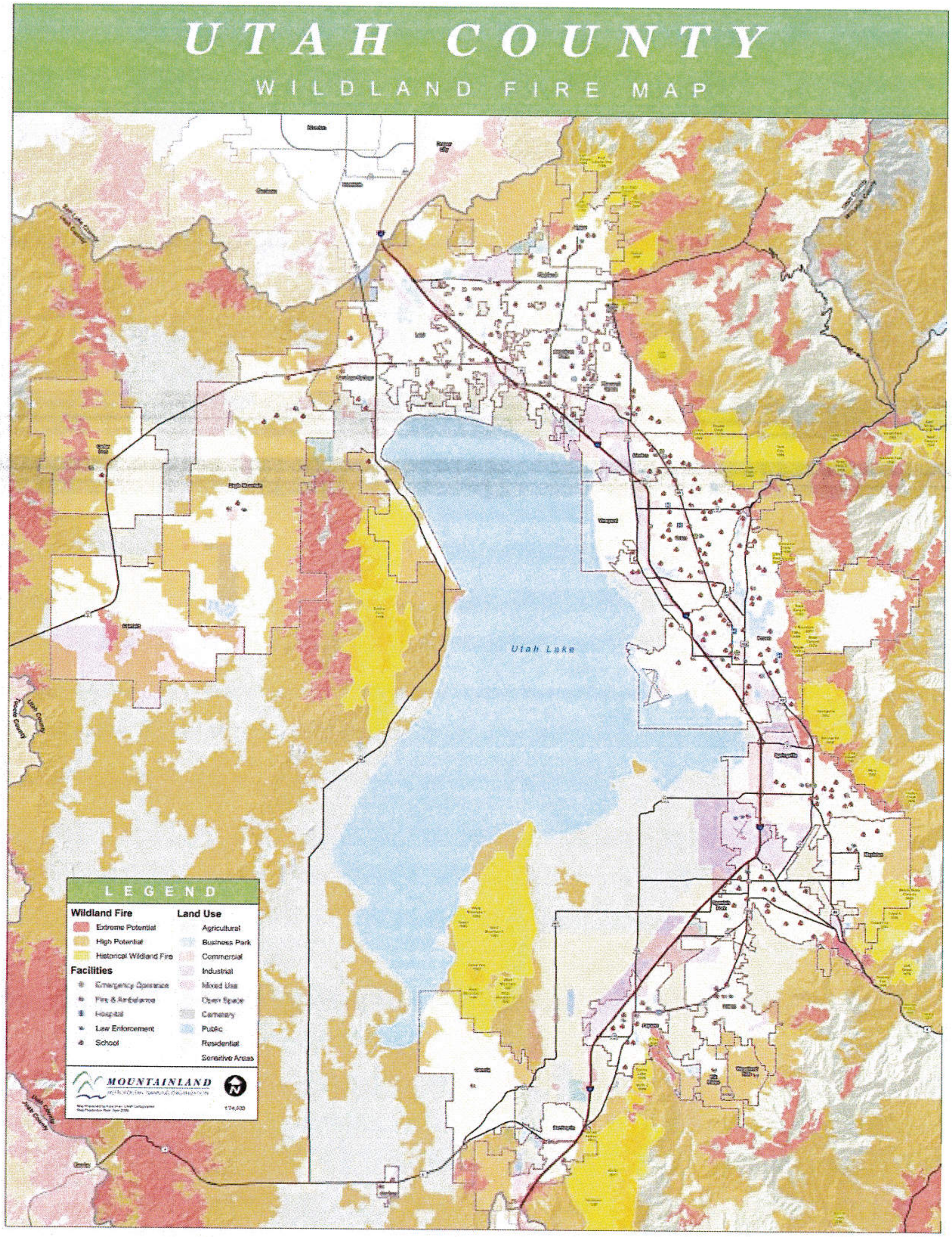
NIFMID	NAME	DAY	MONTH	YEAR	ACRES
	Orem Park	20	7	1960	505
	Box Elder Canyon	2	7	1961	491
	Bear Canyon	20	7	1961	80
81649	Sagehen Spring	18	10	1970	53
81803	Whitmore	2	8	1973	105
81995	Oak Brush	30	9	1976	442
81961	Brimhall	6	8	1976	175
82079	Slide Canyon	7	7	1979	50
82113	Sherwood Hills	20	7	1980	15

82114	East Lindon	23	7	1980	40
	Santaquin	4	8	1981	211
	Left Fork	27	8	1981	50
82207	Long Hollow	13	7	1982	20
82245	Broad Hollow	15	7	1983	80
82238	Cedar Fire	5	7	1983	80
82239	Tower	5	7	1983	400
	Castilla	26	10	1983	18
	Diamond Fork	19	8	1985	120
217068	Rifle Engine	1	7	1986	40
217069	Three Sisters	3	7	1986	20
217117	Squaw Creek	5	8	1987	1272
217128	Big Jane	30	6	1987	356
217178	Fort Canyon Fire	31	8	1988	389
217211	Maple Flat Fire	3	8	1989	60
217245	Middle Slide Canyon	2	9	1989	700
264607	Fort Canyon	16	9	1992	30
264579	Dry Creek	29	6	1992	355
264580	Rock Canyon	5	7	1992	155
264587	GRA	24	7	1992	790
281754	Betts Fire	28	6	1993	39.75
294505	Trojan II	10	9	1994	2950
314100	Sterling Hollow	4	8	1996	148.3
319599	Bunnells Fork	27	4	1996	131
311768	Wanrhoades	1	8	1996	70
314625	Vivian Park	11	8	1996	350
314099	Tank Fire	5	8	1996	3000
	Soldier Pass	20	6	1996	7620
327886	West Mountain	28	8	1997	640
334885	Beehive Fire	18	7	1998	52
330529	West Mountain 1	14	6	1998	129
334311	West Mountain 2	18	9	1998	1316
346560	West Mountain 3	25	6	1999	2059
346551	West Mountain 4	2	7	1999	7076
354431	East Vivian	26	7	2000	1753
354348	Wing	10	6	2000	813
354367	Oakhill	30	7	2000	1028
354368	Box Elder	21	7	2000	125
371237	Mollie	18	8	2001	8021
371164	Y Mountain	21	7	2001	461
371165	Nebo Creek	2	7	2001	4378

379680	Springville	30	6	2002	2259
379665	Bennie Creek	21	8	2002	11.5
379690	Brimhall	17	7	2002	50.9
391802	Cherry Creek 2	25	10	2003	5720
391760	Lavanger	3	8	2003	14.7
391801	Crowd Fire	10	8	2003	140
391815	Diamond Fire	1	8	2003	38.6
391803	Little Rock Canyon	15	8	2003	102
397916	Red Bull	29	7	2004	1836
397541	Ether	27	7	2004	32
397545	Red Hollow	1	8	2004	13.9
	P Fire	21	7	2005	51.4
1420728	Explosion	10	8	2005	58
1426830	Springville	2	10	2005	158
1435968	Hobble Creek	5	6	2006	113.7
	Spring Lake		7	2008	0
1470109	Molly 2	28	6	2008	20
1469848	Y Mtn.	25	7	2008	5
1471944	Bridal Falls 2	24	7	2008	220

Utah Division of Forestry Fires and State Lands 2009

State Fire Marshal's Office
Due to the high number of events, yearly reports for the previous 5 years are included in the annexes portion of the is plan.


UTAH COUNTY
WILDLAND FIRE MAP
Utah Lake
LEGEND
Wildland Fire
Extreme Potential
High Potential
Historical Wildland Fire
Facilities
Emergency Operation
Fire & Ambulance
Hospital
Law Enforcement
School
Land Use
Agricultural
Business Park
Commercial
Industrial
Mixed Use
Open Space
Cemetery
Public
Residential
Sensitive Areas
MOUNTAINLAND

Earthquake

Overview

Please see the HAZUS-MH Earthquake event report for Utah County. HAZUS is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop earthquake losses at a regional scale. For this plan a Utah County earthquake was simulated. The complete results are within the event report.

Development Trends

As development occurs in Utah County, more buildings and people will be in danger from earthquakes. However, newer buildings will be built to better standards, which will actually decrease the risk of damage. It is interesting to note that when most residential structures are engineered, out the three categories of design criteria; seismic zone, wind shear and snow load; the design criteria for wind shear over-rules the other criteria.

Profile

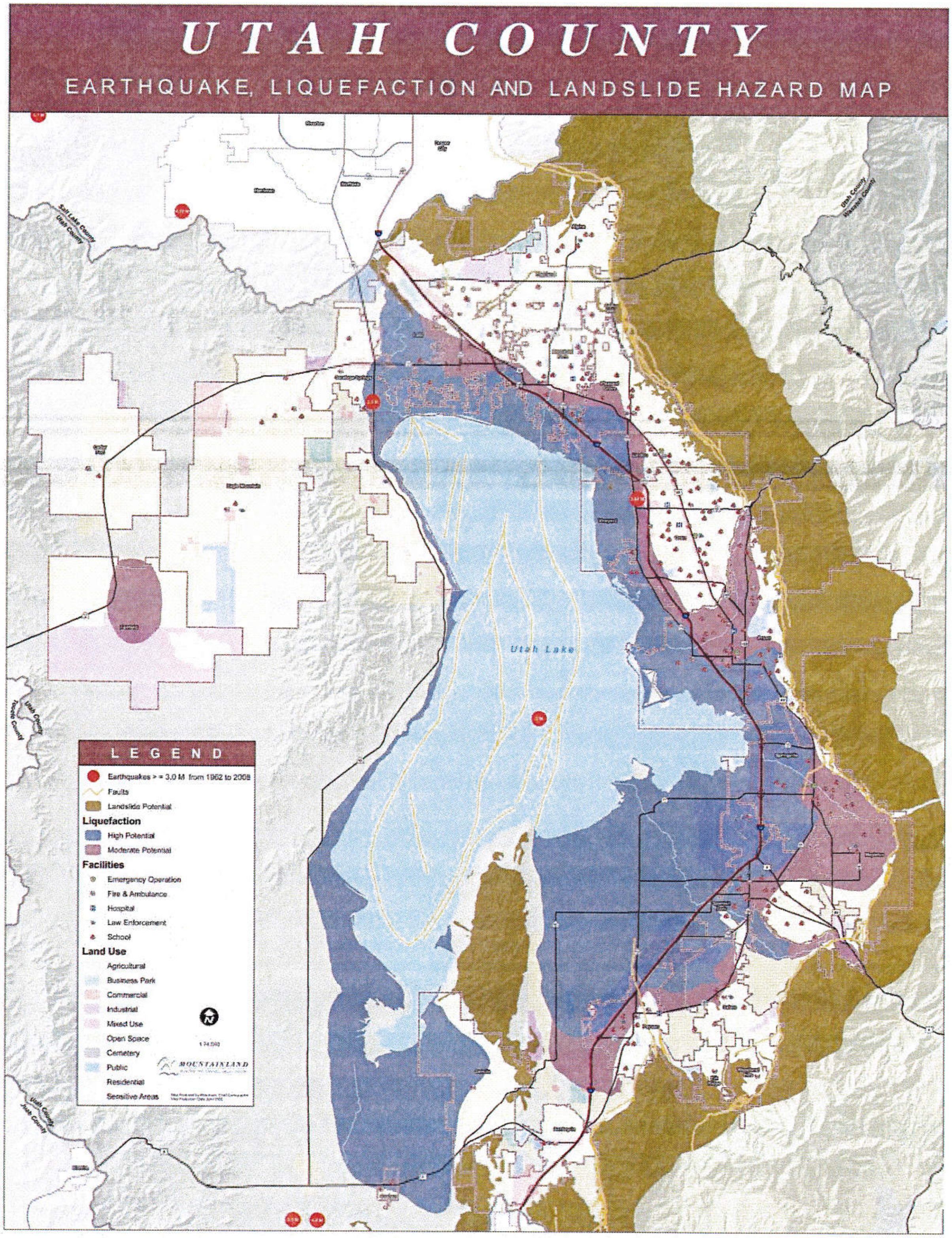
Frequency	Low -Events above 3.0 on the Richter scale are rare. Minor events (below 3.0) occur every month.
Severity	High (up to 7.0)
Location	Multiple faults throughout the county with the primary Wasatch Fault along the mountain benches.
Seasonal Pattern	None
Duration	1 to 6 minutes excluding aftershocks.
Speed of Onset	Seconds
Probability of Future Occurrences	Low- .13 (events above 3.0)

History

Recorded Earthquakes magnitude 3.0 or greater since 1950: Utah County		
Date	Richter Magnitude	Epicenter
February 20, 1950	3.7	Payson
May 8, 1950	4.3	Payson
August 12, 1951	4.3	Provo
July 21, 1952	3.7	Santaquin
September 28, 1952	4.3	Lehi
July 27, 1971	3.0	Near Lehi
August 5, 1973	3.2	Northeast of Orem

May 24, 1980	4.4	Elberta

University of Utah Seismology Department 2009


UTAH COUNTY
EARTHQUAKE, LIQUEFACTION AND LANDSLIDE HAZARD MAP
Utah Lake
LEGEND
Earthquakes > = 3.0 M from 1962 to 2008
Faults
Landslide Potential
Liquefaction
High Potential
Moderate Potential
Facilities
Emergency Operation
Fire & Ambulance
Hospital
Law Enforcement
School
Land Use
Agricultural
Business Park
Commercial
Industrial
Mixed Use
Open Space
Cemetery
Public
Residential
Sensitive Areas
MOUNTAINLAND

Landslide

Overview

Due to the topography of Utah County, landslides are an issue. The foothills and alluvial fans on the bench areas are desirable for home locations. Landslides and debris flows often occur after a wildfire event. The following table illustrates the vulnerability assessment for landslides in Utah County. Problem soils are also an issue in the county. Most of the problem soils deal with expansive and collapsible soils. Damage is usually caused by homeowners directing either sprinklers or gutter down pipes toward the foundations of homes or water main breaks. Cities should require site-specific soils reports when the community approves subdivisions.

Development Trends

Development along the foothills and bench areas is very desirable as more development occurs, more homes will be at risk for landslide damage. As more of the county land is developed, more marginal areas with problems soils will be developed. Increased analysis and geotechnical reports should become an integral part of the development and building process. Careful consideration should be given to ensure cutting and filling for any project is minimized.

Profile

Frequency	Movement occurs nearly every year.
Severity	Moderate several structures have been condemned.
Location	Along most benches and hillsides.
Seasonal Pattern	Spring when ground saturation is at its peak.
Duration	Minutes to years.
Speed of Onset	Seconds to days.
Probability of Future Occurrences	High - .75

History

Date	Type	Name
4/12/1983	Landslide	Landslide/ Thistle
9/12/2002	Landslide	Santaquin Debris Flow
9/10/2003	Landslide	Provo-Debris Flow (fire related)
7/26/2004	Landslide	Spring Lake, Santaquin Debris Flow (fire related)
4/28/2005	Landslide	Cedar Hills/ Sage Vista Lane
5/12/2005	Landslide	Provo Rock Fall
6/28/2005	Landslide	Provo Sherwood Hills Slide

SHELDUS University of South Carolina 2009

Thistle Slide

In 1983 the town of Thistle, Utah, known to many highway travelers as the small community where both the Spanish Fork River and nearby U.S. highways branch, was eliminated by the most costly landslide on record in the United States.

Thistle was located at the triple junction of transportation systems leading south to Sanpete County, east to the coal counties of Carbon and Emery and points beyond, and northwest to the Wasatch Front and Salt Lake City. Two major highways converged at Thistle (U.S. Highways 89 and 6). Until the landslide, two rail lines also converged at Thistle--the main line of the Denver and Rio Grande Western Railroad (D&RGW) joining Denver and Salt Lake City, and a branch line to Marysvale.

Ironically, the main line of the D&RGW railway from Denver to Salt Lake City follows the Soldier Creek and Spanish Fork drainages because of, rather than in spite of, landslides. Few corridors through the Rocky Mountains accommodate the gentle gradients required by railroads. Less stable landforms susceptible to landslides have eroded and formed the gentler terrain that allows modern rail passage. The advantages of this route had long been known. Undoubtedly the local Native Americans who guided the Spanish explorers traveled this route. Later trappers and pioneers used this natural corridor for their trade and transportation needs. The name "Spanish Fork" refers to the early exploration of the area by the Spanish, specifically Dominguez and Escalante in 1776 as they sought a trading route from Mexico to California. Soldier Creek is named for the route taken by federal troops as they moved through the area in the mid-1800s.

Storms heralding the 1982 to 1986 wet cycle kicked off the wettest month ever recorded at the Salt Lake City International Airport in September 1982, and saturated the ground before the winter snows. The winter was neither exceptionally wet nor cold. However, snows and cold nights continued late into April and May 1983, and resulted in an unusually late and sudden snowmelt when temperatures did warm up. May snowpacks of northern Utah averaged two to three times their normal. Utah's landslide problems correlate with precipitation and snowmelt. Two large landslides in the early spring alerted geologic experts to the situation. The National Weather Service briefed local and national officials about the unusual conditions. Yet even with the geologic and climatic indicators, the events of April, May, and June caught the state by surprise.

Starting in January, the D&RGW watched the Thistle area as well as several other landslide-prone areas near Soldier Summit. Their geotechnical experts visited the area on April 12. Days later, when the Thistle landslide began to move visibly, no one recognized it as a major hazard. The railroad tracks went out of alignment on Wednesday, 13 April. The highway became bumpy, fractured, and became impassible on Friday, 15 April. The streambed and deposits on the canyon floor rose approximately one foot an hour as a huge tongue of earth piled up against the bedrock buttress of Billies Mountain, filled the canyon, and dammed the river. The waters of the Spanish Fork River rapidly created Thistle Lake upstream of the landslide dam.

The railroad company and the Utah Department of Transportation (UDOT) initially tried to keep the railroad tracks, highway, and river open. Sunday, 17 April the landslide defeated efforts to cut down through the rising toe of the landslide and allow passage of the river water. Efforts to siphon waters rising behind the landslide dam also failed. Rising lake waters drowned the community of Thistle. That very day, the president of the D&RGW announced at Thistle that the railroad would tunnel a new railroad course through Billies Mountain. To be successful, the tunnel had to be above Thistle Lake's eventual highest water line. Railroad experts in consultation with the state decided to form the landslide into a dam and to construct an overflow spillway tunnel to control the uppermost rise of the lake. Having calculated how fast an overflow tunnel could be constructed, and how fast the lake would rise, they began drilling. The state took charge of public safety priorities. Armies of workers and heavy equipment shaped the landslide dam while it moved by transferring 500,000 cubic yards of earth from the middle area of the landslide onto its toe. This also provided a platform from which to construct the tunnels. The state constructed a third tunnel to drain the impounded water. UDOT decided to relocate the highway over Billies Mountain. The Army Corps of Engineers constructed a pumping system to keep Thistle Lake from rising to dangerously high levels.

The impounded water rose at approximately the rate predicted and the D&RGW contractors completed the overflow tunnel system with two days to spare. Trains passed through the new tunnel on 4 July, eighty-one days after the initiation of the project and eleven days before the contracted completion date. The new tunnel provided a permanent bypass for the Spanish Fork River around the landslide. The relocated highway encountered difficult geotechnical problems. The highway opened at the end of the year but was often closed due to major rockfalls and slope stability problems.

The town of Thistle was destroyed. The Marysvale branch line of the railroad was never reopened, leaving a large area of central Utah without rail service. Thistle resulted in Utah's first presidential disaster declaration and became the most costly landslide the United States had experienced. The Utah Business and Economic and Research Bureau reported the following dramatic impacts of the landslide. The D&RGW and Utah Railway embargoed all shipment that normally went through Thistle. The rerouting surcharge of $10 per ton virtually stopped coal shipments. Two trucking companies laid off workers, cancelled contracts, and even suspended operations. Most of the area's coal mines laid off miners, cancelled contracts, and experienced shut downs. Some miners' commutes suddenly exceeded 100 miles. Some coal haulage commutes trebled. Due to market conditions and the Thistle landslide, coal production dropped nearly 30 percent in 1983. Uranium producers paid substantially more for supplies in an already soft market. At least one oil company became non-competitive due to increased travel costs. Tourism in the area, particularly in-state tourism, sagged in response to negative publicity and difficult access. To the south, the blockage of route 89 and the Marysvale line hurt coal companies, turkey and feed operations, and gypsum, cement, and clay shipments.

The Thistle landslide caused total estimated capital losses of $48 million and revenue losses of $87 million, plus associated losses in tax revenues. Direct costs of Thistle tally over $200 million, including relocating the railroad at a cost of $45 million, relocating the highway at a cost of $75 million, and lost revenue to the railroad of $1 million per day (which totaled $80 million, including $19 million in charges that the D&RGW paid the Union Pacific to use their rail lines).
See: O.B. Sumsion, Thistle . . . Focus on Disaster (1983).

Santaquin Mollie Fire Debris Flow

In August of 2001, the 8,000+ acre Mollie Fire burned Dry Mountain above Santaquin. The bench development area of Santaquin City is located not more than 50 yards from the edge of the fire perimeter. This enormous wild fire left a devastated hillside, and the city below, vulnerable to the slipping of loosened earth with the onset of late summer monsoon rains.

At approximately 6:45 p.m. on Thursday, September 12, 2002, after nearly a week of steady rain, the charred earth of the ironically named Dry Mountain gave way and mud flowed out of five separate canyons. Of the five flows, two caused extensive property damage, one to residents of Santaquin and one to the residents of unincorporated Spring Lake. Furthermore, one flow of nearly equal volume flowed through a principally undeveloped area of Santaquin. According to USGS statistics, the highest possibility of ground slippage will occur within the first year after the fire. Although chronologically the mudslide occurred more than 365 days from the wild fire, it was still in the first monsoon season following the fire.

Following the fire, Santaquin City and the US Forest Service participated in a massive re-seeding effort on the mountain in an attempt to prevent or minimize the potential for a mudslide. Furthermore, the City took steps to prevent the potential mudslide from impacting the citizens of the community. Jersey barriers were placed along the upper boundaries of the developed community. In addition, walls of straw bails were constructed in areas analyzed to be the highest possibility of water flows. Both the City and the Forest Service, with the help of the National Weather Service, maintain constant monitoring of the mountainside.

Over the course of the 12+ months that followed the Mollie fire, the City collaborate with numerous governmental divisions, private firms and private property owners to develop and design a plan to handle whatever may come out of the canyons. Even before the mudslide event, the City initiated efforts to record easements for the construction of debris flow channels. Although they found it hard skating, the mudslide event showed that the efforts of the parties involved was in fact necessary.

In the time since September 2002, a formal diversion channel has been constructed to lead any further debris that comes out of the canyons into a natural ravine. Within the ravine, silt fencing and flow breaks have been installed to slow the flow of debris in the ravine and thereby minimizing its potential impact. This ravine travels between developed areas and down the hill to the location of US highway 198. Here UDOT has approved and is constructing culverts under the highway that will allow the debris pass under the highway and be disposed of without endangering private property.

