Bernalillo County and the City of Albuquerque Hazard Mitigation Plan

May 2007





prepared for:
COA Emergency Services
Bernalillo County
Emergency Services

under contract with:
the City of Albuquerque

prepared by

URS

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Final Report

Bernalillo County / City of Albuquerque Hazard Mitigation Plan

Prepared for

City of Albuquerque Emergency Management

Bernalillo County Emergency Management

Bernalillo County, New Mexico

Prepared by

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May 2007

Appendices

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Note to City of Albuquerque and Bernalillo County Reviewers: Adoption renders validity and authority to the Plan and is required by the Federal Emergency Management Agency (FEMA). Approval by FEMA is required to ensure continued eligibility for certain categories of federal disaster relief and mitigation funding both before and after disaster events. Two model resolutions for adopting the plan are included here, one for Bernalillo County and one for each of the participating municipalities.

RESOLUTION NO. ____

WHEREAS Bernalillo County is vulnerable to natural hazards such as flash floods, wildfire, and drought as well as human-caused hazards that can result in property loss, loss of life, economic hardship, and threats to public health and safety,

WHEREAS a Hazard Mitigation Plan for the Bernalillo County / City of Albuquerque, New Mexico (hereinafter referred to as the "Plan") has been developed by Bernalillo County Emergency Management and the people of the County,

WHEREAS the Plan recommends mitigation activities that will reduce losses to people and property affected by the natural and human-caused hazards that face the County, and

WHEREAS a series of public meetings were held to develop and review the Plan,

NOW THEREFORE BE IT RESOLVED by the Bernalillo County Commissioners that:

The Hazard Mitigation Plan for Bernalillo County / City of Albuquerque, New Mexico, is hereby adopted as an official plan.

The Bernalillo County / City of Albuquerque Mitigation Planning Team or its successor is hereby recognized as the official advisory body for hazard mitigation planning and related activities in the County. The Team members and its Chair shall be appointed by the Chair of the Bernalillo County Commissioners, subject to the approval of the Bernalillo County Commissioners.

The Mitigation Planning Team shall meet as often as necessary, but at least quarterly, to ensure all appropriate activities are targeted toward implementing the Plan. The schedule of meetings shall be posted in appropriate places. All meetings of the Mitigation Planning Team shall be open to the public.

The respective Bernalillo County officials and agencies identified in Section Three of the Plan, Mitigation Plan and Implementation Strategy, are hereby directed to implement the recommended activities assigned to them. By August 31st of each year, the respective Bernalillo County officials and agencies shall report to the Mitigation Planning Team on the progress of their activities.

By September 30th of each year, the Mitigation Planning Team shall prepare an annual evaluation report to the Bernalillo County Commissioners and the governing board of each of the communities within the County that have adopted the plan and participated in its implementation. The report shall include an assessment of progress made toward meeting the goals and objectives and implementing specific actions identified in the Plan. The report shall also include targets for the following year including any appropriate revisions to the Plan.

ADOPTED this the _____ day of _____, 2004

ATTEST:

BOARD OF COUNTY COMMISSIONERS OF BERNALILLO COUNTY

_____
Name, County Clerk

_____
Name, Chair

_____
Name, Vice Chair

_____
Name, Member

APPROVED AS TO FORM:

_____
Name, Member

_____
Name, County Attorney

_____
Name, Member

[CITY OF ALBUQUERQUE (OR OTHER MUNICIPALITIES)
NEW MEXICO
PLAN ADOPTION RESOLUTION

Note to Reviewers: The following draft resolution is recommended for each participating jurisdiction to adopt the Plan.

RESOLUTION NO. ____

WHEREAS [insert community name], Bernalillo County, is vulnerable to natural hazards such as flash floods, wildfire, and drought as well as human-caused hazards that can result in property loss, loss of life, economic hardship, and threats to public health and safety,

WHEREAS a Hazard Mitigation Plan for City of Albuquerque / Bernalillo County, New Mexico (hereinafter referred to as the "Plan") has been developed by Bernalillo County Emergency Management and the people of the County,

WHEREAS the Plan recommends mitigation activities that will reduce losses to people and property affected by the natural and human-caused hazards that face the County, and

WHEREAS a series of public meetings were held to develop and review the Plan,

NOW THEREFORE BE IT RESOLVED by the [insert elected official and/or governing body] of [insert community name] that:

The Hazard Mitigation Plan for Bernalillo County / City of Albuquerque, New Mexico is hereby adopted as an official Plan of [insert community name].

The Bernalillo County / City of Albuquerque Mitigation Planning Team or its successor is hereby recognized as the official advisory body for hazard mitigation planning and related activities in the County.

The [insert appropriate community official and/or agency] is hereby recognized as the official representative for [insert community name] to the Mitigation Planning Team and shall be responsible for coordinating the related actions and programs of [insert community name] accordingly.

By August 31st of each year, the [insert above named community official and/or agency] shall prepare an annual evaluation report first to the [insert elected official and/or governing body] and subsequently to the Mitigation Planning Team, including an assessment of progress made toward meeting the goals and objectives and implementing specific actions identified in the Plan. The report shall include targets for the following year, including recommendations for any appropriate revisions to the Plan.

ADOPTED this the _____ day of _____, 2004

_____

[insert appropriate title] of
[insert community name],
Bernalillo County, New Mexico

ATTESTED and FILED this the _____ day of _____, 2004

_____

[insert appropriate title] of
[insert community name],
Bernalillo County, New Mexico

The plan was formally adopted by the Bernalillo County Commissioners and the City of Albuquerque City Councilors on [**Note**: date of actual approval will be inserted here in the final document] and subsequently by the incorporated communities of [**Note**: list of communities that adopt the document will be inserted here in the final document]:

The City of Albuquerque and the incorporated Villages of Los Ranchos de Albuquerque and Tijeras lie within Bernalillo County, New Mexico. All jurisdictions are threatened by a number of different natural and human-caused hazards. These hazards endanger the health, safety, and welfare of the County's population, jeopardize its economic vitality, and imperil the quality of its environment. To avoid, or minimize vulnerability to these hazards, the New Mexico Office of Emergency Management (NMOEM) and the Federal Emergency Management Agency (FEMA) provided support to Bernalillo County to undertake a hazard mitigation planning process. The resulting *Hazard Mitigation Plan for Bernalillo County / City of Albuquerque, New Mexico* (hereinafter referred to as the "Plan") identifies and profiles the hazards that can affect Bernalillo County, assesses the County's vulnerability to these hazards, and identifies alternative mitigation actions. The Plan also includes an implementation strategy for preferred mitigation actions, as selected and prioritized by a multi-jurisdictional community-based planning team.

Bernalillo County and City of Albuquerque Emergency Managers took the lead in soliciting the participation of both incorporated municipalities, and the unincorporated communities within the County, to form the *Bernalillo County / City of Albuquerque Mitigation Planning Team,* whose goal was to undertake a comprehensive planning process that would culminate in the publication of this document. In addition, because of the diversity of interests in the County and municipalities, the Mitigation Planning Team encouraged citizens to add their voices to the planning process and the decisions that will affect their future. As a result, this document represents the work of citizens, elected and appointed government officials, business leaders, and volunteers of non-profit organizations to develop a plan that will help protect community assets, preserve the economic viability of the community, and save lives.

The following summarizes the results of this effort and is organized according to the major sections of the Plan:

Hazard Identification and Risk Assessment (Section One) – identifies and profiles the natural and human-caused hazards that can affect Bernalillo County as follows:

- ✓ Wildfires
- ✓ Human-caused hazards, including hazardous materials releases, terrorism and nuclear facility accidents
- ✓ Floods, including flash floods
- ✓ Drought
- ✓ Severe weather including winter storms
- ✓ Earthquakes
- ✓ Other hazards, including landslides/land subsidence, dam failure, and volcanoes

These hazards are listed in order of priority as determined by the Mitigation Planning Team. However, severe weather, wildfire, and human-caused hazards are considered to pose significantly higher risk to the residents of Bernalillo County than the others on this list. A brief summary of the relevant issues is provided for these three hazards with more detail regarding the entire list within the Plan.