The developed area within Santaquin City, which was hardest hit by the mudslide is as yet to be protected from future slide events. Due to the unwillingness of private property owners, no effort other than re-seeding the mountainside, have taken place to protect those residences.

Recommendations related to the Mollie Flow

- Coordinate with the Uinta National Forest Burned Area Emergency Rehabilitation (BAER) Team on post-wildfire watershed improvements.
- Consult with the USDA's Natural Resources Conservation Service (NRCS) concerning eligibility for the Emergency Watershed Protection (EWP) program.
- Note: This program is still available to the City of Santaquin.
- Promote purchasing of flood insurance through the National Flood Insurance Program (NFIP) for those individuals building or purchasing homes on alluvial fans.
- Construction of detention basins, deflectors, or other engineered structures.
- Note: Detention basins at the mouths of canyons catch all incoming debris flows, thus there is less chance for failure.
- Note: Possible funding mechanisms include special projects fees as part of a storm water collection fee, for homeowners living on alluvial fans.
- Adopt and enforce ordinances requiring geotechnical reports addressing debris flow, flooding, earthquakes, rock falls, and landslides for all proposed developments in areas susceptible to natural hazards. Maps illustrating the location of most of the above mentioned natural hazards are available through Utah County.

- Note: Utah Geological Survey (UGS) provides no cost independent review and recommendations of geotechnical reports to determine their accuracy and completeness. In addition, the Division of Emergency Services and UGS will aid in the design and implementation of ordinances concerning natural hazards.
- Register any structure pertaining to water impoundment with Division of Water Rights, Dam Safety Section.
- Note: The retention basin located within the impacted subdivision was not registered with Dam Safety.

Buckley Draw—Springville Fire

The Springville fire started on June 30, 2002 at 7:19 p.m. The fire burned a total of 2,207 acres above dozens of homes. The immediate post fire impacts for Provo City were: loose surface rock, silty and sandy soils, and blackened steep (40% grade) hillsides. Steep terrain and impervious soils cause rapid run off with rocks. Post fire conditions increased sediment expectations to 13 tons per acre. Brian McInerney of the NWS stated our risk level was the highest in the state.

Recommendations for mitigation offered to Provo City included the Uinta National Forest rehabilitating the burn area with vegetation (seed and mulch) and installing wire fences in the upper channel. The Natural Resource Conservation Service (NRCS) and the Emergency Watershed Program (EWP) implemented temporary measures to reduce the transport of sediment. Additionally, a Rain Activated Weather Station (RAWS) unit was relocated to the Buckley Draw area (elevation of 9,143 feet) to monitor site conditions on Sunday, July 13, 2002.

Provo City held public meetings on Sunday, July 13, and Monday, July 14, 2002 to present information and resources for the residents. National Flood Insurance Program (NFIP) information distributed. Sandbags and sand drops were scheduled and delivered.

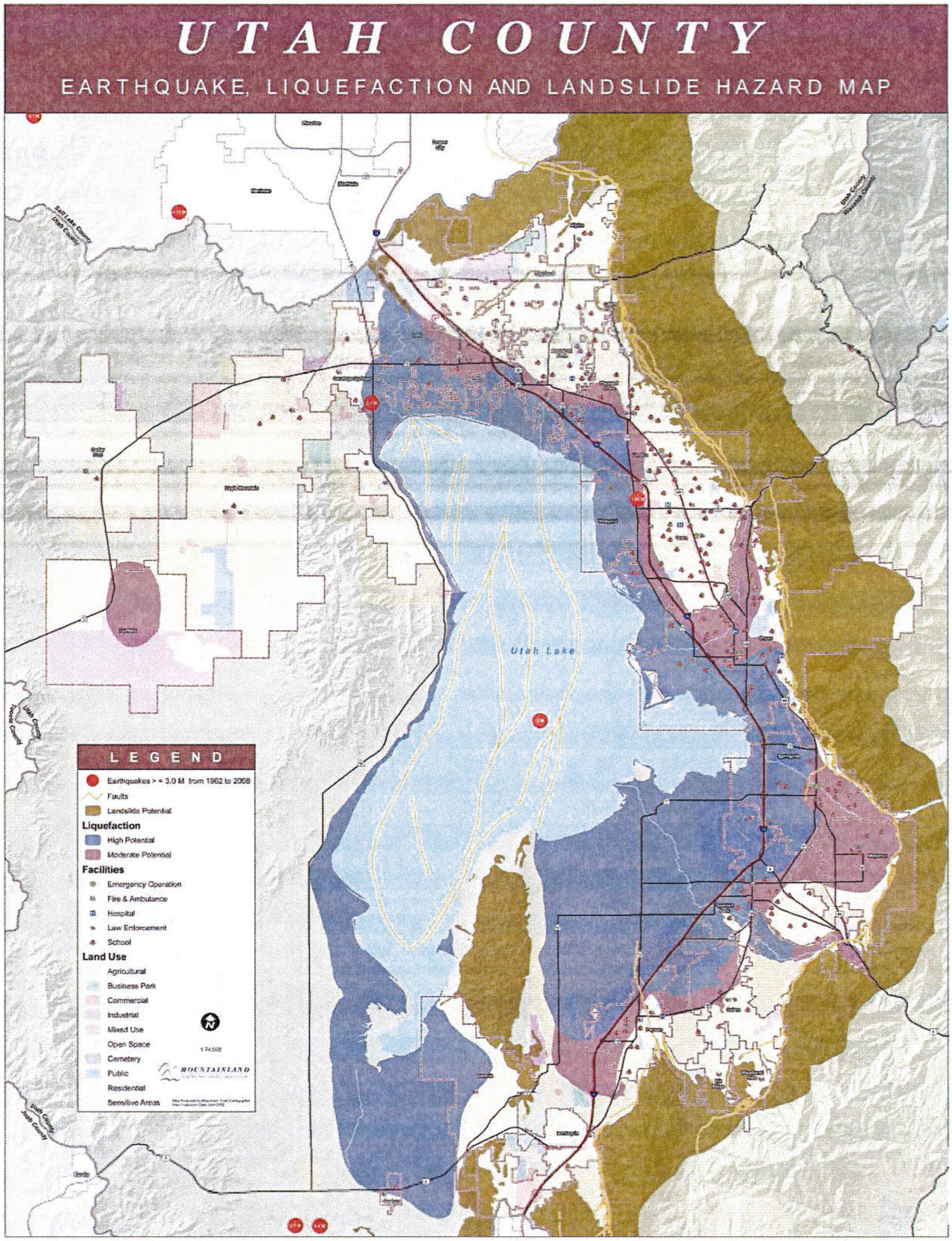
On July 15, 2002, information was distributed to the Neighborhood regarding the increase in risk of post fire debris flow, with information about the NFIP program. Communication links to relay current hazard information to the residents were established. The evacuation plan was updated.

On July 16, 2002 a helicopter overview of the burn area was taken. Provo Public Safety responders had a Post Fire Debris Flow Risks in Utah class on July 31, 2002. NRCS and the EWP engineered of a trench to redirect potential debris flow. Provo City obtained the necessary property agreements. Two debris flow events just to the north and just to the south of Provo in September, 2002 provided motivation to secure agreements and build the trench.
A SNOTEL was installed above the Little Rock Canyon drainage to monitor soil moisture and snow pack conditions on 22 October, 2002.

At the April 29, 2003 neighborhood meeting, the debris flow in Santaquin was contrasted with the conditions at the Buckley Draw. Plans for trench construction were discussed. A flag notification system and evacuation plan for the residents for the risk level was proposed and accepted. A web link with updated hazard information, a phone 'hot line' with an updated message, and a notification procedure alerting the Neighborhood Chair of any changes in the hazard level were implemented. A practice evacuation drill was held on Saturday, May 10, 2003.

The 1500 feet long trench was essentially complete on July 28, 2003. Weather conditions continued to be monitored on a daily basis.

At approximately 3:00 a.m. on September 10, 2003, four separate debris flows were triggered. The second largest flow came down the newly finished trench. There was little or no warning. This flow would have been life threatening and would have caused significant property damage without the debris trench in place. The spreader fences in the debris field distributed the runoff materials and completely contained this debris flow.


UTAH COUNTY
EARTHQUAKE, LIQUEFACTION AND LANDSLIDE HAZARD MAP
Utah Lake
LEGEND
Earthquakes > = 3.0 M from 1962 to 2008
Faults
Landslide Potential
Liquefaction
High Potential
Moderate Potential
Facilities
Emergency Operation
Fire & Ambulance
Hospital
Law Enforcement
School
Land Use
Agricultural
Business Park
Commercial
Industrial
Mixed Use
Open Space
Cemetery
Public
Residential
Sensitive Areas
MOUNTAINLAND

Review of 2004 Plan Mitigation Strategies

For the previous (2004) Mountainland Hazard Mitigation Plan, each participating jurisdiction prioritized there mitigation efforts and identified a single project. Below is a list of those projects and an update on the status of each project.

Utah County Communities
PRIORITIZATION OF INDIVIDUAL COMMUNITY
MITIGATION STRATEGIES
Table U-24

Community	Hazard	Mitigation	Status	Comments
Alpine	Wildfire	Educate Homeowners on Firewise practices	Ongoing	Community is partnering with various fire prevention agencies to educate. New standards in International Building Code.
American Fork	Liquefaction	Educate Homeowners/Require mitigation on new development	Ongoing	Community is working to ensure structures are build to proper standards.
Cedar Fort	Wildfire	Educate Homeowners on Firewise practices	Ongoing	Community is partnering with various fire prevention agencies to educate. New standards in International Building Code.
Cedar Hills	Landslides/ Flood	Participate in the NFIP/Require site-specific soils reports	Ongoing	Geotechnical reports are required for development.
Eagle Mountain	Wildfire	Educate Homeowners on Firewise practices	Ongoing	Community is partnering with various fire prevention agencies to educate. New standards in International Building Code.
Elk Ridge	Wildfire/ Flood	Educate Homeowners on Firewise practices Join NFIP Flood Map Community	Ongoing	Community is partnering with various fire prevention agencies to educate. New standards in International Building Code.
Genola	Liquefaction	Educate Homeowners/Require mitigation on new development	Ongoing	Community is working to ensure structures are build to proper standards.
Goshen	Liquefaction	Educate Homeowners/Require mitigation on new development	Ongoing	Community is working to ensure structures are build to proper standards.
Highland	Flood	Encourage Homeowner Participation in NFIP	Ongoing	The City is encouraging participation in the NFIP.
Lehi	Liquefaction	Educate Homeowners/Require mitigation on new development	Ongoing	Community is working to ensure structures are build to proper standards.

Lindon	Landslide	Prohibit development in Landslide areas	Ongoing	Geotechnical reports are required for development.
Mapleton	Liquefaction	Educate Homeowners/Require mitigation on new development	Ongoing	Community is working to ensure structures are build to proper standards.
Orem	Dam Failure	Establish Early Warning System	Completed	Early warning system is in place.
Payson	Liquefaction	Educate Homeowners/Require mitigation on new development	Ongoing	Community is working to ensure structures are build to proper standards.
Pleasant Grove	Flood	Encourage Homeowner Participation in NFIP	Ongoing	The City is encouraging participation in the NFIP.
Provo	Dam Failure	Establish Early Warning System	Completed	Early system is in place.
Salem	Liquefaction	Educate Homeowners/Require mitigation on new development	Ongoing	Community is working to ensure structures are build to proper standards.
Santaquin	Flood	Map flood and debris flow areas in newly annexed areas	Ongoing	New information has been developed and will continue as growth occurs
Saratoga Springs	Liquefaction	Educate Homeowners/Require mitigation on new development	Ongoing	Community is working to ensure structures are build to proper standards.
Spanish Fork	Liquefaction	Educate Homeowners/Require mitigation on new development	Ongoing	Community is working to ensure structures are build to proper standards.
Springville	Liquefaction	Educate Homeowners/Require mitigation on new development	Ongoing	Community is working to ensure structures are build to proper standards.
Utah County	Liquefaction	Educate Homeowners/Require mitigation on new development	Ongoing	Community is working to ensure structures are build to proper standards.
Vineyard	Liquefaction	Educate Homeowners/Require mitigation on new development	Ongoing	Community is working to ensure structures are build to proper standards.
Woodland Hills	Landslide	Prohibit development in Landslide areas	Ongoing	Geotechnical reports are required for development.

Damage Assessment and Mitigation

Overview

Each jurisdiction represented by this plan has participated in the creation of its contents and given local input into their individual mitigation goals and priorities. Early in the process the planning team determined that creating a list of basic mitigation strategies would stimulate each jurisdiction by acting as a beginning point for additional mitigation planning as well as helping to fulfill the requirements of this plan. Each jurisdiction has accepted and or made changes to the mitigation table to reflect their needs.

Listed below are the damage assessments for each of the participating jurisdiction followed by that community's mitigation strategies. Damage assessments were calculated using the methodologies mentioned earlier in this plan. Strategies were developed by the planning committee and then modified, if desired, by the individual community.

These strategies were assigned a priority of high, medium, or low by communities according to the following criteria:

- Number of people affected by the project
- Technical feasibility
- Political support
- Available funding and priorities
- Environmental impact
- Cost to benefit ratio

Earthquake -county wide

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Earthquake	58,449	$ 9,445,163,027.85		1935	$ 1,506,695,508.93		0	0	339	$ 1,818,707,536.71	106

Alpine

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
FEMA Flood Plain	124	$17,385,800	137	21	$6,058,300	50	-	-	2	$6,968,100	-
HAZUS Flood	25	$3,504,000	25	3	$713,500	0	-	-	0	0	-
Debris	391	$55,174,400	323	36	$12,071,400	0	-	-	6	$27,043,300	-
Wild Fire	696	$99,339,200	587	72	$20,694,900	0	-	-	16	$71,520,400	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

American Fork

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	4,177	$527,699,300	5716	675	$254,513,900	10640	17	$6,663,000	86	$480,791,100	10
FEMA Flood Plain	59	$8,561,500	59	5	$733,500	770	-	-	1	$7,494,600	1
HAZUS Flood	44	$5,328,500	110	8	$3,038,500	20	1	$398,000	1	$4,087,400	-
Debris	3	$456,500	8	1	$48,300	0	-	-	0	0	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam	Update Flood and Inundation mapping and	High	2 years	TBD	Local Cash,	Local Government,

Failure	incorporate them into general plans and ordinances.				Grants	FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Cedar Fort

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Steep Slopes	16	$2,046,900	0	2	$275,900	0	-	-	-	-	-
Wild Fire	59	$6,689,900	250	3	$415,200	510	-	-	3	$15,332,900	1

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within	High	1 year	Minimal	Local Cash, Grants	Local Government

	areas at risk.					
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Cedar Hills

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	4	$0	11	4	$349,000	0	1	-	-	-	-
Debris	443	$32,644,500	269	17	$4,817,000	0	3	-	5	$22,070,300	-
Wild Fire	455	$36,144,400	296	16	$2,499,000	10	3	-	9	$39,884,400	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and	High	1 year	Minimal	Local Cash,	Local Government,

	preparation.				Grants	UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Draper

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Debris	506	$0	0	3	$439,300	0	-	-	-	-	-
Wild Fire	484	$0	0	3	$419,700	0	-	-	-	-	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS

	ordinances.					
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Eagle Mountain

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
HAZUS Flood	8	$1,044,800	18	1	$44,300	0	-	-	0	0	-
Steep Slopes	54	$7,216,000	0	2	$251,400	0	-	-	-	-	-
Wild Fire	442	$58,546,800	53	9	$1,552,600	4580	-	-	18	$76,705,400	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding	Join NFIP community/participation.	Medium	1 year	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding	Join NFIP community/participation.	Medium	1 year	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Elk Ridge

	Residential			Commercial			Bridges		Roads		Critical Facilities
Hazard	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
HAZUS Flood	0	$0	0	1	$7,100	0	-	-	-	-	-
Debris	190	$30,299,200	259	10	$3,551,900	0	-	-	5	$21,302,900	-
Wild Fire	258	$40,832,000	506	20	$6,932,800	0	-	-	7	$33,622,900	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Fairfield

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
HAZUS Flood	1	$78,100	11	1	$6,100	1100	-	-	2	$11,212,900	-
Wild Fire	5	$634,900	202	1	$50,800	20190	-	-	19	$87,189,200	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government

Genola

	Residential			Commercial			Bridges		Roads		Critical Facilities
Hazard	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	2	$190,800	26	1	$67,000	0	-	-	1	$4,596,400	-
HAZUS Flood	3	$292,900	99	1	$106,200	0	-	-	0	0	-
Debris	23	$2,185,700	806	3	$244,200	30	-	-	4	$12,308,700	-
Wild Fire	13	$1,003,800	1186	1	$105,200	0	-	-	2	$4,003,500	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

	susceptible areas.					

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Goshen

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	70	$7,442,900	173	2	$210,400	390	-	-	3	$14,789,100	-
Wild Fire	1	$68,000	3	0	$0	0	-	-	0	0	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government

Highland

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	177	$23,425,600	81	13	$3,368,900	20	1	$147,000	5	$22,406,900	-
FEMA Flood Plain	59	$7,927,800	17	6	$1,459,400	0	-	-	1	$6,226,300	-
HAZUS Flood	18	$2,854,900	7	2	$548,700	0	-	-	0	0	-
Debris	53	$8,336,300	15	5	$782,300	0	1	$147,000	1	$6,857,000	-
Wild Fire	160	$30,962,600	65	10	$1,543,200	0	1	$147,000	6	$29,306,100	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE	High	Ongoing	Minimal	Local Cash,	Local Government

	practices.				Grants	
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Lehi

	Residential			Commercial			Bridges		Roads		Critical Facilities
Hazard	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	2,652	$316,012,300	3549	290	$84,870,900	3730	8	$7,930,000	56	$293,779,500	5
FEMA Flood Plain	557	$67,353,300	342	38	$9,885,700	330	3	$1,647,000	10	$52,434,100	2
HAZUS Flood	52	$5,469,400	92	11	$2,668,600	210	2	$1,259,000	2	$10,859,900	-
Debris	927	$52,700,100	1441	13	$4,508,400	690	-	-	7	$34,040,900	-
Wild Fire	710	$24,241,100	2206	13	$5,883,500	3770	-	-	28	$160,751,600	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding	Responsible Party

					Sources	
Flooding/Dam Failure	Promote NFIP participation/Clean dam drainage and remove debris from water ways	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Implement a power line inspection and maintenance program in the wild land areas.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Create a vegetation placement and management plan	High	1 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Lindon

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	866	$123,640,900	851	223	$139,675,900	9760	2	$1,555,000	44	$288,044,000	2
FEMA Flood Plain	49	$7,985,100	45	19	$8,645,800	760	-	-	2	$8,129,500	1
HAZUS Flood	41	$5,190,600	75	20	$17,381,100	1080	-	-	3	$18,023,600	-

Debris	479	$76,438,200	478	59	$14,710,900	0	1	-		8	$34,303,200	-
Wild Fire	558	$89,905,200	522	65	$16,740,600	0	1	-		8	$34,868,400	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation. Ditch improvements. Annual dam inspections (Dry Canyon, Squaw Hollow)	High	Ongoing	Moderate	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Follow and apply current building codes adopted by City.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices. Fire supression required in homes on steep slopes.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Debris Flow	Construct / Install debris flow basins in inventoried hazard areas.	Medium	5 years	High	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Restrict development in hazard areas, maintain storm drainage facilities, update ordinances.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation. Avoid hazard areas (faults), Canberra tank fault study.	High	3 years	Moderate	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	2 years	Minimal	Local Cash, Grants	Local Government
Debris Flow	Maintain debris flow basins. Monitor wildfire and landslide areas.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Mapleton

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	11	$1,632,600	30	3	$649,700	0	-	-	0	0	-
FEMA Flood Plain	8	$1,244,100	26	2	$394,700	0	-	-	0	0	-
HAZUS Flood	16	$2,043,700	46	3	$412,500	180	-	-	1	$3,765,800	-
Debris	55	$8,031,800	189	10	$1,976,500	30	-	-	5	$10,719,600	-
Wild Fire	67	$9,366,600	338	12	$2,196,400	90	-	-	6	$18,065,000	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping	High	1 year	Minimal	Local Cash,	Local Government

	requirements into local ordinances within areas at risk.				Grants	
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Orem

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	1,369	$213,985,700	1552	156	$58,086,700	440	6	$2,266,000	18	$82,448,900	1
FEMA Flood Plain	18	$2,447,900	59	3	$3,376,800	40	1	$227,000	0	0	-
HAZUS Flood	6	$755,500	16	1	$242,800	50	2	$448,000	0	0	-
Debris	414	$63,634,600	637	56	$27,583,000	120	-	-	8	$28,626,700	-
Wild Fire	163	$23,845,400	246	27	$8,944,300	170	4	$1,255,000	5	$12,201,300	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party

Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Payson

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	1,146	$113,309,500	996	138	$44,842,300	910	-	-	16	$76,694,100	6
FEMA Flood Plain	201	$20,161,900	130	34	$13,073,600	230	-	-	3	$16,662,500	1
HAZUS Flood	121	$11,978,100	510	20	$7,358,200	1860	-	-	4	$22,280,700	-
Debris	29	$3,758,300	629	1	$55,600	1300	-	-	4	$18,877,500	-
Wild Fire	110	$8,771,600	822	5	$491,900	2830	-	-	5	$25,859,300	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering	Medium	1 year	TBD	Local Cash,	Local Government,

	practices and retaining measures in susceptible areas.				Grants	UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Pleasant Grove

	Residential			Commercial			Bridges		Roads		Critical Facilities
Hazard	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	3,771	$511,907,700	4522	469	$126,662,200	3720	2	$136,000	63	$298,569,000	8
HAZUS Flood	7	$755,600	0	4	$1,465,300	260	-	-	1	$4,153,800	-
Debris	1,408	$220,701,600	1779	146	$30,348,700	20	1	$136,000	22	$96,897,200	-
Wild Fire	271	$41,858,100	297	29	$4,053,100	0	1	$241,000	4	$17,383,300	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS

Flooding/Dam Failure	Pipe water from flood basin 200 S. and 500 N. to canal. Approx. 8000 ft. high pressure pipe	High	Ongoing	2 million	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
	Pipe water from flood basin 200 S. and 500 N. to canal. Approx. 8000 ft. high pressure pipe	High	Ongoing	2 million	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Provo

	Residential			Commercial			Bridges		Roads		Critical Facilities
Hazard	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	14,403	$2,469,658,300	14369	1,873	$978,723,000	20020	34	$30,378,000	224	$1,184,401,900	34
FEMA Flood	180	$27,949,000	174	34	$19,556,700	1270	12	$5,643,000	8	$47,941,100	-

Plain											
HAZUS Flood	976	$126,931,800	972	146	$87,894,500	1570	3	$840,000	17	$86,942,000	1
Debris	2,250	$339,294,700	2367	256	$96,068,400	1060	2	$819,000	49	$164,348,200	2
Wild Fire	652	$89,960,400	814	96	$56,744,600	1900	3	$1,367,000	22	$72,913,900	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Salem