- ✓ ***Wildfire*** – The forested areas along the Rio Grande (the Bosque) and the East Mountains of Bernalillo County are extremely susceptible to wildfires due to recent drought conditions and years of fire suppression. In addition, the Bark Beetle outbreak in the East Mountains further increases the risk of catastrophic wildfires. The higher than normal accumulation of fuel loads in proximity to residential areas present a significant threat of wildfire to structures located in the wildland-urban interface (WUI) areas. The Plan determines that more than 1000 residential structures, with an aggregate value of $135 million, are vulnerable to the WUI of the Bosque. In the East Mountain WUI, this plan determined that there are over 6,200 residential parcels valued at $625 million.

- ✓ ***Human-caused hazards, including hazardous materials releases*** – Hazardous material releases of toxic chemicals, radioactive materials, or infectious substances can occur wherever hazardous materials are manufactured, stored, transported, or used. Railway freight traffic in Bernalillo County presents the highest potential for some type of hazardous material release. A preliminary study of the hazardous materials traffic through the County identified 22,000 railcars containing hazardous materials flowing through Albuquerque from April 1, 2003 to March 31, 2004. The estimate includes the numbers of railcars containing hazardous materials but does not include the quantity of the transported hazardous material. Increased truck traffic at the intersection of I-25 and I-40 (the Big I) also presents a risk for materials spills.
- ✓ **Floods/Flash Floods** - Bernalillo County has suffered damage from numerous major floods and localized flash flooding repeatedly since 1893. Many minor flash flood events occur each year during New Mexico's summer monsoon season. Two federal declarations for flash flooding have been issued in the past five years. Assets in the 100-year floodplain are estimated to be over $1.3 billion. Floods and flash floods affect all communities within the County, some to a greater extend than others.
- ✓ **Drought** - All of Bernalillo County is currently in a severe drought situation. Given that drought is a slow-moving hazard, without an event to mark its arrival, a one-time drought can be difficult to define. However, the consequences of a moderate-to-severe drought in Bernalillo County pose significant challenges. Long term solutions for coping with a limited water supply will require increased cooperation between urban users and agricultural use. Critical facilities in rural parts of Bernalillo County may need to increase or diversify their sources of water.

Goals, Objectives and Alternative Mitigation Actions (Section Two) – This section of the Plan presents a series of goals and objectives to guide hazard mitigation actions. In addition, this section identifies mitigation actions to address these goals and objectives on a community-by-community basis.

Mitigation Plan and Implementation Strategy (Section Three) – This section of the Plan identifies preferred and prioritized mitigation actions as determined by the Mitigation Planning Team as an overall approach to reducing the County's vulnerability to natural and human-caused hazards. This section recommends specific actions and an implementation strategy, including details about the organizations responsible for carrying out the action, their estimated cost, possible funding sources, and timelines for implementation.

The mitigation projects priority list follows, and summarizes the results of this report. Projects are listed first for all jurisdictions, followed by multiple, but not all jurisdictions, and finally, each jurisdiction has a list of prioritized projects.