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
FEMA Flood Plain	34	$4,269,900	48	3	$647,500	30	-	-	0	0	-
HAZUS Flood	4	$399,700	182	2	$784,500	260	-	-	1	$2,464,500	-
Debris	307	$43,168,500	1344	31	$10,017,600	470	1	$113,000	15	$63,618,500	1
Wild Fire	37	$5,489,600	781	6	$872,300	640	-	-	6	$27,069,000	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within	High	1 year	Minimal	Local Cash, Grants	Local Government

	areas at risk.					
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Santaquin

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	1,527	$133,504,200	5147	96	$17,481,700	1640	4	$1,158,000	29	$132,326,400	3
HAZUS Flood	165	$13,122,300	456	12	$2,305,700	90	1	$92,000	4	$18,274,900	-
Debris	180	$12,133,500	1287	4	$215,000	480	-	-	7	$31,278,000	1
Wild Fire	376	$33,284,700	4160	14	$1,361,200	2490	2	$938,000	21	$97,689,300	1

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS

Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Saratoga Springs

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	170	$14,621,900	494	0	$0	0	-	-	3	$11,291,100	-
FEMA Flood Plain	242	$24,221,600	373	14	$7,902,300	170	1	$251,000	4	$20,592,600	-
HAZUS Flood	3	$417,400	5	1	$800	70	-	-	0	0	-
Steep Slopes	8	$727,200	0	1	$51,300	0	-	-	-	-	-
Wild Fire	1,282	$24,637,000	12866	12	$1,563,200	3870	-	-	40	$179,729,100	2

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Spanish Fork

	Residential			Commercial			Bridges		Roads		Critical Facilities
Hazard	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
FEMA Flood Plain	338	$15,160,300	685	10	$2,577,800	770	6	$1,374,000	7	$38,445,000	1
HAZUS Flood	217	$9,005,100	453	4	$916,600	210	2	$488,000	4	$16,684,700	-
Debris	251	$36,664,700	589	25	$7,673,400	80	1	-	4	$20,572,800	-
Steep Slopes	33	$4,846,100	0	7	$2,338,700	0	-	-	-	-	-
Wild Fire	98	$13,413,100	572	25	$8,405,500	1370	3	$1,008,000	4	$24,261,000	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS

Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Springville

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	3,345	$377,420,300	4254	409	$123,661,300	7330	24	$5,182,000	57	$294,865,800	11
FEMA Flood Plain	40	$4,741,300	87	8	$2,020,100	2530	5	$1,396,000	8	$54,580,700	-
HAZUS Flood	450	$28,294,100	1036	45	$11,147,100	2340	1	$153,000	14	$71,720,400	-
Debris	647	$84,459,000	889	48	$10,097,900	70	-	-	12	$51,180,700	-
Wild Fire	580	$72,567,500	672	54	$10,787,200	130	-	-	11	$44,515,100	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Utah County (unincorporated)

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count

Dam Failure	456	$49,072,100	1337	62	$24,992,700	2270	9	$6,542,000	-	-	-
FEMA Flood Plain	141	$13,722,100	326	22	$3,279,200	990	6	$2,343,000	-	-	-
HAZUS Flood	116	$10,967,300	138	16	$2,758,500	110	4	$777,000	-	-	-
Debris	432	$45,346,800	85	57	$15,304,400	60	3	$1,824,000	-	-	-
Wild Fire	952	$123,460,700	1506	86	$46,623,800	910	23	$8,216,000	-	-	2

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Canyon Debris Basins	High	Ongoing	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Vineyard

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	0	$0	2	1	$156,000	510	-	-	1	$2,887,300	-
FEMA Flood Plain	1	$76,800	0	1	$11,100	20	-	-	0	0	-
HAZUS Flood	0	$0	0	0	$0	70	-	-	0	0	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Woodland Hills

Hazard	Residential	Commercial	Bridges	Roads	Critical Facilities

	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Debris	130	$19,385,600	209	13	$1,735,700	10	-	-	9	$41,464,500	1
Wild Fire	206	$30,626,200	337	22	$3,244,000	10	-	-	15	$66,630,200	1

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Part VIII
Wasatch County
Profiles and Mitigation

Background

Area: 1,191 square miles; *county seat*: Heber City; *origin of county name*: from the Wasatch Mountains; *economy:* hay, livestock, recreation; *points of interest*: Strawberry, Deer Creek, and Jordanelle reservoirs, Wasatch Mountain State Park, Wasatch LDS Tabernacle in Heber City, Heber Creeper, historic homes in Midway.

Heber Valley, one of several back valleys in the Wasatch Mountains, is often called Utah's Switzerland because of the rugged beauty of Mount Timpanogos located to the west, its climate, and a large population of Swiss that settled in Midway. The county's highest peaks top 10,000 feet, and over half of the land is 7,500 feet above sea level. The climate zone, classified as undifferentiated highlands, offers cool summers and very cold winters. The average annual precipitation is about sixteen inches.

The county is divided into two watersheds--the Colorado and the Great Basin drainage systems. Because of its annual precipitation and its location between the Uinta and Wasatch mountains, Heber Valley is well endowed with water. Flowing from the east are Daniels, Lake, and Center creeks. From the north and northeast is the Provo River. From the west Snake Creek drains a central portion of the Wasatch Mountains. Two additional sources of water are man-made: the Ontario Drain Tunnel west of Keetley drains many of the Park City mines, and the Weber/Provo diversion canal diverts water from the Weber across the Kamas prairie in Summit County to the Provo River in Wasatch County.

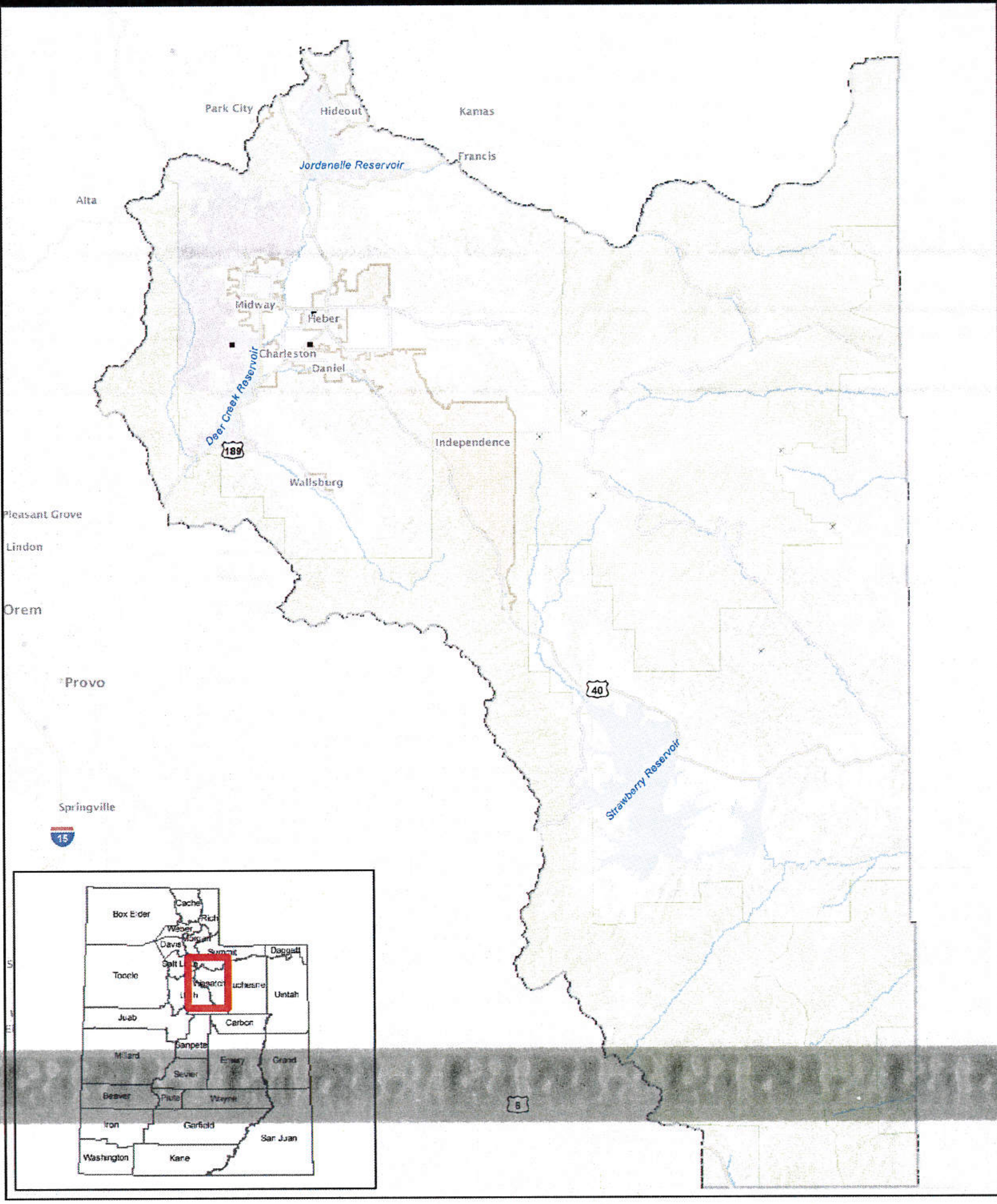
Prior to the 1850s, Heber Valley was an important summer hunting ground for the Timpanogos Utes living around Utah Lake. The first white men to visit the county were members of the Dominguez-Escalante expedition in 1776. They skirted Heber Valley, traveling down Diamond Fork to Spanish Fork Canyon and then into Utah Valley. Fifty years later fur trappers entered the county. In 1824 and 1825 Etienne Provost from Taos, New Mexico, trapped beaver in the Uinta and Wasatch mountains. About the same time, William Henry Ashley and members of his fur company from St. Louis also hunted and trapped for beaver in the county.

The first settlers came into Wasatch County from Utah Valley in the spring of 1859 and located a short distance north of present Heber City at the London or John McDonald Spring. That same year, Midway and Charleston were also settled. In 1862 the territorial legislature created Wasatch County, which then included all of the Uinta Basin. Wasatch in Ute means "mountain pass" or "low pass over high range." Heber City, named for Mormon Apostle Heber C. Kimball, was selected as the county seat.

The county produces hay, dairy products, sheep and cattle. During the early 1900s, after the Denver and Rio Grande Railroad completed a line into the county from Provo, Heber City became an important shipping terminal for wool and sheep. In 1922 the Union Pacific Railroad constructed a spur from Park City to the mines west of Keetley. Lead, zinc, and silver ore were shipped from these mines on this railroad spur. Today neither railroad line is in full operation, and other economic activities are more important to the county than transportation and mining.

Strawberry Reservoir (completed in the 1910s), Deer Creek Reservoir (completed in the 1940s), and Jordanelle Reservoir (completed in the 1990s), together with sparkling streams and beautiful mountain scenery, have made Wasatch a popular recreation area. (Source: Utah Historical Encyclopedia. Craig Fuller, Author)

WASATCH COUNTY



Population

The following table shows historic population data:

	1930	1940	1950	1960	1970	1980	1990	2000	2007
Wasatch	5,636	5,754	5,574	5,308	5,863	8,523	10,089	15,215	19,609

Economy

						% Change
Wasatch County	2002	2003	2004	2005	2006	2005-06
Population	17,476	18,515	19,177	19,999	21,053	5.3
Employment:						
Average civilian labor force	8,207	8,488	8,783	9,246	9,942	7.5
Average employment	4,823	4,978	5,236	5,708	6,438	12.8
Income:						
Average annual wage ($)	24,034	25,124	25,695	26,483	27,788	4.9
Total payroll wages ($ thousands)	115,908	125,058	134,538	151,154	178,900	18.4
Total personal income ($ thousands)	361,146	379,127	420,927	455,779	502,700	10.3
Per capita personal income ($)	21,346	21,547	23,231	23,969	24,821	3.6
Taxes:						
Total assessed valuation ($ thousands)	1,721,152	1,865,033	2,039,214	2,061,544	2,530,231	22.7
Property taxes charged, by all taxing units ($ thousands)	17,442	19,233	22,609	22,889	26,318	15.0
Gross taxable sales ($ thousands)	186,567	184,211	190,081	221,599	268,418	21.1
Net local sales tax allocations ($ thousands)	1,933	1,926	2,052	2,230	2,673	19.9
Construction (permit-authorized):						
New dwelling units (number)	384	265	319	511	625	22.3
Value of new residential construction ($ thousands)	71,015	61,453	70,903	134,331	188,632	40.4
Value of new nonresidential construction ($ thousands)	6,131	10,542	9,988	36,522	10,787	-70.5
Value of total construction ($ thousands)	80,154	76,524	83,963	175,024	205,702	17.5
Miscellaneous:						
Payment in Lieu of Taxes Act ($ thousands)	520	596	590	604	615	1.8
New car and truck registrations by owners county (number)	592	595	636	737	869	17.9

Wasatch County, though still largely rural in nature, has seen its economy show greater signs of life than ever before. Heber City and Midway, the two largest cities in the county, have both seen a number of new developments add some vitality and tax base to their communities. New economic development and housing plans currently being completed will no doubt add to Wasatch County's ability to focus and channel resources into the most beneficial sectors and activities.

Social Characteristics	Estimate	Percent	U.S.
Average household size	2.97	(X)	2.6
Average family size	3.37	(X)	3.19
Population 25 years and over	11,606		
High school graduate or higher	(X)	91.2	84.00%
Bachelor's degree or higher	(X)	31.1	27.00%
Disability status (population 5 years and over)	1,660	9.3	15.10%
Foreign born	1,466	7.4	12.50%
Speak a language other than English at home (population 5 years and over)	N	N	19.50%
Household population	19,609		
Economic Characteristics	Estimate	Percent	U.S.
In labor force (population 16 years and over)	N	N	64.70%
Mean travel time to work in minutes (workers 16 years and over)	20.4	(X)	25.1
Median household income	57,542	(X)	50,007
Median family income	61,572	(X)	60,374
Per capita income (in 2007 inflation-adjusted dollars)	24,236	(X)	26,178
Families below poverty level	(X)	7.9	9.80%
Individuals below poverty level	(X)	8.3	13.30%
Housing Characteristics	Estimate	Percent	U.S.
Total housing units	8,709		
Occupied housing units	6,604	75.8	88.40%
Owner-occupied housing units	5,084	77	67.30%
Renter-occupied housing units	1,520	23	32.70%
Owner-occupied homes	5,084		
Median value (dollars)	255,300	(X)	181,800
Median of selected monthly owner costs			
With a mortgage (dollars)	1,426	(X)	1,427
Not mortgaged (dollars)	401	(X)	402
Demographic Estimates	Estimate	Percent	U.S.
Total population	19,747		

Male	10,063	51	49.20%
Female	9,684	49	50.80%
Median age (years)	29.6	(X)	36.4
Under 5 years	1,835	9.3	6.90%
18 years and over	13,621	69	75.30%
65 years and over	1,817	9.2	12.50%
One race	N	N	97.90%
White	N	N	74.10%
Black or African American	N	N	12.40%
American Indian and Alaska Native	N	N	0.80%
Asian	N	N	4.30%
Native Hawaiian and Other Pacific Islander	N	N	0.10%
Some other race	N	N	6.20%
Hispanic or Latino (of any race)	N	N	14.70%

Source: U.S. Census Bureau, 2005-2007 American Community Survey

Flooding/Dam Failure

Overview

Although Utah is considered a dry desert state, flooding does occur. Ranging from Most floods have occurred either from snow melt or severe thunderstorms. Often times flooding is increased by soils that are more impervious due to either wildfire or drying out. Floods occur on a regular basis in Wasatch County.

Development Trends

As development occurs on the bench areas of HeberValley, along the shore of Deer Creek and Jordanel Reservoirs, or along river and stream corridors more homes will be in danger of floods. Communities need to make developers and homeowners aware of the danger as well as contribute to mitigation actions. Cities should review every development that it is in compliance with NFIP guidelines.

The following table identifies the communities in Utah County with their NFIP Status.

COUNTY	CITY/TOWN	POPULATION	STATE MAP LOCATION	NFIP STATUS	THREAT (or NSFHA-eligible)
Wasatch	Unincorporated	5718		490164A - 10/1/86(L)	Provo River & Tributaries
Wasatch	Charleston	378	E5	490165 - 8/5/80(M)	
Wasatch	Heber City	7291	D5	490166 - 3/18/87	
Wasatch	Midway	1554	D5	490167 - 8/19/80(M)	
Wasatch	Wallsburg	274	E5	Not Participating	Spring & Main Creeks

Source: FEMA Utah State Department of Homeland Security

The primary goal of those non participating communities is to join the NFIP. Wallsburg is already starting the process.

Profile

Frequency	Some flooding happens within Wasatch County on a regular basis.
Severity	Moderate
Location	Primarily along streams, rivers and along the shores of Deer Creek and Jordanel Reservoirs.
Seasonal Pattern	Spring time due to snow melt. Isolated events throughout the year due to severe weather (microburst).
Duration	A few hours to a few weeks depending upon conditions
Speed of Onset	Sudden to 12 hours
Probability of Future Occurrences	High - for delineated floodplains there is a 1% chance of flooding in any given year.

Assessing Vulnerability: Addressing Repetitive Loss Properties

There are no repetitive loss properties in Wasatch County (FEMA, 2008).

History

Hazards	Date	Location	Critical Facility or Area Impacted	Comments
Flood Wasatch Presidential	Spring 1983	Wasatch County	Uncontrolled flooding washed out culverts, bridges, public and private roads. Irrigation systems along with livestock holding fences, corrals were destroyed. 2.5 miles of the Heber Creep track was destroyed.	
		Heber City	Clogged culverts, and flooding damage to residential, commercial and public property.	
Flood Wasatch Presidential	Spring 1984	County wide	Damage to stream banks, culverts, bridges, structures, and roadways near or along streams.	County damage was estimated at $646,526.

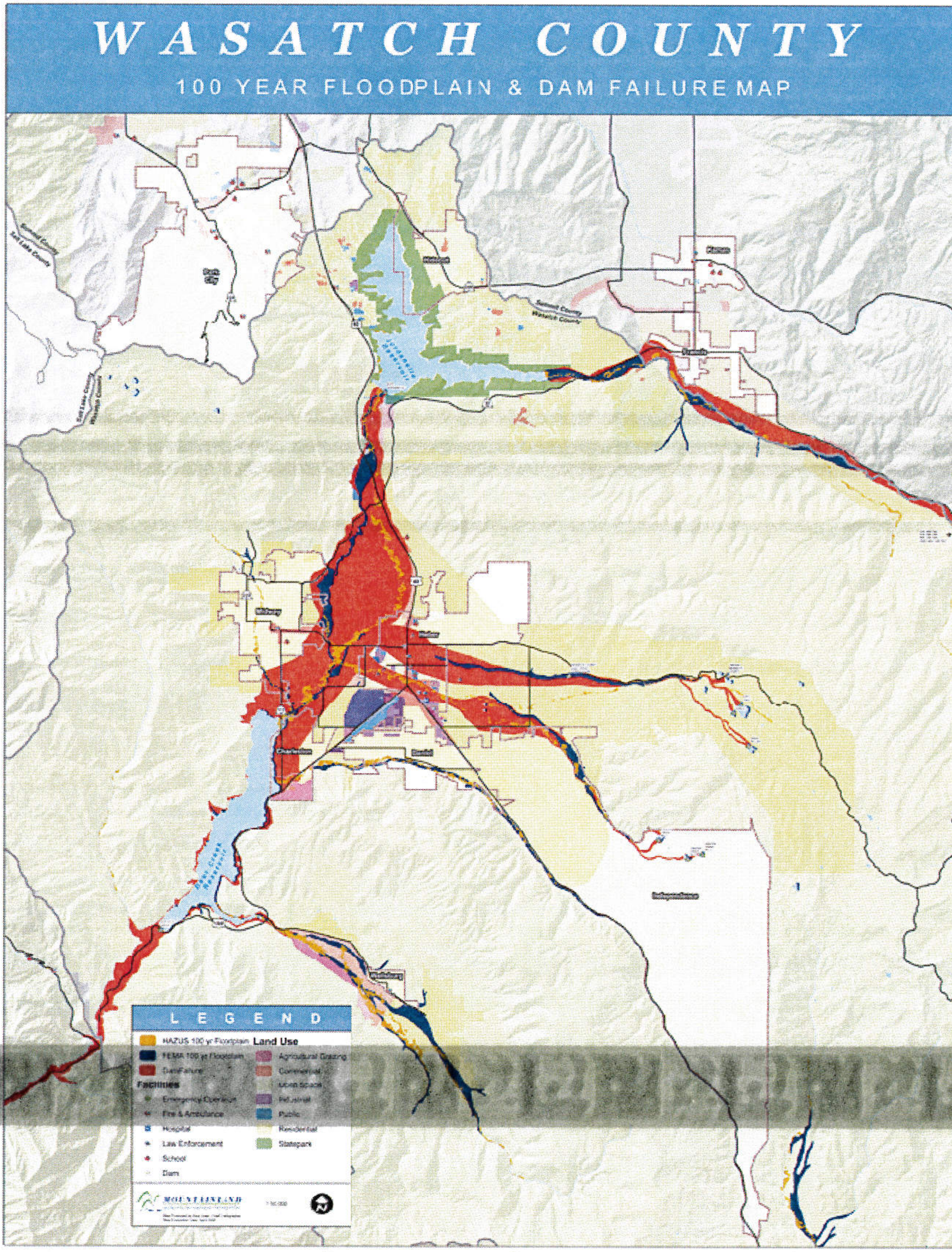
(All dollar values for given are for year of disaster)

Source: Flood Hazard Identification Study: Mountainland Association of Governments, US Army Corps of Engineers.

SHELDUS Data

DATE	Hazard	INJURIES	FATALITIES	PROPERTY DAMAGE (2007)	CROP DAMAGE (2007)
2/17/1986	Flooding	0	0.09	85763.21	0
2/19/1986	Flooding	0	0	55493.96	0
12/26/1998	Flooding	0	0	421.94	0
9/5/1965	Flooding	0.71	0	22222.2	2222.2

SHELDUS University of South Carolina 2009


WASATCH COUNTY
100 YEAR FLOODPLAIN & DAM FAILURE MAP
LEGEND
HAZUS 100 yr Floodplain
FEMA 100 yr Floodplain
Dam Failure
Facilities
Emergency Operation
Fire & Ambulance
Hospital
Law Enforcement
School
Dam
Land Use
Agricultural Grazing
Commercial
Open Space
Industrial
Public
Residential
Statepark
MOUNTAINLAND

Wildland Fire

Overview

Wildland fire is a big concern in the Wasatch County area. On August 24, 1990, the most devastating urban wildland interface wildfire (URWIN) to have occurred in Utah began just west of the Heber Valley and lasted for six days, burning nearly 3,000 acres until it was officially contained. The Wasatch Mountain Fire, as it is referred to now, killed two firefighter, destroyed 18 homes and cost the state approximately $1.42 million in fire suppression. The overall loses were estimated to be about $2 million. Following this wildfire, precautions were taken in Midway for flash flooding and the NRCS Emergency Watershed Protection Program (EWP) was implemented with emergency flash flood mitigation measures.