All County Jurisdictions	Hazard	Priority	Jurisdiction
Wildland Urban Interface (WUI) Code for entire County.	Wildfire	1	All
Establish alternate hazardous materials routes away from sensitive receptors, critical facilities, schools and population centers.	Human-Caused	2	All
Continue training fire fighters in advanced Wildland fire fighting techniques to respond and control wildfires.	Wildfire	3	All
Establish an All Hazards Citizen's Emergency Response Team (CERT) program and develop county-wide HazMat support.	Human-Caused	4	All
Integrated Wildland Resource Group.	Wildfire	5	All
Develop and support a County-wide response program to HazMat and WMD incidents.	Human-Caused	6	All
Increase number of sirens and radios/televisions with warning capabilities, in public buildings, parks, and recreational areas to announce alerts from the Emergency Alert System and National Weather Radio.	Severe Weather	7	All
Develop and implement a County-wide Winter StormReady Program.	Severe Weather	8	All
Create a State Drought Management Plan Work Group.	Drought	9	All
Create a Wellhead Protection Awareness Program.	Drought	10	All
Create and maintain defensible space around all critical facilities and structures, including housing, administrative, and other structures.	Wildfire	11	All
Further investigations to examine the vulnerability of structures to severe weather and hailstorms.	Severe Weather	12	All
Expand existing projects to use treated effluent for non-potable uses.	Drought	13	All
Create water conservation programs for residential, commercial and industrial users.	Drought	14	All
Increase awareness of potential for earthquakes in Bernalillo County.	Earthquake	15	All
Review and update existing building codes for earthquakes.	Earthquake	16	All

Conduct Technical Assistance Visits to help homeowners implement non-structural earthquake retrofits of their home.	Earthquake	17	All
Map areas vulnerable to landslides and land subsidence and input into GIS.	Landslides/ Land Subsidence	18	All
Anchor slope mesh over areas prone to landslides that threaten infrastructure and critical facilities.	Landslides/ Land Subsidence	19	All
Create a list of special populations (Elderly and Homebound) Welfare Check System.	Extreme Heat	20	All

Multiple Jurisdictions	**Primary Hazard (Secondary Hazard)**	**Priority**	**Jurisdiction**
Implement aggressive program to repair leaks in existing municipal water system, including lines to homes.	Drought	1	City/County/ Los Ranchos
Increase water storage capacity for fire suppression in the Bosque.	Wildfire	2	City/County
Improve access into the Bosque for emergency response.	Wildfire (Multi-Hazard)	3	City/County
Continue thinning and fuel reduction projects in Bosque.	Wildfire	4	City/County
Remove jetty jacks from along the Rio Grande in targeted high-risk areas to aid first responder access to the Bosque during wildfires.	Wildfire	5	City/County/ Los Ranchos
Improve access to identified East Mountain areas for emergency response.	Wildfire (Multi-Hazard)	6	County/Tijeras
Participate in State's program to use bio mass fuels as a way to dispose of tree thinning debris in the Bosque and East Mountain areas.	Wildfire	7	City/County
Study alternate chemical treatment methods at the waste water treatment plant.	Human-Caused	8	City/County
Develop mitigation strategies for known roads and buildings in flood areas in Bernalillo County.	Flood/ Flash Flood	9	City/County

Create a volcano awareness program to educate citizens on the potential dangers of the Albuquerque Volcanic Fields.	Volcano	10	City/County/Albuquerque
Map areas vulnerable to volcanic explosion and assign a high/medium/low risk value.	Volcano	11	City/County/Albuquerque
Create a list of special populations (Elderly and Homebound) Welfare Check System.	Extreme Heat	12	All

Bernalillo County	**Primary Hazard (Secondary Hazard)**	**Priority**	**Jurisdiction**
Wildland Urban Interface (WUI) Code for entire County.	Wildfire	1	City/County
Establish alternate hazardous materials routes away from sensitive receptors, critical facilities, schools, and population centers.	Human-Caused	2	City/County
Increase number of sirens and radios/televisions with warning capabilities, in public buildings, parks, and recreational areas to announce alerts from the Emergency Alert System and National Weather Radio.	Severe Weather	3	City/County