Due to this fire a grant was received to implement a Children's Wildfire Mitigation Awareness Program. In the summer of 2003, a second wildfire, also started by the Forest Service, this time in the Cascade Springs area of Utah County, got out of control and burned into Wasatch County. The original "Prescribed" Burn was to be about 600 acres. The wildfire consumed more than 8,000 acres and threatened homes in the Midway area. Mudflows from the burned areas may have a negative effect on water quality in the Deer Creek Reservoir. There was considerable concern on the part of Wasatch County Officials that Forest Service Officials would not let the County aid in fighting the fire.

Development Trends

As development occurs on the bench areas of Wasatch County more homes will be in danger of wildfire. Communities need to make developers and homeowners aware of the danger. Cities should also require firebreaks and access roads along urban/wildland interfaces. Although development brings homes closer to areas of potential wildfire, it also brings water and access for firefighters closer to the urban fringe. Firewise community development principles, such as not storing firewood near homes, installing fire resistant roofing and cleaning debris from rain gutters will reduce potential loses.

Profile

Frequency	Multiple wildland fires occur in Wasatch County Every year.
Severity	Moderate
Location	Hillsides and mountainous areas, open grass and range lands.
Seasonal Pattern	Summer and fall depending on weather conditions.
Duration	A few hours to a few weeks depending upon conditions
Speed of Onset	1 to 48 hours
Probability of Future Occurrences	High Major Fires – .47 fires per year (FFSL) All Fires – 18 per year (USFM)

History -Forestry Fires and State Lands

NIFMID	NAME	DAY	MONTH	YEAR	ACRES
	Deer Creek	29	7	1960	415
	Broadhead Meadows			1961	200
	Bear Canyon	20	7	1961	80
	Wallsburg	16	10	1964	180
	Danials Creek	4	9	1964	195
	Little Deer Creek			1968	13
81969	Jims Hole	16	8	1976	35
	Broadhead (maybe Murdock Basin)			1980	0
82118	Piuta	28	7	1980	325
	Beaver Creek			1984	15
	Iron Mine Lake			1985	18
	Wasatch Mountain Fire	30	8	1990	3000
281753	Center Canyon	3	10	1993	160
314625	Vivian Park	11	8	1996	350
314108	Daniels Canyon	13	8	1996	483
354438	Iron Mine Lake	19	7	2000	200
354431	East Vivian	26	7	2000	1753
354370	Wallsburg	26	7	2000	99.82
371251	South Hollow	17	8	2001	2121
391800	Cascade	23	9	2003	7828

Utah Division of Forestry Fires and State Lands 2009

State Fire Marshal's Office
Due to the high number of events, yearly reports for the previous 5 years are included in the annexes portion of the is plan.

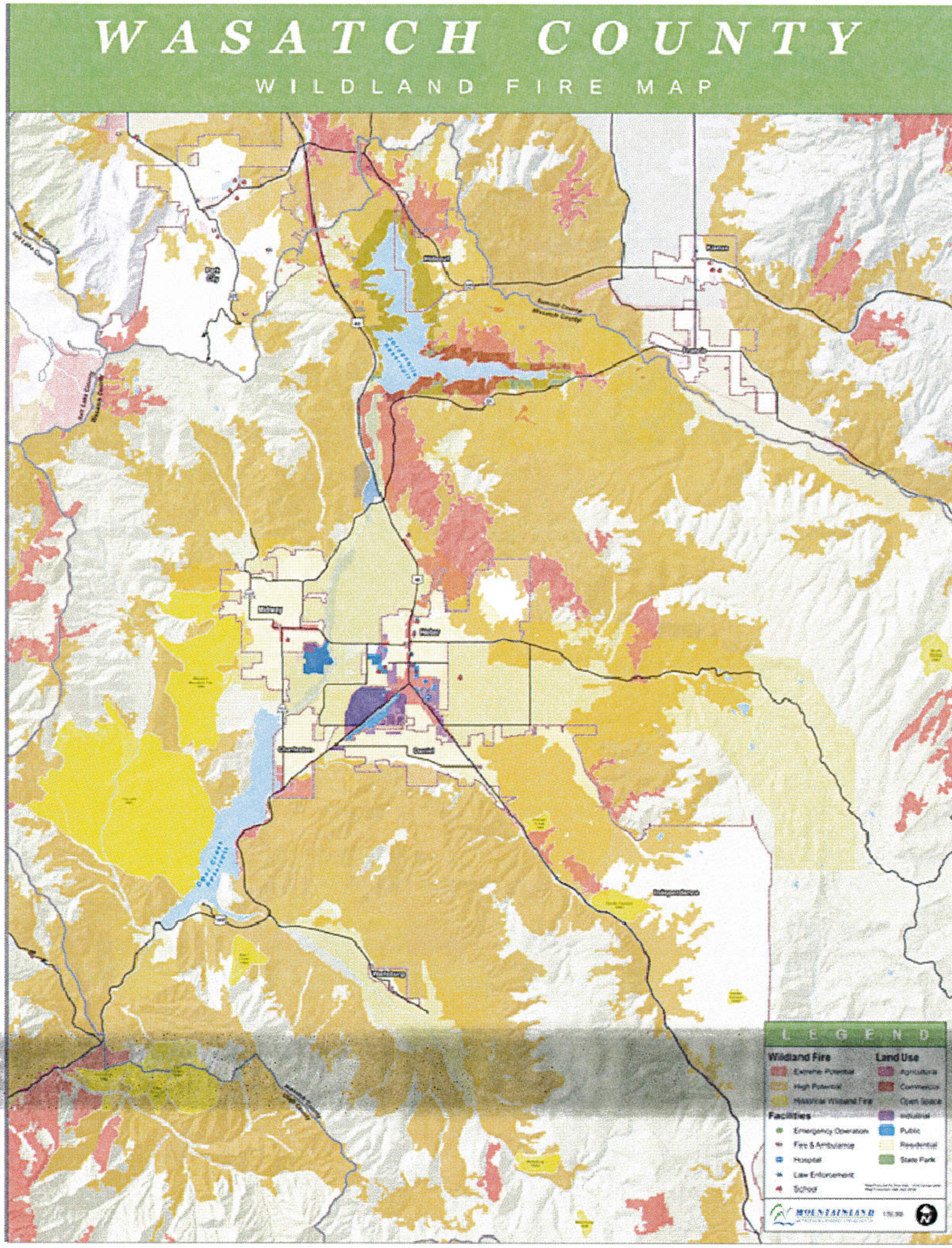
Timberlakes Project Report

Due to increasing Wildland fire activity in the western US and in particular, the terrible Wildland fire season of 2000, the National Fire Plan was developed. In 2001, the Timberlakes community, a Wildland Urban/Interface community, was listed as the #2 Wildland Hazard Risk in the State of Utah. This community is a mixture of permanent and seasonal residents with over 500 homes and 3,000 people located in the Lake Creek region approximately five (5) miles east of Heber City.

The State of Utah, Division of Forestry, Fire and State Lands, in collaboration with the Timberlakes Homeowners Association Board, Timberlakes residents, The Church of Jesus Christ of Latter-Day Saints. Wasatch County, and the US Forest Service, applied for a hazardous fuel reduction grant. This grant was approved for $20,400. The grant objectives were to primarily educate and undertake an assessment of the severity of the wildfire hazard faced by the individual homeowners. The remaining objective of the grant was to demonstrate how these hazards could be mitigated through the use of a demonstration of defensible space around the homes and a perimeter fuel break. The project was not intended to "mitigate all of the wildfire hazards" faced by the community.

The risk in the Timberlakes community was evaluated using the Division of Forestry, Fire, and State Lands wildfire hazard rating criteria. Risk factors included poor road access, lack of a reliable water system, fuel loading within the subdivision, and fire history. Following this evaluation, an action plan was developed for further action. This consisted of providing information and education to Timberlakes residents, homeowner and community action, and hazardous fuel reduction. Lot assessments were completed for 342 lots of which 300 were rated high, 16 were rated extreme, and 26 were rated as moderate, with an overall rating of high. As a response to the lot assessment program and education efforts significant interest in creating defensible space resulted with 107 lots doing some kind of fuel reduction and approximately 1,000 tons of slash removed.

As a result of these activities, the Timberlakes community has taken the first step and the initial response by the partners to continue. So it is very important that the initial work completed is maintained and the creation of defensible space and proactive community involvement continues in the future.


WASATCH COUNTY
WILDLAND FIRE MAP
LEGEND
Wildland Fire
Land Use
Facilities
Emergency Operation
Fire & Ambulance
Hospital
Law Enforcement
School
Open Space
Public
Residential
State Park

Landslide/Problem Soils

Overview

The Utah Interagency Technical Team (IAT) has worked with Wasatch County in 1999 due to extensive landslide complexes identified by the Utah Geological Survey in the Timber Lakes area and also in several mountain communities on the west side of the Heber Valley. In one such area of Timber Lakes, more than 200 homes are in a Landslide Study Area of the UGS. Thus, the UGS has completed, and is still conducting, Landslide Hazard and Risk Analysis for Timber Lake and other communities. These reports can be obtained from the UGS.

Development Trends

As development continues on the foothills of the Heber Valley, more houses may be in danger of landslides. Increased analysis and geotechnical reports should become an integral part of the development and building process. An emphasis should also be put on ensuring proper drainage is developed. Reseeding wildfire areas, cuts and fills must also be a priority.

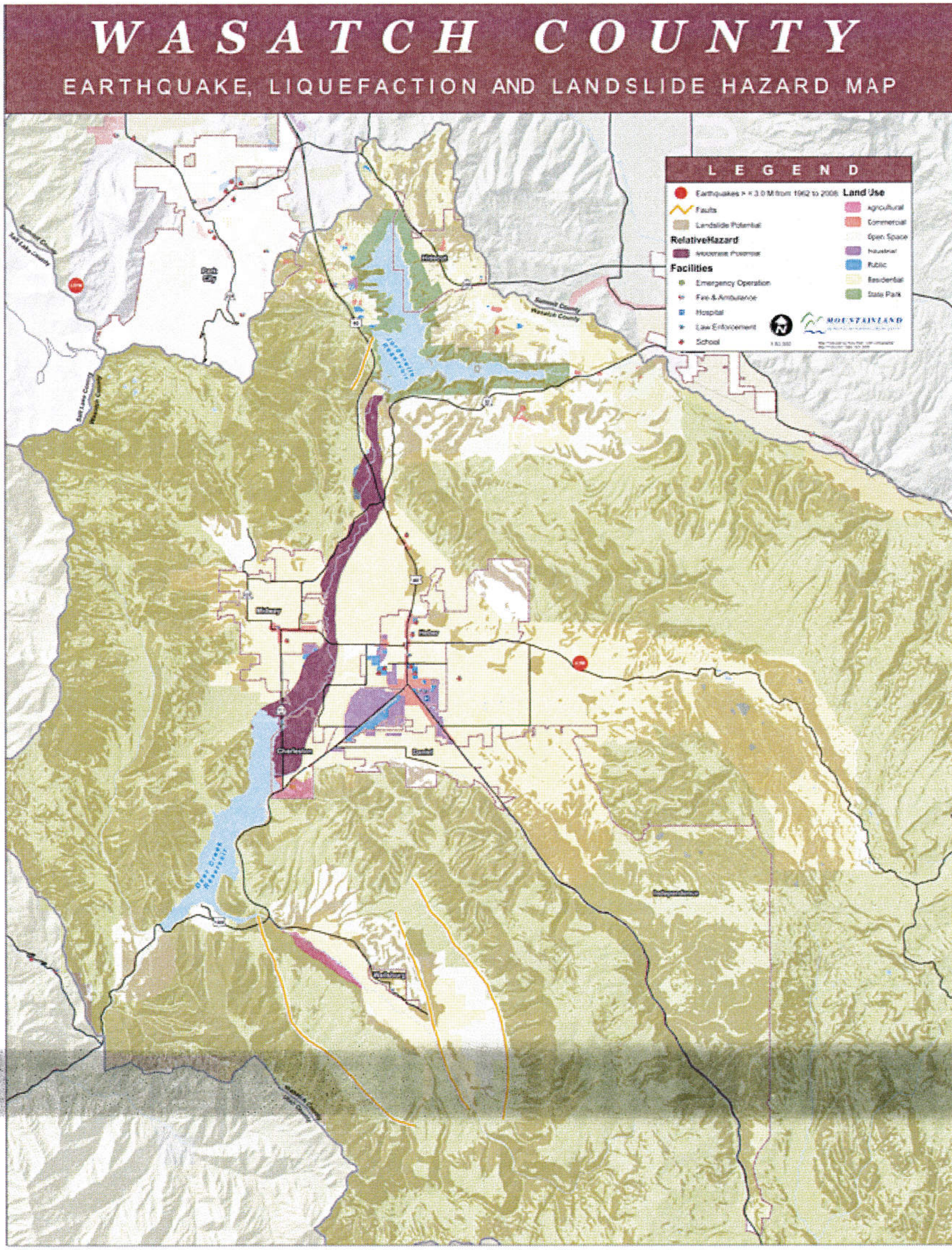
Profile

Frequency	Movement occurs nearly every year.
Severity	Moderate several structures have been condemned.
Location	Along most benches and hillsides.
Seasonal Pattern	Spring when ground saturation is at its peak.
Duration	Minutes to years.
Speed of Onset	Seconds to days.
Probability of Future Occurrences	Specific data is unavailable. However, terrain and topography make the probability of future occurrences relatively high.

History

The following table is from a GIS analysis of active landslides in Wasatch County specifically the data being produced for the Timber Lakes area.

County	City	Population	Households	Type
Wasatch		371	138	Deep Seated
Wasatch		1066	338	LS and LS/talus/colluvial/etc
Wasatch	Midway	20	9	LS and LS/talus/colluvial/etc


WASATCH COUNTY
EARTHQUAKE, LIQUEFACTION AND LANDSLIDE HAZARD MAP
LEGEND
Faults
Landslide Potential
RelativeHazard
Facilities
Emergency Operation
Fire & Ambulance
Hospital
Law Enforcement
School
Land Use
Agricultural
Commercial
Open Space
Industrial
Public
Residential
State Park
Park City
Midway
Heber
Charleston
Daniel
Wallsburg
Independence

Earthquake

Overview

Please see the HAZUS-MH Earthquake event report for Wasatch County. HAZUS is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop earthquake losses at a regional scale. For this plan a Utah County earthquake was simulated. The complete results are within the event report.

Development Trends

As development occurs in Wasatch County, more buildings and people will be in danger from earthquakes. However, newer buildings will be built to better standards, which will actually decrease the risk of damage. It is interesting to note that when most residential structures are engineered, out the three categories of design criteria; seismic zone, wind shear and snow load; the design criteria for wind shear over-rules the other criteria.

Profile

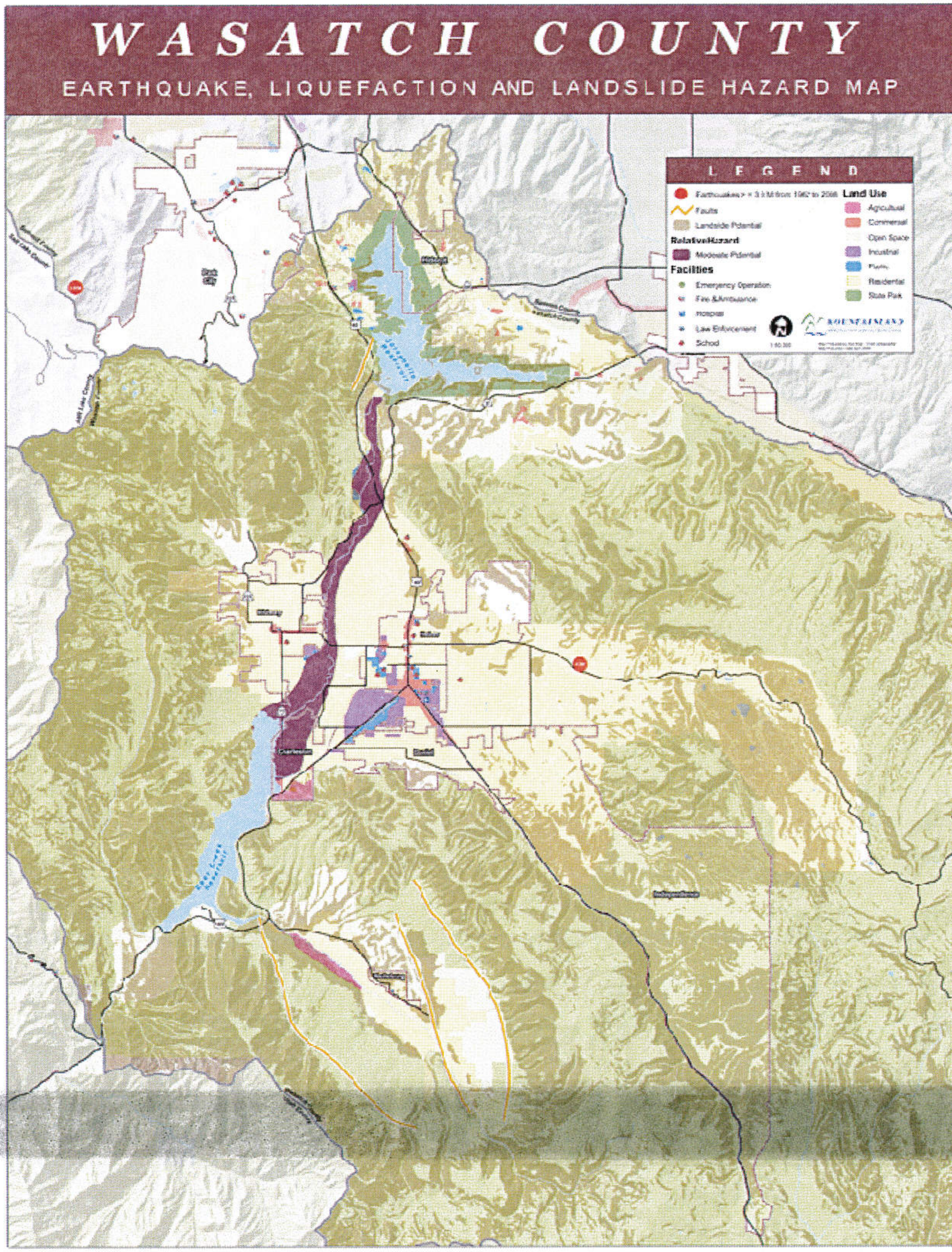
Frequency	Low -Events above 3.0 on the Richter scale are rare. Minor events (below 3.0) occur every month.
Severity	High (up to 5.0)
Location	Multiple faults throughout the county particularly around Wallsburg.
Seasonal Pattern	None
Duration	1 to 6 minutes excluding aftershocks.
Speed of Onset	Seconds
Probability of Future Occurrences	Low- .1 (events above 3.0)

History

Recorded Earthquakes magnitude 3.0 or greater since 1950: Wasatch County

Date	Richter Magnitude	Epicenter
August 17, 1963	3.9	12 miles northeast of Strawberry Reservoir
October 1, 1972	3.8	Near Heber
October 2, 1972	3.2	Near Heber
December 24, 1972	3.0	Near Heber
August 5, 1973	3.4	Deer Creek Reservoir
August 19, 1973	3.4	South of Heber

University of Utah Seismology Department 2009


WASATCH COUNTY
EARTHQUAKE, LIQUEFACTION AND LANDSLIDE HAZARD MAP
LEGEND
Land Use
Faults
Landslide Potential
Facilities
Emergency Operation
Law Enforcement
School
Residential
State Park
Open Space
Charleston

Review of 2004 Plan Mitigation Strategies

For the previous (2004) Mountainland Hazard Mitigation Plan, each participating jurisdiction prioritized there mitigation efforts and identified a single project. Below is a list of those projects and an update on the status of each project.

Wasatch County Communities
PRIORITIZATION OF INDIVIDUAL COMMUNITY
MITIGATION STRATEGIES

Community	Hazard	Mitigation	Status	Comments
Charleston	Dam Failure	Establish an early warning system	Ongoing	Funding has been an issue.
Heber	Dam Failure	Establish an early warning system	Ongoing	Funding has been an issue.
Midway	Earthquake	Retrofit Community Center	Ongoing	Midway was awarded a PDM grant and is currently working on the project details.
Wallsburg	Wildfire	Distribute Information on Firewise Communities	Ongoing	Community is partnering with various fire prevention agencies to educate. New standards in International Building Code.
Wasatch County	Wildfire	Distribute Information on Firewise Communities	Ongoing	Community is partnering with various fire prevention agencies to educate. New standards in International Building Code.

Damage Assessment and Mitigation

Overview

Each jurisdiction represented by this plan has participated in the creation of its contents and given local input into their individual mitigation goals and priorities. Early in the process the planning team determined that creating a list of basic mitigation strategies would stimulate each jurisdiction by acting as a beginning point for additional mitigation planning as well as helping to fulfill the requirements of this plan. Each jurisdiction has accepted and or made changes to the mitigation table to reflect their needs.

Listed below are the damage assessments for each of the participating jurisdiction followed by that community's mitigation strategies. Damage assessments were calculated using the methodologies mentioned earlier in this plan. Strategies were developed by the planning committee and then modified, if desired, by the individual community.

These strategies were assigned a priority of high, medium, or low by communities according to the following criteria:

- Number of people affected by the project
- Technical feasibility

- Political support
- Available funding and priorities
- Environmental impact
- Cost to benefit ratio

Earthquake (county wide)

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Earthquake	256	$ 27,876,808.63		7	$ 6,996,239.59		0	0	0	0	0

Charleston

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	181	$13,397,300	0	19	$4,165,100	270	1	$442,000	9	$42,096,400	-
FEMA Flood Plain	0	$0	0	1	$1,900	0	-	-	0	0	-
HAZUS Flood	6	$508,400	0	1	$78,900	40	-	-	0	0	-
Debris	5	$411,000	0	1	$102,000	10	-	-	1	$2,106,200	-
Steep Slopes	4	$354,400	0	1	$93,300	0	-	-	-	-	-
Wild Fire	7	$518,000	0	2	$240,700	30	-	-	2	$2,955,600	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding	Responsible Party

					Sources	
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Daniel

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	-	-	-	-	-	-	-	-	-	-	-
FEMA Flood Plain	30	$3,646,200	12	3	$440,000	0	-	-	0	0	-

HAZUS Flood	14	$1,747,400	7	2	$199,600	0	-	-	0	0	-
Debris	4	$342,800	0	1	$13,000	0	-	-	0	0	-
Steep Slopes	0	$0	0	1	$3,100	0	-	-	-	-	-
Wild Fire	3	$349,300	5	1	$44,400	0	-	-	1	$890,800	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Heber

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	2,145	$182,050,600	3028	271	$92,969,300	2730	-	-	37	$178,359,100	9
FEMA Flood Plain	13	$928,000	129	1	$82,100	10	-	-	1	$4,019,100	-
HAZUS Flood	57	$4,334,600	81	10	$4,336,100	250	-	-	1	$7,170,000	-
Debris	238	$23,086,000	594	22	$4,131,900	0	-	-	8	$36,550,300	-
Steep Slopes	6	$577,400	0	1	$30,900	0	-	-	-	-	-
Wild Fire	131	$13,701,700	685	6	$945,900	0	-	-	10	$44,823,100	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Hideout

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Steep Slopes	57	$1,815,449	-	0	$84,214	-	-	-	-	-	-
Wild Fire	109	$3,024,926	-	1	$140,319	-	-	-	-	-	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping	High	1 year	Minimal	Local Cash,	Local Government

	requirements into local ordinances within areas at risk.				Grants	
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Independence

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	11	$1,719,700	148	2	$183,400	0	-	-	-	-	-
FEMA Flood Plain	5	$830,300	100	1	$82,800	0	-	-	-	-	-
HAZUS Flood	2	$300,800	38	1	$31,200	0	-	-	-	-	-
Debris	9	$1,461,200	56	3	$297,800	0	-	-	-	-	-
Steep Slopes	16	$2,396,400	0	3	$413,100	0	-	-	-	-	-
Wild Fire	37	$5,970,700	79	5	$784,100	0	-	-	-	-	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Midway

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	263	$28,101,600	912	14	$3,197,100	90	-	-	9	$39,828,800	-
FEMA Flood Plain	4	$269,200	68	1	$42,200	0	-	-	0	0	-
HAZUS Flood	9	$931,700	51	2	$237,800	0	-	-	0	0	-
Debris	145	$14,302,800	665	6	$1,038,100	0	-	-	4	$16,938,400	-
Steep Slopes	63	$7,417,000	0	3	$390,300	0	-	-	-	-	-
Wild Fire	100	$10,170,600	411	4	$592,700	0	-	-	1	$5,492,200	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic	High	3 years	TBD	Local Cash,	Local Government

	standards.				Grants	
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Wallsburg

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count
Dam Failure	-	-	-	-	-	-	-	-	-	-	-
FEMA Flood Plain	1	$54,600	51	1	$5,900	0	-	-	0	0	-
HAZUS Flood	-	-	-	-	-	-	-	-	-	-	-
Debris	58	$5,884,300	142	2	$205,500	0	-	-	2	$10,104,800	-
Steep Slopes	4	$465,100	0	1	$38,300	0	-	-	-	-	-
Wild Fire	23	$2,556,300	168	1	$102,600	0	-	-	1	$4,745,800	-

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Wasatch County (unincorporated)

Hazard	Residential			Commercial			Bridges		Roads		Critical Facilities
	Count	Cost	Planned Units	Count	Cost	Planned Jobs	Count	Cost	Length (mi)	Cost	Count

Dam Failure	531	$65,618,200	1376	59	$13,508,900	1390	22	$4,500,990	-	-	1
FEMA Flood Plain	107	$12,937,200	278	21	$6,829,300	90	17	$4,793,000	-	-	-
HAZUS Flood	58	$6,361,900	89	10	$2,713,500	40	10	$1,181,000	-	-	-
Debris	1,080	$141,518,500	795	33	$6,826,000	340	1	-	-	-	-
Steep Slopes	632	$78,532,000	0	22	$5,528,700	0	1	-	-	-	-
Wild Fire	1,202	$130,667,600	2630	51	$12,927,800	1330	8	$3,574,000	-	-	2

Protecting Current Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Promote NFIP participation.	High	Ongoing	Minimal	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Inventory current critical facilities for seismic standards.	High	3 years	TBD	Local Cash, Grants	Local Government
Wildfire	Educate homeowners on FIREWISE practices.	High	Ongoing	Minimal	Local Cash, Grants	Local Government
Landslide	Public education on and correct watering practices and retaining measures in susceptible areas.	Medium	1 year	TBD	Local Cash, Grants	Local Government, UGS

Protecting Future Residents and Structures

Hazard	Action	Priority	Timeline	Estimated Cost	Potential Funding Sources	Responsible Party
Flooding/Dam Failure	Update Flood and Inundation mapping and incorporate them into general plans and ordinances.	High	2 years	TBD	Local Cash, Grants	Local Government, FEMA, UDHS
Earthquake	Promote earthquake awareness and preparation.	High	1 year	Minimal	Local Cash, Grants	Local Government, UGS, USGS
Wildfire	Incorporate FIREWISE landscaping requirements into local ordinances within areas at risk.	High	1 year	Minimal	Local Cash, Grants	Local Government
Landslide	Coordinate and update landslide mapping within the area with UGS and USGS.	High	3 years	Minimal	Local Cash, Grants	Local Government, UGS, USGS

Part IX
Plan Maintenance

Plan Update

Over the past five years, the previous Mountianland Hazard Mitigation Plan was amended using the most of the procedures listed below. While there were no major amendments, minor changes were initiated by jurisdictions to better reflect changing priorities and needs. As communities identified new mitigation projects, the mitigation strategy portion of the plan was updated. This has led to success in procuring grant funding to accomplish some mitigation strategies such as seismic retrofitting of public buildings and increased public awareness of hazards.

Unfortunately, a weakness of the previous plan was the documentation of these minor changes and the documentation of mitigation projects performed. During the updating process, it was determined that the plan maintenance procedures from the previous plan, should be adjusted to change this trend. Those adjustments have been incorporated in the new procedures listed below.

As this plan moves forward, a heightened awareness for this program and hazard mitigation in general will increase. Making the data available to each community and updating changes to that data will help ensure the plan stays as accurate as possible. This will be accomplished through the annual report and evaluation procedure. A new addition will be an annual plan review meeting where the Plan Steering Committee, which consists of staff engineers, planners and emergency officials, can review the plan and mitigation activities can be documented. This will ensure more accurate documentation of progress and changes as well as motivation for each responsible party to move forward with their mitigation projects.

Monitoring, Evaluating and Updating the Plan

Periodic monitoring and reporting of the Plan is required to ensure that the goals and objectives for the Mountainland Region are kept current and that local mitigation efforts are being carried out. The Plan has therefore been designed to be user-friendly in terms of monitoring implementation and preparing regular progress reports.

Annual Reporting Procedures

The Plan shall be reviewed annually, as required by the Executive Council, or as situations dictate such as following a disaster declaration. Each year the MAG Community Development Department Staff will conduct a Steering Committee meeting to review the plan and ensure the following:

1. The Executive Director and the Executive Council will receive an annual report and/or presentation on the implementation status of the Plan at an Executive Council Meeting.

2. The report will include an evaluation of the effectiveness and appropriateness of the mitigation actions proposed in the Plan.

3. The report will recommend, as appropriate, any required changes or amendments to the Plan.

If the MAG Executive Council determines that a modification of the Plan is warranted, the Council may initiate a Plan amendment.

Revisions and Updates

Periodic revisions and updates of the Plan are required to ensure that the goals and objectives for the Mountainland 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.

Five (5) Year Plan Review

The entire plan including any background studies and analysis should be reviewed every five (5) years to determine if there have been any significant changes in the Mountainland 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 Pre-Disaster Hazard Mitigation Plan Steering Committe, with a potential membership representing every jurisdiction in the MAG area, will be reconstituted for the five (5) year review/update process. Typically, the same process that was used to create the original plan will be used to prepare the update.

Further, following a disaster declaration, the Plan will need to be revised to reflect on lessons learned or to address specific circumstances arising out of the disaster.

The results of this five (5) year review should become summarized in the annual report prepared for this Plan under the direction of the Community Development Director. The annual report will include an evaluation of the effectiveness and appropriateness of the Plan, and will recommend, as appropriate, any required changes or amendments to the Plan.

If the Executive Council determines that the recommendations warrant modification to the Plan, the Council may either initiate a Plan amendment as described below, or, if conditions justify, may direct the MAG Community Development Department to undertake a complete update of the Plan.

Plan Amendments

An amendment to the Plan should be initiated only by the Executive Council, either at its own initiative or upon the recommendation of the Executive Director, Community Development Director, Mayor of an affected community or the State Department of Emergency Services and Homeland Security.

Upon initiation of an amendment to the Plan, Mountainland 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 Ad-Hoc committee may be reconstituted or the MAG Regional Growth Committee may review the amendment. At a minimum, the information will be made available through public notice in a newspaper of general circulation and on the Mountainland Website at www.mountainland.org. Information will also be forwarded to the Utah Department of Public Safety, Division of Emergency Services and Homeland Security. This information will be sent out in order to seek input on the proposed Plan amendment for not less than a forty-five (45) day review and comment period.

At the end of the comment period, the proposed amendment and all review comments will be forwarded to the Executive Director (or his/her designee) for consideration. If no comments are received from the reviewing parties within the specified review period, such will be noted accordingly. The Executive Director (or his/her designee) will review the proposed amendment along with comments received from other parties and submit a recommendation to the Executive Council within sixty (60) days.

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

There are errors or omissions made in the identification of issues or needs during the preparation of the Plan; and/or

New issues or needs have been identified which were not adequately addressed in the Plan; and/or

There has been a change in information, data or assumptions from those on which the Plan was based.

The nature or magnitude of risks has changed.

There are implementation problems, such as technical, political, legal or coordination issues with other agencies.

Upon receiving the recommendation of the Executive Director or his/her designee, the Executive Council will hold a public hearing. The Executive Council will review the recommendation (including the factors listed above) and any oral or written comments received at the public hearing. Following that review, the Executive Council will take one of the following actions:

1. Adopt the proposed amendment as presented.

2. Adopt the proposed amendment with modifications.

3. Refer the amendment request back to the Executive Director for further consideration.

4. Defer the amendment request for further consideration and/or hearing.

5. Reject the amendment request.

Implementation through Existing Programs

Process

The Mountainland Association of Governments Pre-Disaster Hazard Mitigation Plan will be implemented through the General Plans and Capital Improvement Plans (CIP) of each local jurisdiction. 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).

Administrative

Project administration is purely a function of project size and complexity, for given jurisdictions within the planning area. Jurisdictions have self-funded or received state and federal funding for numerous projects in the past. The larger the project the more administration resources are needed. Local jurisdictions with current staff could administer small projects or request county or state assistance. Larger projects would most likely still by managed "in-house" but would require additional staff be hired and may request state technical assistance.

Funding Sources

Although all mitigation techniques will likely save money by avoiding losses, many projects are costly to implement. The Mountainland jurisdictions will 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 Mountainland jurisdictions to consider, and also briefly discusses local and non-governmental funding sources.

Federal

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 hazard 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: SBA Disaster Assistance Program
Agency: US Small Business Administration

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 fro 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

See the Capabilities Assessment Annex of this document for a full description of the State Programs available.

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 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. On a yearly basis the plan will be profiled at Mountainland's Annual Open Houses, which are held in the fall of every year. There are typically 400 to 500 local citizens who attend the Open Houses. The plan will also be available on the MAG website to provide additional opportunities for public participation and comment.

Mountainland Association of Governments staff has been designated by its Executive Council as the lead agency in preparing and submitting the Mountainland Pre-Disaster Hazard Mitigation Plan, which includes coverage for all incorporated cities and counties within the three county region, i.e. Summit, Utah and Wasatch Counties. The strategy of the Association of Governments in preparing the plan is to use available resources and manpower in the most efficient and cost effective manner to allow our cities and counties continued access to data, technical planning assistance and FEMA eligibility. In addition, the AOG 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 AOG will publicly advertise all hearings, requests for input and meetings directly related to the Pre-Disaster Hazard Mitigation Plan process. Executive Council 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 AOG will advertise each hearing and request for input at least seven days (7) in advance of the activity and will publish notices of the event in the Provo Herald, the Wasatch Wave and the Summit County Bee. 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. The AOG has established a mailing list of many local agencies and individuals that may have an interest in the Pre-Disaster Hazard 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 Hazard Mitigation Plan; however, the AOG 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 AOG 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 final draft of the Hazard Mitigation Plan will be presented to the Mountainland Executive Council at its regularly scheduled monthly meeting for adoption and approval. Executive Council policies on adoption or approval of items will be in force and adhered to. This document is intended to be flexible and in constant change so comments can be taken at any time of the year for consideration and inclusion in the next update. Additionally, after FEMA approval of the Plan, the Plan will be promulgated for each local jurisdiction for adoption by resolution.

STEP 6. The following policies will guide AOG staff in making access and input to the Hazard 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 AOG 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 Hazard Mitigation Plan, and/or any other documents prepared for distribution by the Association of Governments that may be adopted as part of the plan by reference. The AOG 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. AOG staff will assist to the extent practical, however, limited staff time and resources may prohibit staff from giving all the assistance requested. The AOG will be the sole determiner of the amount of assistance given all requests.

E. Public Hearings: The AOG will plan and hold 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), and 3- Hearings will be adequately publicized. Hearings may be held for a number of purposes or functions including to: a-identify and profile hazards, b-develop mitigation strategies, and c-review plan goals, performance, and future plans.

F. Comment Period: The AOG will sponsor a 30-day public comment period prior to final plan adoption. The comment period will begin with a public hearing to open the 30-day solicitation of input. Comments may be made orally, or in writing, and as far as possible, will be included in the final Pre-Disaster Hazard Mitigation Plan according to the outlined participation rules.

Part X
Capability Assessment

INTRODUCTION

What follows is a description of the organizational, technical and political capacity of the Mountainland Region to implement hazard mitigation strategies and goals. The best plan will do nothing to improve hazard mitigation efforts in the region without sufficient implementation capacity and capability; particularly local level capacity (town, city and county government). The purpose of this section is to analyze gaps and potential capability weaknesses for local level jurisdictions in the region.

LOCAL ORGANIZATIONAL AND TECHNICAL CAPABILITY

Not all of communities in the Mountainland region have full time professional staff. In many cases a limited tax base means that hiring full time professional staff in the smaller cities and towns is financially unobtainable. Often these smaller communities rely on local volunteers or elected and appointed officials to perform many of the tasks normally handled by professional staff. It's not uncommon to have a volunteer city council persons or planning commissioner assigned the task of emergency management, grant writing or long range planning. Professional staff at MAG (and each of the three counties to some degree) help provide some technical and planning assistance to these smaller communities. This regional assistance is often limited by staffing capacity and funding. As funding allows, some communities are able to contract for professional services from private consultants.

State and Regional Hazard Mitigation Resources **MAG District**	
Agency/Group	Description
Utah Div. of Emergency Services and Homeland Security	Training, technical assistance and funding.
Utah League of Cities and Towns	Training, technical assistance and planning assistance
Utah Geologic Survey	Technical assistance, plan review
Mountainland Association of Governments	Technical assistance, plan review, GIS and Community Development Block Grants.
Local Health Departments	Emergency preparedness and response. Homeland security planning.
Local Chapters of the American Red Cross	Training, emergency preparedness and response.
Utah Association of Conservation Districts	Technical assistance and planning assistance.

Local Level Hazard Mitigation Capability **MAG District**		
Jurisdiction	Professional Staffing (e.g. City Manger, Engineer, Planner)	Technical Capacity (In House)
SUMMIT COUNTY	County Emergency Management Coordinator , County Planner, Public Works, Building Inspector	GIS Staffing and equipment
Coalville	Volunteer\contracted consultant	None
Francis	Volunteer\contracted consultant	None
Henefer	Volunteer\contracted consultant	None
Kamas	Police, Planner, Public Works, Consultant	None
Oakley	Police, Planner, Public Works, Consultant	None
Park City	Emergency Manager, Planning Department, Public Works	GIS Staffing and equipment
UTAH COUNTY	Countywide Planner, Emergency Manager, Sheriff	Advanced GIS capability with customized application to Emergency Management.
Alpine	City Administrator, Planner, Public Works	Some GIS Capability
American Fork	Chief of Staff, Public Works, Police	GIS Capability and staffing
Cedar Fort	Volunteer\contracted consultant	None
Cedar Hills	City Administrator, Planner, Public Works	None
Eagle Mountain	City Administrator, Planner, Public Works	Some GIS Capability
Elk Ridge	Planner, Volunteer	Some GIS Capability
Genola	Volunteer\contracted consultant	None
Goshen	Volunteer\contracted consultant	None
Highland	City Administrator, Planner, Public Works	Some GIS Capability
Lehi	City Administrator, Planner, Public Works	GIS Capability and staffing
Lindon	City Administrator, Planner, Public Works	Some GIS Capability
Mapleton	City Administrator, Planner, Public Works	Some GIS Capability
Orem	Emergency Management Department, Planning Department, City Engineers & Public Works.	Advanced GIS capability with customized application to Emergency Management.
Payson	City Administrator, Planner, Public Works	Some GIS Capability
Pleasant Grove	City Administrator, Planner, Public Works	Some GIS Capability
Provo	Emergency Management Department, Planning Department, City Engineers & Public Works.	Advanced GIS capability with customized application to Emergency Management.
Salem	City Administrator, Public Works	None
Santaquin	City Administrator, Planner, Public Works	Some GIS Capability
Saratoga Springs	City Administrator, Planner, Public Works	Some GIS Capability
Spanish Fork	City Administrator, Planner, Public Works	Some GIS Capability
Springville	City Administrator, Planner, Public Works	Some GIS Capability
Vineyard	Volunteer\contracted consultant	None
Woodland Hills	Volunteer\contracted consultant	None

Local Level Hazard Mitigation Capability **MAG District**		
Jurisdiction	Professional Staffing (e.g. City Manger, Engineer, Planner)	Technical Capacity (In House)
WASATCH COUNTY	County Administrator, Countywide Planner , Emergency Manager, Sheriff	Advanced GIS capability with customized application to Emergency Management.
Charleston	Volunteer\contracted consultant	None
Heber	City Administrator, Planner, Public Works	Some GIS Capability
Midway	City Administrator, Planner, Public Works	Some GIS Capability
Wallsburg	Volunteer\contracted consultant	None
Daniel	Volunteer\contracted consultant	None
Independence	Volunteer\contracted consultant	None
Hideout	Volunteer\contracted consultant	None

POLICY AND PROGRAM CAPABILITY

All thirty-six jurisdictions in the MAG Region have an adopted General Plan. Although many communities have recently updated their General Plan, many are very outdated and have not been revised in years. Generally speaking, if these plans address natural hazards at all, it is usually limited to flood related hazards.

All of the thirty-six municipalities have an adopted zoning ordinance. Again, often these ordinances are outdated and often are not consistent with the jurisdiction's General Plan. Most zoning ordinances do not address natural hazards in any way. A few communities have a "sensitive area" or "hazard area" overlay zone. All communities issue building permits and enforce local building codes. Often this service is contracted for with the county.

Many of the smaller communities lack emergency response plans.

Authority

Federal: Public Law 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 also added that provide for the availability of significant mitigation measures in the aftermath of Presidentially declared disasters. Civil Preparedness Guide 1-3, Chapter 6- Hazard Mitigation Assistance Programs places emphasis on hazard mitigation planning directed toward hazards with a high impact and threat potential.

The Disaster Mitigation Act of 2000 was signed 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 (HMGP), if they submit for approval a mitigation plan, which is a summary of local and/or regional mitigation plans, that identifies natural hazards, risks, vulnerabilities, and describes actions to mitigate the hazards, risks and vulnerabilities in that plan.

State: The State of Utah derives its authority under the Emergency Management Act of 1981 (Utah Code 53-2, 63-5) as well as the Governor's Emergency Operations Directive and Executive Order of the Governor 11.

Association of Governments: The Association of Governments have been duly constituted under the authority of Title XI, Chapter13, Utah Code Annotated, 1953, as amended (The Inter-local Cooperation Act) and pursuant to Section 3 of the Executive Order of the Governor of the State of Utah, dated May 27, 1970, with the authority to conduct planning studies and to provide services to its constituent jurisdictions.

Local: Utah Code, Title 17, Chapter 27 is the County Land Use Development and Management Act that grants authority to counties. Utah Code, Title 10 Chapter 9 grants similar authority to municipalities.

The state of Utah maintains a philosophy of local responsibility for hazard mitigation. State agencies still provide an integrated network of support, services, and resources for hazard mitigation activities. As demonstrated during past disasters, these agencies are well organized in their delivery and coordination of services. The following is a review of State departments with disaster responsibilities describing their existing and planned mitigation programs.

An evaluation of the laws, regulations, authorities, policies, and programs used in Utah to mitigate hazards demonstrate that they work exceptionally well, as evidenced by the massive amount of mitigation accomplished in Utah, the few numbers of disasters, and the limited nature of those emergencies that do occur. According to the Utah SHMT, the only changes that could be considered by the Legislature might be ones that parallel the Federal Disaster Mitigation Act of 2000, which would integrate predisaster mitigation considerations into the code of various state agencies.

Utah Division of Emergency Services and Homeland Security

For Associated state laws see "Authority" at the beginning of this plan.

Capabilities of DESHS Hazard Mitigation Program
Prepare, implement, and maintain programs and plans to provide for preventions and minimization of injury and damage caused by disasters.
Identify areas particularly vulnerable to disasters.
Coordinate hazard mitigation and other preventive and preparedness measures designed to eliminate or reduce disasters.
Assist local officials in designing local emergency actions plans.
Coordinate federal, state, and local emergency activities.
Coordinate emergency operations plans with emergency pans of the federal governments.

Through the State Hazard Mitigation Program, the following occurs:

Provides a state coordinator for hazard mitigation, the State Hazard Mitigation Officer.
Provides a central location of the coordination of state hazard mitigation activities.
Provides coordination for the Federal Pre-Disaster Mitigation Program.
Provide for coordination of Project Impact.
Provide coordination for Comprehensive Multi-hazard Mitigation Plan development, implementation, and monitoring.
Provide for interagency coordination
Provide development of procedures for grant administration and project evaluation.
Provide State Hazard Mitigation Team assistance to local governments.
Provide for development of specific hazard mitigation plans, such as drought and wildfire.
Provide for local hazard and risk analysis.
Provide for development of SHMT mitigation recommendations following disasters.

Utah Department of Agriculture

The Utah Department of Agriculture administers programs serving the state's large agricultural sector. The department's response role during and after a disaster period has been to coordinate damage reports for funding needs and provide loan and recovery program information and assistance to disaster victims. This service is provided for flood, drought, insect infestation, fire, livestock disease, and frost.

Assistance During Drought Disasters:

A damage reporting network coordinated through the existing County Emergency Board was established during the drought disaster of 1996. Each county agent assembled damage reports in his area and transmitted them through a computer network based at Utah State University. The individual damage reports from each county were recapped in the Department of Agriculture and formed the basis of documentation for an appeal to the legislature for additional funds to mitigate the damage.

Loans Handbook
The department has prepared a handbook listing the types of loans available for flood damage to agriculture, the funding requirements, and applications procedures. This includes loans from both state and federal sources. There are three loan programs operated by the agriculture department, all of which can be used for flood damage: 1) Rural Rehabilitation Loan Program (federally funded and operated by the state); 2) Agriculture Resource Development Loan Program (state funded); and 3) Emergency Loan Program (state funded).

Soil Conservation Program
The Department of Agriculture also administers the ongoing Soil Conservation Program. In each of the state's thirty-nine soil conservation districts, three unpaid, elected supervisors offer technical assistance and consultation on watershed protection. The state offers limited technical and planning assistance through a staff member. The program works cooperatively with the federal Soil Conservation Service which provides most of the technical assistance. The ongoing program is not regulatory, but is directed at improved water use and soil conservation.

Disaster Easements:
Because of the similarity between past events the department in now working on a permanent hazard mitigation concept known as "Disaster Easements", which may have widespread agreements with irrigation companies, water districts, or water users associations for the purpose of routing flood water through town.

Monitoring Ground Water Quality:
The Department also monitors groundwater quality of private individuals wells and springs throughout the State.

Non-Point Source Pollution:
The Departments Non-Point Source Pollution Program focuses on flood prevention through reduction of erosion, vegetating streams, and restoring "natural stream structure" The Department also monitors drought conditions, which are a precursor to wildfire.

Department of Community and Economic Development

Community Impact Board
The Utah Permanent Community Impact Fund Board provides loans and/or grants to state agencies and sub-divisions of the state, which may be socially or economically impacted by mineral resource development of federal lands.

Permanent Community Impact Fund:
The Permanent Community Impact Fund provides loans and/or grants to state agencies and subdivisions of the state, which are or may be socially or economically impacted, directly or indirectly, by mineral resource development on federal lands.

Under the Federal Mineral Lease Act of 1920, leaseholders on public land make royalty payments to the federal government for the development and production of non-metalliferous minerals. In Utah, the primary source of these royalties is the commercial production of fossil fuels on federal land held by the U.S. Forest Service and the Bureau of Land Management. Since the enactment f the Minerals Lease Act of 1920, a portion of these royalty payments, called mineral lease payments, have been returned to the state in an effort to help mitigate the local impact of energy and mineral developments on federal lands.

Funding Options:
The Board has the option of funding projects with loans and/or grants. The Board's preferred financing mechanism is an interest-bearing loan.

Loan Requirements:
In providing financial assistance in the form of a loan, the Board may purchase an applicant's bonds only if the bonds are accompanied by legal opinion of recognized municipal bond counsel to the effect that the bonds are legal and binding under applicable Utah Law.

The Board may purchase either a taxable or tax-exempt bond. The board may purchase taxable bonds if it determines, after evaluating all relevant circumstances, including the applicant's ability to pay, that the purchase of the taxable bonds is in the best interest of the state and the applicant.

Grants
Grants may be provided only when the other financing mechanisms cannot be utilized, where no reasonable method of repayment can be identified, or in emergency situations regarding public health and/or safety.

Community Development Block Grant:
The Community Development Block Grant, or CDBG program, provides funding from the federal government's Department of Housing and Urban Development or HUD, to small cities and counties in the State of Utah.

Utah Division of State History

The Utah State Historical Society, Utah's Division of State History, was founded in 1897 on the 50th anniversary of the first settlement in the Salt Lake Valley by the Mormon Pioneers. The Society became a state agency in 1917, now housed in the historic Rio Grande Depot since 1980. The Division stimulates archaeological research, study; oversees the protection and orderly development of sites; collects and preserves specimens; administers site surveys; keeps excavation records; encourage and supports the preservation of historic and pre-historic sites and publishes antiquities records. The Division also issues archaeological permits and consults with agencies and individuals doing archaeological work.

Preserving and Sharing Utah's Past
The mission of the State Division of History is "preserving and sharing Utah's past for the present and the future."

State Historical Preservation Officer (SHPO)
The SHPO administers the Section 106 process (national Historic Preservation Act) in Utah. The SHPO also serves on the Utah State Hazard Mitigation Team, providing guidance on historical and cultural preservation regulations.

Historic properties include districts, buildings, structures, objects, landscapes, archeological sites, and traditional cultural properties that are included in, or eligible for inclusion in, the National Register of Historic Places. These properties are not just "old buildings" or "well-known historic sites, but places important in local, state, or national history. Facilities as diverse as bridges and water treatment plants my, be considered historic.

Utah Geological Survey (UGS)

The Utah Geologic and Mineral Survey is the principal state agency concerned with geologic hazards. Through years of study, the UGS has developed considerable information on Utah's geologic hazards. When geologic events occur or threaten to occur, the UGS is consulted by other state agencies, local governments, and private organizations for assistance in defining the threat from natural hazards. The UGS works in partnership with other agencies, such as DESHS, in relating the threats from natural hazard to the communities at risk.

Functions:
The functions of the UGS include the following:
Evaluation of individual geological hazards;
Participation on local government and state agency technical teams;
Prediction of the performance on individual slides once they began to move;
Coordination and awareness of research efforts undertaken by other agencies;
Provide information on status of individual geologic hazards;
Reconnaissance reports on status of hazards statewide;
Advise Division of Water Rights on geologic hazards associated with dam sites; and
Provide geologic information for use during planning of remedial actions.

Laws/authorities/policies of the Utah Geological Survey for conducting mitigation

Utah Code Annotated
Chapter 73 Geological and Mineral Survey

Section 68-73-6 Objectives of Survey
(e) Determine and investigate areas of geologic and topographic hazards that could affect the safety of, or cause economic loss to, the citizens of this state; (f) assist local and state government agencies in their planning, zoning, and building regulations functions by publishing maps, delineating appropriately wide special earthquake risk areas, and, at the request of state agencies, review the siting of critical facilities: Utah State Office of Education (USOE) Rule R277-455 Standards and Procedures for building plan review

R277-455-4 Criteria for Approval

To receive approval of a proposed building site, the local school district must certify that:
Staff of the Utah Geologic Survey have reviewed and recommended approval of the geologic hazards report provided by the school districts geotechnical consultant.
Division of Water Resources
Mitigation Functions
The Divisions role of planning, funding and constructing water projects serves as both active and passive hazard mitigation against drought and flood situations throughout the state. The various State water plans contain brief summaries of flood threat and risk for each drainages.

The Division is one of seven agencies in the State Department of Natural Resources. The eight member Water Resources Board, appointed by the governor, administers three state water conservation and development funds. They are:
Revolving Construction fund – This fund started in 1947 with 1 million legislative appropriation to help construct irrigation projects, wells and rural culinary water systems. Further appropriations have added to this fund.
Conservation and Development Fund – This fund was created in 1978 wit the sale of 25 million in general obligations bonds. Money was added to this fund with bond sales in 1980 and 1983. The C & D Fund generally helps sponsors finance larger multi-purpose dams and water systems.
Cities Water Loan Fund – Established with an initial legislative appropriation of 2 million dollars in 1974, and with continued appropriations, this fund provides financing to help construct new culinary water projects for cities, towns, improvement districts, and special service districts.

Construction Funds: In addition to overseeing these three construction funds, the Division also manages the State funds appropriated each year for renovation and reconstruction of unsafe dams. As the funding arm of the state for water resource projects the Division works closely with Water Rights, the Regulatory arm of the state charged with jurisdiction over all private and state owned dams.

Water Resource Planning: The Division is also charged with the general water resource planning for the state. The State Water Plan is a process that is coordinated to evaluate existing water resources in the state, determine water-related issues that should be confronted and recommend how and by whom issues can be resolved. The plan identifies programs and practices of state and federal agencies, water user groups and environmental interests and describes the state's current, future, and long-term water related needs. The plan is continually updated using current hydrologic databases, river basin simulations, water supply and demand models and water related land use inventories. Revisions reflect the latest water conservation and development options concerning water rights, water transfers, population, zoning, and many other complex issues for the next 50 years in the state's major river basins.

Utah Division of Forestry, Fire, and State Lands

The Division of Forestry, Fire & State Lands utilizes the principles of stewardship and ecosystem management to assist non-federal landowners in management of their natural resources. The agency provides wildland fire protection for non-federal landowners commensurate with risk; and optimizes the benefits from ecosystem based, multiple-use management of resources held in the public trust. Wildfires are managed from six area offices 1) Bear River Office, 2) Northeast Area, 3)Wasatch Front Area, 4) Central Area, 5) Southwest Area, and 5) Southeast Area.

The Division operates under the authority of the Utah Code Annotated 65-A-3-1 though 10.

The Flame-n-Go's (pronounced Flamingoes): In 1978 the Division of Forestry, Fire, and State Lands and the Utah State Prison signed a cooperative agreement establishing Utah's first volunteer, inmate wildland fire hand-crew. The inmates named themselves the "Flame-N-Go's" and designed a logo that has become well known in the wildland fire fighting community.

All Flame-N-Go's are carefully screened for the program. They must complete rigorous training and sign a yearly contract committing themselves to preserving Utah's natural resources and building responsible lives.

The Flame-N-Go's are divided into three crews, each of which can respond to fires anywhere in the United States. A twenty-man type II handline crew is the backbone of the group, responding to each assignment with all tools and equipment needed to do battle on the fireline. An Engine Strike Team, (five fire engines, outfitted with men and equipment) is ready to respond when needed as an Engine Strike Team or a Type II Handline Crew. The Hotshot crew is trained to tackle the most dangerous fires in the most rugged terrain. All crews during peak fire season are on 24-hour call to respond within an hour's notice. These crews respond to an average of 50 fires per year and typically spend 45,000 hours fighting fires each season. At least one Division of Forestry, Fire, and State Lands supervisor and two Department of Corrections staff accompany each crew.

Each year, Flame-N-Go's are put through at least 80 hours of extensive training including classroom work and practical field exercises. Safety, individual, and team skills, and professionalism are stressed.

National Fire Plan: The Division administers the State responsibilities of the National fire Plan, a current emphasis of the U.S. Congress, which also addresses hazard and risk analysis and hazard mitigation.

Living With Fire Committee: The Division works in partnership with the U.S. Forest Service, Bureau of Land Management, and various other entities tasked with suppressing wildland fires on the "Living With Fire" program promoting wildland fire mitigation.

Utah Division of State Parks and Recreation

The goal of the Division of Parks and Recreation is to enhance the quality of life for residents and visitors of our state through parks, people, and programs. They are responsible for protecting, preserving, and managing many of Utah's natural and heritage resources.

Hazard and Risk Analyses: The Division develops hazard and risk analyses for the State Parks as part of the park resource management plans. The Utah Division of Emergency Services and Homeland Security produced one analysis for Snow Canyon State Park in Washington County.

Non-Motorized Trail Program: The Recreational Trails Act of 1991 charged Utah State Parks and Recreation with coordinating the development of a statewide network of non-motorized trails. The Non-Motorized Trail program makes state and federal funds available on a 50/50 matching basis to any federal, state, or local government agency, or special improvement district for the planning, acquisition, and development of recreational trails.

Grants from State Parks Boards: The council advises the Division of Parks and Recreation on non-motorized trail matters, reviews requests for matching grant fiscal assistance, rates and ranks proposed trail projects and along with State Park's staff provides recommendations for funding to the State Parks Board.

Riverway Enhancement Program: In 1986, the Utah Legislature passed a bill which established the Riverway Enhancement Program. The program makes state funds available on a 50/50 matching basis to state agencies, counties, cities, towns, and/or special improvement districts for property acquisition and/or development for recreation, flood control, conservation, and wildlife management, along rivers and streams that are impacted by high density populations or are prone to flooding. Public outdoor recreation should be the primary focus of the project.

Utah Division of Water Rights

The Division of Water Rights is the state agency that regulated appropriation and distribution of water in the State of Utah. It is an office of public record. The Utah State Engineer's Office was created in 1897. The State Engineer's Office is the chief water rights administrative officer. A complete "water code" was enacted in 1903 and was revised and reenacted in 1919. This law, with succeeding complete reenactments of State statutes, and as amended, is presently in force mostly as *Utah Code, Title 73*. In 1963, the name was changed from State Engineers office to the Division of Water Rights.

All water in Utah are public property. A water right is a right to the use of water based upon 1) quantity, 2) source, 3) priority date, 4) nature of use, 5) point of diversion, and 6) physically putting water to beneficial use.

Regulate Dams: The State engineer has the authority to regulate dams for the purpose of protecting public safety. Dams are classified according to hazard, size, and use. The dam inventory gives the identification, location, construction parameters, and the operation and maintenance history of the dams in Utah.

Stream Alterations Program: The Utah state Engineer's Office administers a Stream alterations program with the purpose of regulation activities affecting the bed or banks or natural streams. The State Engineer's working definition of a natural stream is any natural waterway in the state, which has flows of sufficient duration to develop a characteristic ecosystem distinguishing it from the surrounding environments. Any individual planning an activity that will affect a natural stream must first obtain a Stream Alterations Permit from this office.

Most proposals reviewed by the State, are covered by General Permit 40, which authorizes the state to have its Stream Alteration Permit fulfill the requirements of Section 404 of the Clean Water Act for most activities. General permit 40 does not apply in some instances and a U.S. Army Corps of Engineers Individual Permit is required. Projects requiring this additional permit include those involving wetlands, threatened or endangered species, properties listed on the National Historic Register, stream relocation, or the pushing of streambed material against a stream bank.

Dam Safety Program: The Dam Safety Section of the Division of Water Rights was established under Chapters 73-5a 101 thru 73-5a 702 including chapters 73-2-22 for Flood Control and the Chapter 63-30-10 Waiver of Immunity of the Utah Code and Rules R655-10 thru R655-12-6A. The program basically has jurisdiction over all private and state owned dams in the state during design, construction, operation, and decommissioning. This involved periodic inspections according to hazard classifications, inventory maintenance, design, and construction approval and systematic upgrade of all the high hazard structures to current dam safety Minimum Standards and creation of Emergency Action Plans for High Hazard dams. Since 1991, detailed dam reviews have been undertaken by the staff and by private consulting firms. Since 1995, the State Legislature has provided 3-4 million dollars per year to finance 50 % of the instrumentation, investigations, and design and 80 to 90 % of the construction costs of retrofitting and upgrading deficient dams, starting with the worst dams in the most hazardous locations.

The impetus for this dam safety program has been in reaction to dam failures, both in Utah and in other states, including the Teton Dam in Idaho and the Trial Lake Dam in Summit County and the Quail Creek Dam near St. George Utah. Since the establishment of our Minimum Standards program we have fostered the repair of dozens of dams and have not had a catastrophic failure since.

Future recommendations include continuation of the funding for dam upgrades for all the high hazard dams, and then the moderate hazard dams, continued annual inspections for maintenance items and dangerous deficiencies, upgrading EAP, and hazard assessment to reflect downstream development. Inclusion of the scanned design drawings and inundation maps from the EAP studies is being considered for our web page for public information and emergency access. Possible expansion of the program to cover canals and dikes has been considered.

Utah Division of Wildlife Resources

It is the mission of the Utah Division of Wildlife Resources to serve people of Utah as trustee and guardian of the State's wildlife. Regulates hunting, fishing and trapping, and promotes recreational, educational, scientific and aesthetic enjoyment of wildlife.

Wildlife Habitats and Hazards: Wildlife species and/or their habitats are frequently exposed to hazards. These may be either natural or human influenced (i.e. drought, flood, fire, wind, snow, wetland drainage, water diversions, hazardous material spills, improper/illegal chemical use, earthquake, and other land or water construction/development). Impact resulting either directly or indirectly, from individuals or an accumulation of several hazards, may cause but not be limited to: decreased water supply, stream/lake channel/basin morphology change, riparian/upland vegetation loss or degradation, and impairment of water quality. These in turn have a varying influence, in the extreme causing death or at a minimum temporary stress, on wildlife populations and their habitats. Hazards mentioned may affect a fairly large geographic area or be very localized in nature.

While the Division of Wildlife Resources (DNR) is charged with the management of wildlife, they do not have regulatory authority over water appropriations, water quality, development, or land management; except as allowed or occurring on properties they own. Therefore, when hazards occur, outside DWR property, DWR is limited to be a participating influence only through comments to the other regulatory agencies or individuals.

DWR management of wildlife is carried out largely through regulation of taking controlling, disturbance and/or possession of wildlife, and introduction of movement of species. However, there are numerous non-regulatory means (i.e. conservation agreements, memorandum of understanding, contract, lease agreements, cooperative agreements, and technical assistance) by which DWR interacts with other agencies, groups and individuals, to have an influence on wildlife and/or their habitat.

Hazard Areas of Commentary Interaction
While not being able to control/regulate many of the elements necessary for the benefit of wildlife; DWR provides technical comments for the maintenance, protection, and enhancement of wildlife and/or habitats for various value reasons. It is too extensive list all the areas of comment; however, the following are examples of fairly frequent concern:
Steam Channel Alteration Permit Applications
Water Rights Filings
Energy and Mineral Exploration and Extraction Applications
Federal Agency land management plans
Waste Water Discharge Permit Applications
Hydroelectric plant licensing or regimenting
Urban and rural development project planning
Utility transmission line style and locations
Wetland alteration
Federal land management planning
Highway constructions

The Utah Division of Drinking Water

Division of Drinking Water's Mission Statement is to " protect the public against waterborne heath risks through assistance, educations, and oversight". The Division acts as the administrative arm of the Utah Drinking Water Board. It implements the rules, which they adopt. As such, it is engaged in a variety of activities related to the design and operation of Utah's public drinking water system. The Utah Drinking Water Board is an 11-person board appointed by the Governor. It is empowered by Title 19, Chapter 4 of the Utah Code to adopt rules governing the design, operations, and maintenance of Utah's "public drinking water system".

Safe Drinking Water Act: There is a Federal Safe Drinking Water Act which applies to all public drinking water systems in the country. The U.S. Environmental Protection Agency (EPA) has given Utah "primacy" for enforcing the federal act within its boundaries. To qualifiy for this Utah's laws and rules governing public drinking water systems must be at least as strict as the federal law.

Sanitary Surveys: The Division performs sanitary surveys on the water systems, which is a compliance action that identifies system deficiencies.

Emergency Response Plans: The Division of Drinking Water requires water utilities to prepare emergency response plans under the State Safe Drinking Water Act, Utah Code Section 19-4. The

Division operates according to DDW Rules: R309 gives them authority to administer actions: R309-301 through R309-104 and R309-113, R309-150, R309-301, and R309-211.

Utah Division of Solid and Hazardous Waste

The Tier II Chemical Inventory report, required by the Federal Emergency Planning and community Right-to-Know Act, requires facilities to submit lists of hazardous chemicals present on site. These reports are computerized and the information is provided to local emergency planning committees, the general public, and others for contingency planning purposes. To implement the Federal law, the State operates under Utah State Code, Section 63-5-5. The Division of Solid and Hazardous Waste requires that hazardous waste treatment storage and disposal facilities prepare and emergency response plan as required by regulations authorized by the State Solid and Hazardous Waste Act, Utah Code Section 19-6.

Other Agency programs are regulatory in nature requiring proper use or disposal of hazardous substances or pollutants. For example the Division of Solid and Hazardous Waste regulates the disposal of hazardous waste, the Division of Radiation Control regulates the proper usage and disposal of radioactive materials. As such there is a threat mitigation nature to these programs.
Utah Division of Water Quality

The Utah Division of Water Quality protects, maintains, and enhances the quality of Utah's surface and underground water for appropriate beneficial uses; the Division of Water Quality regulates discharge of pollutants into surface water, and protects the public health through eliminating and preventing water related health hazards which can occur as a result of improper disposal of human, animal, or industrial wastes while giving reasonable consideration to the economic impact.

Water Quality Fund and Wastewater Treatment Project Fund: The Division Manages the Water Quality Revolving Fund that can be used by local governments for water quality projects and a Wastewater Treatment Project Fund.

Abating Watershed Pollution: Federal and State regulations charge the Division with "preventing, controlling, and abating" watershed pollution. Other state and local agencies have similar responsibilities. The Watershed Approach forms partnerships with these groups to pool resources and increase the effectiveness of existing programs. For each watershed management unit, a watershed plan will be prepared. The watershed plan addresses management actions at several spatial scales ranging from those that encompass a watershed management unit to specific sites that are tailored to specific environmental conditions. Ground water hydrologic basins and eco-region areas encompassed within the units will also be delineated.

State Revolving Fund Program: In 1987, Congress replaced the Construction Grants Program, with the State Revolving Fund Program. Rather than provide direct grants to communities, the federal government provides each state with a series of grants, then each state contributes a 20 percent state match. Grants from the federal government are combined with state funds in the Water Quality Project Assistance Program (WQPAP) and are used to capitalize a perpetual source of funds to finance water quality construction control activities at below market interests rates. Projects eligible for WQPAP financing include such traditional activities as construction of wastewater treatment plants and sewers. The program also will finance non-traditional water quality-related activities such as agricultural runoff control, landfill closures, contaminated industrial property (Brownfield) remediation, stream bank restoration, and wellhead protection.

Annex

Severe Weather History

The following table is a list a damaging severe weather since 1960.

DATE	HAZARD	County	INJURIES	FATALITIES	PROPERTY DAMAGE (Adjusted to 2008)	CROP DAMAGE (Adjusted to 2008)
2/9/1960	Wind	Utah	0	0	21848.02	0
4/22/1960	Wind	Utah	0	0	0	2184.82
6/21/1960	Winter Weather	Summit	0	0	0	15475.64
6/21/1960	Winter Weather	Utah	0	0	0	15475.64
6/21/1960	Winter Weather	Wasatch	0	0	0	15475.64
8/22/1960	Wind	Summit	0	0	14856.63	0
8/22/1960	Wind	Utah	0	0	14856.63	0
8/22/1960	Wind	Wasatch	0	0	14856.63	0
4/22/1961	Wind	Utah	0.41	0	2184.82	0
5/15/1961	Lightning	Summit	0	0	371415.84	0
9/1/1961	Wind	Summit	0	0	3095.16	309.54
9/1/1961	Wind	Utah	0	0	3095.16	309.54
9/1/1961	Wind	Wasatch	0	0	3095.16	309.54
10/21/1961	Wind - Winter Weather	Summit	0	0.06	2184.82	218.47
10/21/1961	Wind - Winter Weather	Utah	0	0.06	2184.82	218.47
10/21/1961	Wind - Winter Weather	Wasatch	0	0.06	2184.82	218.47
1/20/1962	Wind - Winter Weather	Utah	0	0.09	3151.56	0
1/20/1962	Wind - Winter Weather	Wasatch	0	0.09	3151.56	0
4/23/1962	Wind	Summit	0	0	11954.1	0
4/23/1962	Wind	Utah	0	0	11954.1	0
4/23/1962	Wind	Wasatch	0	0	11954.1	0
8/22/1962	Lightning	Utah	0	1	0	0

1/29/1963	Severe Storm/Thunder Storm	Summit	0	0	11555.64	1155.58
1/29/1963	Severe Storm/Thunder Storm	Utah	0	0	11555.64	1155.58
6/6/1963	Severe Storm/Thunder Storm	Wasatch	0	0	34666.85	0
9/9/1963	Lightning	Summit	0	0	17333.43	0
4/3/1964	Wind	Utah	1	0	8666.71	0
4/11/1964	Wind	Utah	0.75	0	8666.71	0
5/1/1964	Winter Weather	Summit	0	0	216.67	0
5/1/1964	Winter Weather	Utah	0	0	216.67	0
5/1/1964	Winter Weather	Wasatch	0	0	216.67	0
6/3/1964	Lightning - Wind	Utah	0.25	0	8666.71	0
10/29/1964	Wind	Utah	0	0	11555.64	1155.58
11/15/1964	Wind	Utah	0.5	0	577780.84	0
12/23/1964	Flooding - Severe Storm/Thunder Storm - Wind	Utah	0.09	0	3151.56	315.12
12/23/1964	Flooding - Severe Storm/Thunder Storm - Wind	Wasatch	0.09	0	3151.56	315.12
6/12/1965	Lightning - Wind	Utah	0.33	0	11555.64	1155.58
7/9/1965	Tornado	Utah	0	0	3466.69	346.67
7/18/1965	Flooding - Severe Storm/Thunder Storm	Utah	0	0	346668.52	3466.69
7/30/1965	Flooding - Severe Storm/Thunder Storm	Utah	0	0	86667.13	866.67
8/14/1965	Lightning	Summit	1	0	0	0
8/21/1965	Flooding - Lightning - Severe Storm/Thunder Storm	Utah	0	0	8666.71	866.67
9/5/1965	Flooding - Hail - Lightning - Severe Storm/Thunder Storm	Utah	0.71	0	23111.21	2311.1
9/5/1965	Flooding - Hail - Lightning - Severe Storm/Thunder Storm	Summit	0.71	0	23111.21	2311.1
9/5/1965	Flooding - Hail - Lightning - Severe Storm/Thunder Storm	Wasatch	0.71	0	23111.21	2311.1
9/16/1965	Winter Weather	Wasatch	0	0	1195.38	119540.87
9/16/1965	Winter Weather	Summit	0	0	1195.38	119540.87
9/16/1965	Winter Weather	Utah	0	0	1195.38	119540.87
4/17/1966	Tornado	Utah	0	0	32499.19	0
3/7/1967	Wind - Winter Weather	Utah	0	0	2708.29	270.85

3/11/1967	Wind	Utah	0	0	406.24	406.24
3/29/1967	Wind - Winter Weather	Summit	0	0	112066.17	3249.92
3/29/1967	Wind - Winter Weather	Utah	0	0	112066.17	3249.92
3/29/1967	Wind - Winter Weather	Wasatch	0	0	112066.17	3249.92
7/3/1967	Lightning - Severe Storm/Thunder Storm - Wind	Utah	0	0	8124.8	812.48
7/16/1967	Flooding - Severe Storm/Thunder Storm	Wasatch	0	0	16249.59	1624.96
6/4/1968	Lightning	Utah	0	0	3058.85	0
7/20/1968	Wind	Utah	0	0	3058.85	3058.85
1/21/1969	Wind	Utah	0	0	2626.24	262.6
1/21/1969	Wind	Wasatch	0	0	2626.24	262.6
6/10/1969	Lightning - Wind	Utah	1.5	0	1444.42	144.44
7/29/1969	Flooding - Lightning - Severe Storm/Thunder Storm	Summit	0	0	7222.09	0
8/2/1969	Lightning - Wind	Utah	0	0	2626.24	262.6
8/2/1969	Lightning - Wind	Wasatch	0	0	2626.24	262.6
8/16/1969	Lightning	Utah	0	0	28888.38	0
12/14/1969	Fog - Winter Weather	Summit	0	0.1	996.13	0
12/14/1969	Fog - Winter Weather	Utah	0	0.1	996.13	0
12/14/1969	Fog - Winter Weather	Wasatch	0	0.1	996.13	0
5/21/1971	Wind	Summit	0	0	896.52	0
5/21/1971	Wind	Utah	0	0	896.52	0
5/21/1971	Wind	Wasatch	0	0	896.52	0
8/28/1971	Flooding - Severe Storm/Thunder Storm	Utah	0	1	32499.61	325
9/30/1971	Winter Weather	Utah	0	0	4333.26	433.31
9/30/1971	Winter Weather	Wasatch	0	0	4333.26	433.31
10/28/1971	Wind - Winter Weather	Summit	0	0	896.52	89.65
10/28/1971	Wind - Winter Weather	Utah	0	0	896.52	89.65
10/28/1971	Wind - Winter Weather	Wasatch	0	0	896.52	89.65
8/1/1972	Lightning	Utah	1.5	0	12999.84	0
12/28/1972	Wind - Winter Weather	Summit	0	0	28888.57	0
12/28/1972	Wind - Winter Weather	Utah	0	0	28888.57	0

12/28/1972	Wind - Winter Weather	Wasatch	0	0	28888.57	0
6/14/1973	Wind	Utah	0	0	24762.28	0
7/12/1973	Lightning - Wind	Utah	0	0	825.43	0
7/12/1973	Lightning - Wind	Wasatch	0	0	825.43	0
7/14/1973	Severe Storm/Thunder Storm	Summit	0	0	24762.28	0
8/17/1973	Lightning - Wind	Utah	0	0	82540.96	0
9/7/1973	Hail - Wind	Utah	0	0	3537.49	0
10/23/1973	Severe Storm/Thunder Storm - Wind	Utah	0	0	3537.49	0
11/12/1973	Wind	Utah	0	0	27513.67	0
5/12/1974	Wind	Utah	0	0	4333.32	0
3/25/1975	Winter Weather	Summit	0	0	71428.56	0
3/25/1975	Winter Weather	Utah	0	0	71428.56	0
3/25/1975	Winter Weather	Wasatch	0	0	71428.56	0
4/25/1975	Wind - Winter Weather	Summit	0	0	10000	0
4/25/1975	Wind - Winter Weather	Utah	0	0	10000	0
4/25/1975	Wind - Winter Weather	Wasatch	0	0	10000	0
5/11/1975	Wind	Utah	0	0	20000	20000
5/19/1975	Winter Weather	Utah	0	0	4000	4000
5/23/1975	Wind	Summit	0	0	20000	0
5/25/1975	Winter Weather	Utah	0	0	0	40000
7/10/1975	Severe Storm/Thunder Storm	Utah	0	0	50000	0
10/7/1975	Wind	Utah	0	0	2000	0
11/28/1975	Winter Weather	Summit	0	0	6896.56	0
11/28/1975	Winter Weather	Utah	0	0	6896.56	0
11/28/1975	Winter Weather	Wasatch	0	0	6896.56	0
12/30/1975	Winter Weather	Summit	0	0	8000	0
12/30/1975	Winter Weather	Wasatch	0	0	8000	0
6/14/1976	Winter Weather	Utah	0	0	0	1481455.13
3/9/1977	Wind	Utah	0	0	35861.57	0
5/11/1978	Winter Weather	Utah	0	0	0	1625012.19

1/1/1979	Winter Weather	Utah	0	0	13506.42	0
1/1/1979	Winter Weather	Wasatch	0	0	13506.42	0
7/1/1981	Lightning	Summit	0	0	40752.06	0
7/1/1981	Lightning	Utah	0	0	40752.06	0
7/1/1981	Lightning	Wasatch	0	0	40752.06	0
9/3/1983	Severe Storm/Thunder Storm	Utah	0	1	1805.54	0
9/3/1983	Severe Storm/Thunder Storm	Wasatch	0	0	1805.54	0
3/30/1984	Wind	Summit	0.2	0	20799.97	0
3/30/1984	Wind	Utah	0.2	0	20799.97	0
5/31/1984	Lightning - Severe Storm/Thunder Storm	Utah	1	1	0	0
4/4/1985	Wind	Wasatch	0	0	25000	0
12/8/1985	Winter Weather	Summit	0	0.14	7.14	0
12/8/1985	Winter Weather	Utah	0	0.14	7.14	0
12/8/1985	Winter Weather	Wasatch	0	0.14	7.14	0
12/10/1985	Wind	Utah	0	0	25000	0
1/6/1987	Winter Weather	Summit	0	0	630.29	0
1/6/1987	Winter Weather	Utah	0	0	630.29	0
1/6/1987	Winter Weather	Wasatch	0	0	630.29	0
3/26/1987	Wind	Utah	0	0	94544.77	0
4/18/1987	Wind	Utah	0	0	13506.4	0
7/18/1987	Wind	Wasatch	2	1	94.54	0
7/21/1987	Hail	Utah	8	0	945447.67	945447.67
12/14/1988	Wind	Utah	0	0	130325.08	0
12/14/1988	Wind	Utah	0	0	130325.08	0
12/25/1988	Severe Storm/Thunder Storm - Winter Weather	Utah	0	0	13032.51	0
3/2/1989	Lightning	Utah	0	0	86667.13	0
4/28/1990	Winter Weather	Summit	0	0	0	5502.63
4/28/1990	Winter Weather	Utah	0	0	0	5502.63
4/28/1990	Winter Weather	Wasatch	0	0	0	5502.63
4/30/1990	Winter Weather	Utah	0	0	0	16507.92

7/1/1990	Lightning	Wasatch	0	1	0	0
12/13/1990	Winter Weather	Summit	0	0	4126.98	0
12/13/1990	Winter Weather	Utah	0	0	4126.98	0
12/13/1990	Winter Weather	Wasatch	0	0	4126.98	0
12/18/1990	Winter Weather	Wasatch	1.55	0.24	28461.92	0
12/18/1990	Winter Weather	Summit	1.55	0.24	28461.92	0
12/18/1990	Winter Weather	Utah	1.55	0.24	28461.92	0
12/20/1990	Wind	Utah	0.4	0	16507.92	0
12/21/1990	Winter Weather	Summit	0.17	0.03	284619.23	28461.92
12/21/1990	Winter Weather	Utah	0.17	0.03	284619.23	28461.92
12/21/1990	Winter Weather	Wasatch	0.17	0.03	284619.23	28461.92
12/29/1990	Winter Weather	Wasatch	0	0	28461.92	2846.2
12/29/1990	Winter Weather	Summit	0	0	28461.92	2846.2
12/29/1990	Winter Weather	Utah	0	0	28461.92	2846.2
1/2/1991	Fog	Summit	1.8	0	7878.73	0
1/2/1991	Fog	Utah	1.8	0	7878.73	0
1/2/1991	Fog	Wasatch	1.8	0	7878.73	0
1/7/1991	Fog - Winter Weather	Utah	0.17	0.17	437.71	0
1/7/1991	Fog - Winter Weather	Summit	0.17	0.17	437.71	0
1/7/1991	Fog - Winter Weather	Wasatch	0.17	0.17	437.71	0
1/15/1991	Winter Weather	Summit	0.27	0	3581.25	0
1/15/1991	Winter Weather	Utah	0.27	0	3581.25	0
1/15/1991	Winter Weather	Wasatch	0.27	0	3581.25	0
4/10/1991	Winter Weather	Summit	0.36	0.07	562.76	0
4/10/1991	Winter Weather	Utah	0.36	0.07	562.76	0
4/10/1991	Winter Weather	Wasatch	0.36	0.07	562.76	0
5/8/1991	Wind	Summit	0	0	9848.41	0
5/8/1991	Wind	Utah	0	0	9848.41	0
5/8/1991	Wind	Wasatch	0	0	9848.41	0
8/2/1991	Lightning	Summit	2	2	0	0

8/4/1991	Hail	Utah	21.5	0	39393.65	0
9/9/1991	Severe Storm/Thunder Storm - Wind	Utah	0	0	78787.31	0
11/20/1991	Winter Weather	Summit	0	0	56.27	0
11/20/1991	Winter Weather	Utah	0	1	56.27	0
11/20/1991	Winter Weather	Wasatch	0	0	56.27	0
1/6/1992	Winter Weather	Summit	0.14	0	546.21	0
1/6/1992	Winter Weather	Utah	0.14	0	546.21	0
1/6/1992	Winter Weather	Wasatch	0.14	0	546.21	0
1/6/1993	Winter Weather	Utah	6	0.33	0	0
2/23/1993	Avalanche - Winter Weather	Summit	0	0.07	0	0
2/23/1993	Avalanche - Winter Weather	Utah	0	0.07	0	0
2/23/1993	Avalanche - Winter Weather	Wasatch	0	0.07	0	0
5/31/1994	Severe Storm/Thunder Storm - Wind	Utah	15	0	7294420.13	0
2/21/1996	Winter Weather	Summit	0	0	13684.2	0
2/21/1996	Winter Weather	Wasatch	0	0	13684.2	0
2/25/1996	Winter Weather	Summit	0.06	0.06	804.96	0
2/25/1996	Winter Weather	Utah	0.06	0.06	804.96	0
2/25/1996	Winter Weather	Wasatch	0.06	0.06	804.96	0
3/5/1996	Winter Weather	Utah	0.2	0	5473.68	0
3/17/1996	Wind	Utah	0	0	5701.75	0
3/28/1996	Wind	Summit	0	0	1789.47	0
3/28/1996	Wind	Wasatch	0	0	1789.47	0
3/28/1996	Wind	Utah	0	0	1789.47	0
7/16/1996	Severe Storm/Thunder Storm - Wind	Utah	1	0	273683.92	0
10/19/1996	Winter Weather	Summit	0	0	31578.91	0
10/19/1996	Winter Weather	Wasatch	0	0	31578.91	0
10/19/1996	Winter Weather	Utah	0	0	31578.91	0
10/24/1996	Winter Weather	Summit	0.83	0	57017.49	0
10/24/1996	Winter Weather	Utah	0.83	0	57017.49	0
10/24/1996	Winter Weather	Wasatch	0.83	0	57017.49	0

11/13/1996	Winter Weather	Utah	0	0	5263.15	0
11/13/1996	Winter Weather	Wasatch	0	0	5263.15	0
11/13/1996	Winter Weather	Summit	0	0	5263.15	0
11/15/1996	Winter Weather	Wasatch	0	0	17105.25	0
11/15/1996	Winter Weather	Summit	0	0	17105.25	0
11/22/1996	Winter Weather	Wasatch	0	0	760.24	0
11/22/1996	Winter Weather	Utah	0	0	760.24	0
11/22/1996	Winter Weather	Summit	0	0	760.24	0
11/28/1996	Winter Weather	Wasatch	0.67	0	11403.49	0
11/28/1996	Winter Weather	Utah	0.67	0	11403.49	0
11/28/1996	Winter Weather	Summit	0.67	0	11403.49	0
12/1/1996	Winter Weather	Wasatch	2.73	0	0	0
12/1/1996	Winter Weather	Utah	2.73	0	0	0
12/1/1996	Winter Weather	Summit	2.73	0	0	0
12/3/1996	Winter Weather	Summit	2.78	0	30.41	0
12/3/1996	Winter Weather	Wasatch	2.78	0	30.41	0
12/5/1996	Winter Weather	Summit	1.33	0	27368.39	0
12/5/1996	Winter Weather	Utah	1.33	0	27368.39	0
12/5/1996	Winter Weather	Wasatch	1.33	0	27368.39	0
12/5/1996	Wind	Utah	0	0	195.49	0
12/16/1996	Wind	Wasatch	0.29	0	6516.28	0
12/16/1996	Wind	Summit	0.29	0	6516.28	0
12/16/1996	Wind	Utah	0.29	0	6516.28	0
12/20/1996	Winter Weather	Summit	0.14	0	3110.05	0
12/20/1996	Winter Weather	Utah	0.14	0	3110.05	0
12/20/1996	Winter Weather	Wasatch	0.14	0	3110.05	0
12/27/1996	Wind	Wasatch	0	0	5701.75	0
12/27/1996	Wind	Summit	0	0	5701.75	0
12/27/1996	Wind	Utah	0	0	5701.75	0
1/2/1997	Winter Weather	Summit	0	0	2666.67	0

1/2/1997	Winter Weather	Wasatch	0	0	2666.67	0
1/11/1997	Winter Weather	Wasatch	1.79	0	1904761.91	0
1/11/1997	Winter Weather	Summit	1.79	0	1904761.91	0
1/11/1997	Winter Weather	Utah	1.79	0	1904761.91	0
1/22/1997	Winter Weather	Wasatch	0.45	0	30.31	0
1/22/1997	Winter Weather	Utah	0.45	0	30.31	0
1/22/1997	Winter Weather	Summit	0.45	0	30.31	0
1/25/1997	Winter Weather	Summit	1.33	1	26666.67	0
1/25/1997	Winter Weather	Utah	1.33	1	26666.67	0
1/25/1997	Winter Weather	Wasatch	1.33	1	26666.67	0
2/2/1997	Winter Weather	Wasatch	0.29	0	3921.57	0
2/2/1997	Winter Weather	Utah	0.29	0	3921.57	0
2/2/1997	Winter Weather	Summit	0.29	0	3921.57	0
2/5/1997	Winter Weather	Wasatch	0.4	0	10666.67	0
2/5/1997	Winter Weather	Summit	0.4	0	10666.67	0
2/5/1997	Winter Weather	Utah	0.4	0	10666.67	0
2/12/1997	Winter Weather	Utah	0.13	0	1777.77	0
2/12/1997	Winter Weather	Summit	0.13	0	1777.77	0
2/12/1997	Winter Weather	Wasatch	0.13	0	1777.77	0
2/17/1997	Winter Weather	Summit	0.15	0	4102.56	0
2/17/1997	Winter Weather	Utah	0.15	0	4102.56	0
2/17/1997	Winter Weather	Wasatch	0.15	0	4102.56	0
2/24/1997	Wind	Summit	0.33	0	637037.04	0
2/26/1997	Winter Weather	Wasatch	0.87	0	28985.51	0
2/26/1997	Winter Weather	Utah	0.87	0	28985.51	0
2/26/1997	Winter Weather	Summit	0.87	0	28985.51	0
3/2/1997	Winter Weather	Wasatch	1.88	0	41666.67	0
3/2/1997	Winter Weather	Summit	1.88	0	41666.67	0
3/2/1997	Winter Weather	Utah	1.88	0	41666.67	0
3/31/1997	Winter Weather	Wasatch	3	0	133333.33	0

3/31/1997	Winter Weather	Utah	3	0	133333.33	0
3/31/1997	Winter Weather	Summit	3	0	133333.33	0
4/2/1997	Wind	Summit	1.82	0	521212.12	0
4/2/1997	Wind	Utah	1.82	0	521212.12	0
4/4/1997	Winter Weather	Utah	0.22	0	7407.41	0
4/4/1997	Winter Weather	Summit	0.22	0	7407.41	0
4/4/1997	Winter Weather	Wasatch	0.22	0	7407.41	0
4/9/1997	Winter Weather	Wasatch	0	0	1111.11	0
4/9/1997	Winter Weather	Summit	0	0	1111.11	0
4/9/1997	Winter Weather	Utah	0	0	1111.11	0
4/12/1997	Severe Storm/Thunder Storm - Wind	Utah	0	0	26666.67	0
4/23/1997	Winter Weather	Wasatch	0	0	2807.01	0
4/23/1997	Winter Weather	Utah	0	0	2807.01	0
4/23/1997	Winter Weather	Summit	0	0	2807.01	0
5/1/1997	Winter Weather	Summit	0	0	3333.33	0
5/1/1997	Winter Weather	Utah	0	0	3333.33	0
5/1/1997	Winter Weather	Wasatch	0	0	3333.33	0
5/25/1997	Winter Weather	Wasatch	0	0	13333.33	0
5/25/1997	Winter Weather	Utah	0	0	13333.33	0
5/25/1997	Winter Weather	Summit	0	0	13333.33	0
6/18/1997	Hail	Utah	0	0	2666.67	0
6/30/1997	Wind	Utah	0	0	7500	0
8/12/1997	Severe Storm/Thunder Storm - Wind	Utah	1	1	0	0
8/20/1997	Severe Storm/Thunder Storm - Wind	Summit	0	1	0	0
9/7/1997	Hail	Utah	0	0	33333.33	0
9/7/1997	Lightning	Utah	0	0	13333.33	0
10/6/1997	Wind	Utah	0	0	20000	0
10/10/1997	Winter Weather	Utah	0.12	0	1066.67	0
10/10/1997	Winter Weather	Summit	0.12	0	1066.67	0
10/10/1997	Winter Weather	Wasatch	0.12	0	1066.67	0

10/23/1997	Winter Weather	Wasatch	0	0	1481.48	0
10/23/1997	Winter Weather	Summit	0	0	1481.48	0
10/23/1997	Winter Weather	Utah	0	0	1481.48	0
11/11/1997	Winter Weather	Summit	0	0	289.85	0
11/11/1997	Winter Weather	Utah	0	0	289.85	0
11/11/1997	Winter Weather	Wasatch	0	0	289.85	0
11/26/1997	Winter Weather	Wasatch	0	0	987.65	0
11/26/1997	Winter Weather	Summit	0	0	987.65	0
11/26/1997	Winter Weather	Utah	0	0	987.65	0
12/1/1997	Winter Weather	Utah	0	0	2666.67	0
12/7/1997	Winter Weather	Utah	0.69	0.03	9195.4	0
12/7/1997	Winter Weather	Summit	0.69	0.03	9195.4	0
12/7/1997	Winter Weather	Wasatch	0.69	0.03	9195.4	0
12/21/1997	Winter Weather	Wasatch	0	0	740.75	0
12/21/1997	Winter Weather	Utah	0	0	740.75	0
12/21/1997	Winter Weather	Summit	0	0	740.75	0
12/23/1997	Winter Weather	Summit	0.08	0	4102.56	0
12/23/1997	Winter Weather	Utah	0.08	0	4102.56	0
12/23/1997	Winter Weather	Wasatch	0.08	0	4102.56	0
12/27/1997	Wind	Utah	0	0	1212.12	0
12/27/1997	Wind	Summit	0	0	1212.12	0
12/27/1997	Wind	Wasatch	0	0	1212.12	0
1/4/1998	Winter Weather	Utah	0.32	0	2078.61	0
1/4/1998	Winter Weather	Wasatch	0.32	0	2078.61	0
1/10/1998	Winter Weather	Summit	0	0	235.08	0
1/10/1998	Winter Weather	Utah	0	0	235.08	0
1/10/1998	Winter Weather	Wasatch	0	0	235.08	0
1/11/1998	Winter Weather	Summit	0.31	0	7088.57	1012.65
1/11/1998	Winter Weather	Utah	0.31	0	7088.57	1012.65
1/11/1998	Winter Weather	Wasatch	0.31	0	7088.57	1012.65

1/15/1998	Winter Weather	Summit	0.72	1	10531.58	1053.16
1/15/1998	Winter Weather	Utah	0.72	0	10531.58	1053.16
1/15/1998	Winter Weather	Wasatch	0.72	0	10531.58	1053.16
1/19/1998	Winter Weather	Summit	0.08	0	1579.74	263.29
1/19/1998	Winter Weather	Utah	0.08	0	1579.74	263.29
1/19/1998	Winter Weather	Wasatch	0.08	0	1579.74	263.29
1/30/1998	Winter Weather	Summit	0	0	822.78	0
1/30/1998	Winter Weather	Wasatch	0	0	822.78	0
1/30/1998	Winter Weather	Utah	0	0	822.78	0
2/3/1998	Wind	Utah	0	0	2256.77	1504.52
2/4/1998	Winter Weather	Summit	0	0	146.27	0
2/4/1998	Winter Weather	Utah	0	0	146.27	0
2/4/1998	Winter Weather	Wasatch	0	0	146.27	0
2/7/1998	Winter Weather	Summit	0.74	0.07	3900.58	975.15
2/7/1998	Winter Weather	Utah	0.74	0.07	3900.58	975.15
2/7/1998	Winter Weather	Wasatch	0.74	0.07	3900.58	975.15
2/11/1998	Winter Weather	Summit	0	0	1645.56	0
2/11/1998	Winter Weather	Utah	0	0	1645.56	0
2/11/1998	Winter Weather	Wasatch	0	0	1645.56	0
2/14/1998	Winter Weather	Utah	0.2	0	2632.9	658.22
2/14/1998	Winter Weather	Wasatch	0.2	0	2632.9	658.22
2/18/1998	Winter Weather	Summit	0	0	299.19	29.92
2/18/1998	Winter Weather	Utah	0	0	299.19	29.92
2/18/1998	Winter Weather	Wasatch	0	0	299.19	29.92
2/21/1998	Winter Weather	Utah	2.67	0	78986.86	17552.63
3/3/1998	Winter Weather	Summit	0	0	548.52	0
3/3/1998	Winter Weather	Utah	0	0	548.52	0
3/3/1998	Winter Weather	Wasatch	0	0	548.52	0
3/5/1998	Winter Weather	Utah	0.53	0	8337.5	438.81
3/14/1998	Avalanche	Wasatch	0.71	0	9403.2	0

3/14/1998	Avalanche	Utah	0.71	0	9403.2	0
3/14/1998	Avalanche	Summit	0.71	0	9403.2	0
3/17/1998	Winter Weather	Wasatch	0	0	1316.45	438.81
3/17/1998	Winter Weather	Utah	0	0	1316.45	438.81
3/17/1998	Winter Weather	Summit	0	0	1316.45	438.81
3/27/1998	Winter Weather	Utah	0.24	0	4212.63	315.95
3/27/1998	Winter Weather	Wasatch	0.24	0	4212.63	315.95
3/27/1998	Winter Weather	Summit	0.24	0	4212.63	315.95
4/7/1998	Winter Weather	Summit	0	0	376.12	94.03
4/7/1998	Winter Weather	Utah	0	0	376.12	94.03
4/7/1998	Winter Weather	Wasatch	0	0	376.12	94.03
4/11/1998	Severe Storm/Thunder Storm - Wind	Utah	0	0	0	43.88
4/12/1998	Winter Weather	Summit	0.11	0	1410.48	141.04
4/12/1998	Winter Weather	Utah	0.11	0	1410.48	141.04
4/12/1998	Winter Weather	Wasatch	0.11	0	1410.48	141.04
4/17/1998	Winter Weather	Summit	0	0	202.54	20.25
4/17/1998	Winter Weather	Utah	0	0	202.54	20.25
4/17/1998	Winter Weather	Wasatch	0	0	202.54	20.25
5/21/1998	Severe Storm/Thunder Storm - Wind	Utah	0	0	1316.45	1316.45
5/21/1998	Hail	Summit	0	0	0	263.29
5/22/1998	Winter Weather	Summit	0	0	0	37.61
5/22/1998	Winter Weather	Utah	0	0	0	37.61
5/22/1998	Winter Weather	Wasatch	0	0	0	37.61
5/26/1998	Wind	Utah	0	0	291	485.01
5/29/1998	Wind	Utah	0	0	157.97	210.63
6/3/1998	Lightning	Utah	0	0	65822.38	0
6/3/1998	Hail - Severe Storm/Thunder Storm - Wind	Utah	0	0	10531.58	6582.24
6/4/1998	Winter Weather	Summit	0	0	0	37.61
6/4/1998	Winter Weather	Utah	0	0	0	37.61
6/4/1998	Winter Weather	Wasatch	0	0	0	37.61

6/7/1998	Severe Storm/Thunder Storm	Utah	0	0	342276.4	13164.48
6/7/1998	Hail	Utah	0	0	0	526.58
6/13/1998	Severe Storm/Thunder Storm	Utah	0	0	36860.54	3949.34
6/16/1998	Winter Weather	Summit	0	0	1950.29	390.06
6/16/1998	Winter Weather	Utah	0	0	1950.29	390.06
6/16/1998	Winter Weather	Wasatch	0	0	1950.29	390.06
7/5/1998	Severe Storm/Thunder Storm - Wind	Utah	0	0	1316.45	1316.45
7/24/1998	Severe Storm/Thunder Storm	Summit	0	0	131644.77	39493.43
7/27/1998	Severe Storm/Thunder Storm	Utah	0	0	26328.95	5265.79
7/30/1998	Severe Storm/Thunder Storm - Wind	Utah	0	0	789.87	2632.9
8/26/1998	Hail	Utah	0	0	394934.31	131644.77
9/12/1998	Hail	Utah	0	0	0	1053.16
10/3/1998	Lightning	Utah	1	0	131644.77	0
10/15/1998	Winter Weather	Summit	0	0	14627.2	0
10/15/1998	Winter Weather	Utah	0	0	14627.2	0
10/15/1998	Winter Weather	Wasatch	0	0	14627.2	0
11/5/1998	Winter Weather	Summit	0	0	9113.87	0
11/5/1998	Winter Weather	Utah	0	0	9113.87	0
11/5/1998	Winter Weather	Wasatch	0	0	9113.87	0
11/8/1998	Winter Weather	Summit	0.38	0	25316.3	0
11/8/1998	Winter Weather	Utah	0.38	0	25316.3	0
11/8/1998	Winter Weather	Wasatch	0.38	0	25316.3	0
11/17/1998	Winter Weather	Summit	0	0	1097.04	0
11/17/1998	Winter Weather	Utah	0	0	1097.04	0
11/17/1998	Winter Weather	Wasatch	0	0	1097.04	0
11/23/1998	Wind	Summit	0	0	5723.69	0
11/23/1998	Wind	Utah	0	0	5723.69	0
11/23/1998	Wind	Wasatch	0	0	5723.69	0
12/4/1998	Winter Weather	Summit	0	0	5485.2	0
12/4/1998	Winter Weather	Utah	0	0	5485.2	0

12/4/1998	Winter Weather	Wasatch	0	0	5485.2	0
12/19/1998	Winter Weather	Summit	0.36	0	4701.6	0
12/19/1998	Winter Weather	Utah	0.36	0	4701.6	0
12/19/1998	Winter Weather	Wasatch	0.36	0	4701.6	0
12/21/1998	Winter Weather	Summit	0	0	907.89	0
12/21/1998	Winter Weather	Utah	0	0	907.89	0
12/21/1998	Winter Weather	Wasatch	0	0	907.89	0
1/21/1999	Winter Weather	Summit	0	0	464.28	0
1/21/1999	Winter Weather	Utah	0	0	464.28	0
1/21/1999	Winter Weather	Wasatch	0	0	464.28	0
1/26/1999	Winter Weather	Summit	0.25	0	4062.5	0
1/26/1999	Winter Weather	Utah	0.25	0	4062.5	0
1/26/1999	Winter Weather	Wasatch	0.25	0	4062.5	0
1/29/1999	Avalanche	Utah	0	1	0	0
2/9/1999	Winter Weather	Summit	0	0	7647.06	0
2/9/1999	Winter Weather	Utah	0	0	7647.06	0
2/9/1999	Winter Weather	Wasatch	0	0	7647.06	0
4/1/1999	Winter Weather	Summit	2.92	0	18416.69	0
4/1/1999	Winter Weather	Utah	2.92	0	18416.69	0
4/1/1999	Winter Weather	Wasatch	2.92	0	18416.69	0
4/8/1999	Winter Weather	Summit	0	0	565.21	0
4/8/1999	Winter Weather	Utah	0	0	565.21	0
4/8/1999	Winter Weather	Wasatch	0	0	565.21	0
12/2/1999	Winter Weather	Summit	0.15	0	20000.03	0
12/2/1999	Winter Weather	Utah	0.15	0	20000.03	0
12/2/1999	Winter Weather	Wasatch	0.15	0	20000.03	0
1/1/2000	Winter Weather	Summit	0.08	0	1002.41	0
1/1/2000	Winter Weather	Wasatch	0.08	0	1002.41	0
1/1/2000	Winter Weather	Utah	0.08	0	1002.41	0
1/4/2000	Winter Weather	Summit	0.42	0	3132.52	0

1/4/2000	Winter Weather	Wasatch	0.42	0	3132.52	0
1/4/2000	Winter Weather	Utah	0.42	0	3132.52	0
1/11/2000	Avalanche	Summit	0	0.4	0	0
1/11/2000	Avalanche	Wasatch	0	0.4	0	0
1/11/2000	Avalanche	Utah	0	0.4	0	0
2/14/2000	Wind	Summit	0	0	5220.87	1044.17
2/14/2000	Wind	Wasatch	0	0	5220.87	1044.17
2/14/2000	Wind	Utah	0	0	5220.87	1044.17
2/25/2000	Avalanche	Summit	0.25	0	0	0
2/27/2000	Avalanche	Summit	0.13	0	0	0
3/20/2000	Wind	Wasatch	0	0	313251.8	21301.12
7/23/2000	Wind	Utah	0	0	1253.01	626.5
11/14/2000	Winter Weather	Summit	0	0	5695.48	0
11/14/2000	Winter Weather	Utah	0	0	5695.48	0
11/14/2000	Winter Weather	Wasatch	0	0	5695.48	0
12/15/2000	Winter Weather	Summit	0.08	0.08	1927.7	0
12/15/2000	Winter Weather	Utah	0.08	0.08	1927.7	0
12/15/2000	Winter Weather	Wasatch	0.08	0.08	1927.7	0
2/27/2001	Avalanche	Wasatch	0	0.2	0	0
2/27/2001	Avalanche	Summit	0	0.2	0	0
2/27/2001	Avalanche	Utah	0	0.2	0	0
3/10/2001	Avalanche	Wasatch	0	0.67	0	0
3/10/2001	Avalanche	Summit	0	0.67	0	0
3/27/2001	Hail - Severe Storm/Thunder Storm - Wind	Wasatch	1	1	1209.31	0
4/7/2001	Winter Weather	Summit	1	0.1	12093.07	0
4/7/2001	Winter Weather	Wasatch	1	0.1	12093.07	0
4/7/2001	Winter Weather	Utah	1	0.1	12093.07	0
4/28/2001	Avalanche	Wasatch	0	0.5	0	0
4/28/2001	Avalanche	Summit	0	0.5	0	0
6/2/2001	Wind	Utah	0	0	0	6046.53

6/12/2001	Wind	Utah	0	0	302326.71	30232.67
7/4/2001	Wind	Utah	0	1	0	0
7/14/2001	Hail	Utah	0	0	2418.61	0
11/22/2001	Winter Weather	Utah	0	0	56434.32	0
11/22/2001	Winter Weather	Summit	0	0	56434.32	0
11/22/2001	Winter Weather	Wasatch	0	0	56434.32	0
11/24/2001	Winter Weather	Wasatch	0.08	0	60465.34	5038.78
11/24/2001	Winter Weather	Utah	0.08	0	60465.34	5038.78
11/24/2001	Winter Weather	Summit	0.08	0	60465.34	5038.78
11/29/2001	Winter Weather	Utah	1	2	14684.44	0
11/29/2001	Winter Weather	Summit	0	0	14684.44	0
11/29/2001	Winter Weather	Wasatch	0	0	14684.44	0
12/2/2001	Winter Weather	Utah	0	0	4651.18	930.24
12/2/2001	Winter Weather	Summit	0	0	4651.18	930.24
12/2/2001	Winter Weather	Wasatch	0	0	4651.18	930.24
1/15/2002	Winter Weather	Wasatch	0	0	20229.85	0
1/15/2002	Winter Weather	Summit	0	0	20229.85	0
1/15/2002	Winter Weather	Utah	0	0	20229.85	0
1/27/2002	Winter Weather	Utah	2.92	0	66206.78	0
1/27/2002	Winter Weather	Summit	2.92	0	66206.78	0
1/27/2002	Winter Weather	Wasatch	2.92	0	66206.78	0
1/31/2002	Avalanche	Wasatch	0	1	0	0
2/3/2002	Fog	Utah	0.75	0.75	149425.01	0
4/15/2002	Wind	Utah	0.42	0	99616.67	4980.84
4/15/2002	Wind	Summit	0.42	0	99616.67	4980.84
4/15/2002	Wind	Wasatch	0.42	0	99616.67	4980.84
5/7/2002	Wind	Utah	0	0	5977	597.7
7/25/2002	Severe Storm/Thunder Storm - Wind	Wasatch	0	0	35862	11954
7/26/2002	Severe Storm/Thunder Storm - Wind	Utah	0	0	59770.01	11954
12/29/2002	Winter Weather	Wasatch	0	0	5692.38	0

12/29/2002	Winter Weather	Utah	0	0	5692.38	0
12/29/2002	Winter Weather	Summit	0	0	5692.38	0
3/26/2003	Severe Storm/Thunder Storm - Wind	Utah	0	0	5842.69	0
6/9/2003	Tornado	Utah	0	0	2337.08	0
6/9/2003	Severe Storm/Thunder Storm - Wind	Utah	0	0	2337.08	0
7/19/2003	Lightning	Summit	3	2	0	0
8/14/2003	Lightning	Summit	2	1	0	0
8/29/2003	Lightning	Utah	1	0	0	0
10/1/2003	Lightning	Wasatch	0	1	0	0
11/13/2003	Wind	Utah	0	0	37977.49	29213.46
11/21/2003	Winter Weather	Wasatch	0	0	58426.91	0
11/21/2003	Winter Weather	Summit	0	0	58426.91	0
11/21/2003	Winter Weather	Utah	0	0	58426.91	0
11/25/2003	Winter Weather	Summit	0	0	25967.51	0
11/25/2003	Winter Weather	Utah	0	0	25967.51	0
11/25/2003	Winter Weather	Wasatch	0	0	25967.51	0
11/27/2003	Fog	Utah	2	1	23370.77	0
12/20/2003	Winter Weather	Summit	0	0.13	26292.11	0
12/25/2003	Winter Weather	Wasatch	0	0	76209.02	0
12/25/2003	Winter Weather	Summit	0	0	76209.02	0
12/25/2003	Winter Weather	Utah	0	0	76209.02	0
12/26/2003	Avalanche	Summit	0	3	0	0
12/28/2003	Winter Weather	Utah	0	0.09	16257.92	0
12/28/2003	Winter Weather	Summit	0	0.09	16257.92	0
12/28/2003	Winter Weather	Wasatch	0	0.09	16257.92	0
1/1/2004	Winter Weather	Utah	0	0	152.38	0
1/1/2004	Winter Weather	Summit	0	0	152.38	0
1/1/2004	Winter Weather	Wasatch	0	0	152.38	0
1/25/2004	Winter Weather	Wasatch	0	0	9523.81	0
1/25/2004	Winter Weather	Utah	0	0	9523.81	0

1/25/2004	Winter Weather	Summit	0	0	9523.81	0
4/20/2004	Winter Weather	Wasatch	0	0	351.65	0
4/20/2004	Winter Weather	Summit	0	0	351.65	0
4/20/2004	Winter Weather	Utah	0	0	351.65	0
4/28/2004	Wind	Summit	0.11	0	952.38	0
4/28/2004	Wind	Utah	0.11	0	952.38	0
4/28/2004	Wind	Wasatch	0.11	0	952.38	0
4/28/2004	Wind	Summit	0	0	444.45	0
4/28/2004	Winter Weather	Summit	0	0	142.86	0
5/10/2004	Wind	Utah	0	0	1942.86	0
5/10/2004	Wind	Summit	0	0	1942.86	0
5/10/2004	Wind	Summit	0	0	95.23	0
5/10/2004	Wind	Wasatch	0	0	95.23	0
8/2/2004	Severe Storm/Thunder Storm - Wind	Utah	0	0	5714.29	0
9/18/2004	Wind	Summit	0	0	888.88	0
11/12/2004	Wind	Summit	0	0	1142.86	0
11/12/2004	Wind	Wasatch	0	0	1142.86	0
11/12/2004	Wind	Utah	0	0	1142.86	0
11/27/2004	Winter Weather	Summit	0.44	0	12800	0
11/27/2004	Winter Weather	Utah	0.44	0	12800	0
11/27/2004	Winter Weather	Wasatch	0.44	0	12800	0
12/10/2004	Avalanche	Utah	0	0.8	0	0
12/10/2004	Avalanche	Wasatch	0	0.8	0	0
12/10/2004	Avalanche	Summit	0	0.8	0	0
1/10/2005	Wind	Utah	0	0	603.47	0
1/10/2005	Wind	Wasatch	0	0	603.47	0
5/5/2005	Severe Storm/Thunder Storm - Wind	Utah	0	0	2212.76	0
1/1/2006	Winter Weather	Utah	0	0.08	0	0
3/25/2006	Wind	Utah	0	0	297.83	0
7/1/2006	Severe Storm/Thunder Storm - Wind	Utah	0	0	6433005.61	0

8/1/2006	Severe Storm/Thunder Storm - Wind	Utah	0	0	4288670.4	0
8/1/2006	Severe Storm/Thunder Storm - Wind	Utah	0	0	3216502.8	0
10/13/2007	Lightning	Summit	2	1	0	0
12/25/2007	Avalanche	Summit	0	0.33	0	0
12/25/2007	Avalanche	Wasatch	0	0.33	0	0
12/31/2007	Avalanche	Summit	0.67	0.33	0	0
12/31/2007	Avalanche	Wasatch	0.67	0.33	0	0

SHELDUS University of South Carolina 2009

State Fire Marshal Data

HAZUS Event Reports

HAZUS-MH: Earthquake Event Report

Region Name: Utah County Earthquake

Earthquake Scenario: UC 7.0 M Earthquake

Print Date: December 17, 2008

Totals only reflect data for those census tracts/blocks included in the user's study region.

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

Table of Contents

General Description of the Region

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

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

Utah

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

The geographical size of the region is 2,138.07 square miles and contains 85 census tracts. There are over 99 thousand households in the region and has a total population of 368,536 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 85 thousand buildings in the region with a total building replacement value (excluding contents) of 17,905 (millions of dollars). Approximately 97.00 % of the buildings (and 73.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 2,997 and 846 (millions of dollars) , respectively.

Building Inventory

HAZUS estimates that there are 85 thousand buildings in the region which have an aggregate total replacement value of 17,905 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 77% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

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

For essential facilities, there are 6 hospitals in the region with a total bed capacity of 1,044 beds. There are 179 schools, 30 fire stations, 18 police stations and 3 emergency operation facilities. With respect to HPL facilities, there are 33 dams identified within the region. Of these, 22 of the dams are classified as 'high hazard'. The inventory also includes 85 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within HAZUS, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 2 and 3.

The total value of the lifeline inventory is over 3,843.00 (millions of dollars). This inventory includes over 560 kilometers of highways, 314 bridges, 13,850 kilometers of pipes.

Table 2: Transportation System Lifeline Inventory

System	Component	# locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	314	379.70
	Segments	107	2,069.10
	Tunnels	2	1.80
		Subtotal	**2,450.60**
Railways	Bridges	3	0.20
	Facilities	1	2.10
	Segments	135	237.60
	Tunnels	0	0.00
		Subtotal	**239.90**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Bus	Facilities	1	1.10
		Subtotal	**1.10**
Ferry	Facilities	0	0.00
		Subtotal	**0.00**
Port	Facilities	0	0.00
		Subtotal	**0.00**
Airport	Facilities	6	32.00
	Runways	9	274.10
		Subtotal	**306.20**
		Total	**2,997.70**

Table 3: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	138.50
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**138.50**
Waste Water	Distribution Lines	NA	83.10
	Facilities	8	522.10
	Pipelines	0	0.00
		Subtotal	**605.20**
Natural Gas	Distribution Lines	NA	55.40
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**55.40**
Oil Systems	Facilities	2	0.20
	Pipelines	0	0.00
		Subtotal	**0.20**
Electrical Power	Facilities	3	323.40
		Subtotal	**323.40**
Communication	Facilities	11	1.10
		Subtotal	**1.10**
		Total	**1,123.80**

Earthquake Scenario

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

Scenario Name	UC 7.0 M Earthquake
Type of Earthquake	User-defined
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	7.00
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

HAZUS estimates that about 22,215 buildings will be at least moderately damaged. This is over 26.00 % of the total number of buildings in the region. There are an estimated 2,960 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS technical manual. Table 4 below summaries the expected damage by general occupancy for the buildings in the region. Table 5 summaries the expected damage by general building type.

Table 4: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	16	0.07	29	0.07	25	0.16	12	0.29	9	0.30
Commercial	167	0.75	395	0.96	606	4.01	320	7.73	249	8.42
Education	14	0.06	27	0.07	31	0.20	17	0.41	15	0.49
Government	9	0.04	25	0.06	39	0.26	21	0.51	17	0.58
Industrial	50	0.22	103	0.25	186	1.23	99	2.39	79	2.65
Other Residential	1,227	5.50	2,685	6.52	1,839	12.16	1,804	43.63	886	29.92
Religion	13	0.06	27	0.07	28	0.19	13	0.32	10	0.33
Single Family	20,816	93.29	37,907	92.01	12,366	81.78	1,848	44.71	1,696	57.30
Total	**22,313**		**41,199**		**15,121**		**4,134**		**2,960**	

Table 5: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Wood	19,348	86.71	37113	90.08	9,108	60.23	129	3.12	16	0.54
Steel	48	0.21	110	0.27	405	2.68	263	6.35	99	3.34
Concrete	60	0.27	213	0.52	302	2.00	147	3.56	125	4.21
Precast	39	0.17	94	0.23	212	1.40	77	1.85	67	2.25
RM	2,789	12.50	3528	8.56	4,038	26.71	1,363	32.98	1,048	35.41
URM	19	0.08	67	0.16	284	1.88	631	15.26	923	31.17
MH	11	0.05	73	0.18	772	5.10	1,524	36.87	683	23.08
Total	**22,313**		**41,199**		**15,121**		**4,134**		**2,960**	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 1,044 hospital beds available for use. On the day of the earthquake, the model estimates that only 88 hospital beds (8.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 55.00% of the beds will be back in service. By 30 days, 91.00% will be operational.

Table 6: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	6	1	0	0
Schools	179	62	33	2
EOCs	3	2	1	0
PoliceStations	18	0	0	1
FireStations	30	5	2	3