City of Albuquerque	**Primary Hazard (Secondary Hazard)**	**Priority**	**Jurisdiction**
Wildland Urban Interface (WUI) Code for entire County.	Wildfire	1	City of Albuquerque
Study alternate chemical treatment methods at the waste water treatment plant.	Human-Caused	2	City of Albuquerque
Establish alternate hazardous materials routes away from sensitive receptors, critical facilities, schools, and population centers.	Human-Caused	3	City of Albuquerque
Integrated Wildland Resource Group.	Wildfire	4	City of Albuquerque
Update first floor elevation certificates and incorporate them into City of Albuquerque GIS system.	Flood/ Flash Flood	5	City of Albuquerque
Create monitoring system to track land subsidence due to groundwater depletion in the northeast quadrant of the City of Albuquerque.	Landslides/ Land Subsidence	6	City of Albuquerque

Village of Los Ranchos de Albuquerque	Primary Hazard (Secondary Hazard)	Priority	Jurisdiction
Create Firewise Communities through the National Wildland-Urban Interface Fire Program in the Village of Los Ranchos de Albuquerque.	Wildfire	1	Village of Los Ranchos de Albuquerque
Select a village official to participate in the State Drought Management Plan Work Group.	Drought	2	Village of Los Ranchos de Albuquerque
Implement Los Ranchos de Albuquerque Incident Action Plan (IAP).	Wildfire	3	Village of Los Ranchos de Albuquerque

Village of Tijeras	Primary Hazard (Secondary Hazard)	Priority	Jurisdiction
Continue efforts as a Firewise Community through the National Wildland/Urban Interface Fire Program to educate the community in defensible space.	Wildfire	1	Village of Tijeras
Create a program for green waste disposal at transfer stations to encourage tree thinning by facilitating disposal of debris.	Wildfire	2	Village of Tijeras
Purchase 4-wheel drive emergency vehicle to improve access to difficult to reach areas.	Multi-Hazard (Severe Weather)	4	Village of Tijeras
Secure additional sources of water for emergency use.	Wildfire	5	Village of Tijeras
Flood Control Projects: Arroyo Crossing Points.	Flood/Flash Flood	6	Village of Tijeras
Flood Control Projects Stabilization of Arroyos.	Flood/Flash Flood	7	Village of Tijeras
Hire a Floodplain Manager for the Village.	Flood/Flash Flood	8	Village of Tijeras
Participate in State's program to use bio mass fuels as a way to dispose of tree thinning debris in the Village of Tijeras.	Wildfire	9	Village of Tijeras
Install Living Snow Fences along Critical Roadways in the Village of Tijeras.	Winter storm	10	Village of Tijeras

The following individuals and organizations served as members of the Bernalillo County / City of Albuquerque Mitigation Planning Team or made significant contributions to the planning effort and therefore were instrumental to the development of this plan:

Bernalillo County / City of Albuquerque Mitigation Planning Team Members

Larry Abraham, Village of Los Ranchos de Albuquerque Mayor

Dana Anderson, US Forest Service

Dave Bervin, NM State Forestry

Dave Bezy, Village of Tijeras Safety Officer

Ray Chapler, City of Albuquerque Open Space Division

Gloria Chavez, Village of Tijeras Mayor

Bett Clark, Bernalillo County Fire Chief

Kelly Clarke, Village of Los Ranchos de Albuquerque Fire Chief

Patrice Clifford, Bernalillo County Office of Emergency Management

Bill Ewing, NM Department of Public Safety, Office of Emergency Management

Jeremy Hansen, City of Albuquerque Fire Department

Jay Hart, City of Albuquerque Open Space Division

Jim Hunter, City of Albuquerque Office of Emergency Management

Mushtaq Khan, NM Tech

Don Lopez, Village of Los Ranchos de Albuquerque Mayor Pro Tem

Gabriel Marquez, City of Albuquerque Fire Department

Estefanie Muller, Village of Tijeras Clerk

Will Nuañez, Village of Tijeras Fire Chief

Robert Ortega, City of Albuquerque Fire Chief

Liz Saavedra, City of Albuquerque Office of Emergency Management

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Karen Takai, US Forest Service

Stephen Thomas, City of Albuquerque Open Space Division

Terrell Treat, City of Albuquerque Fire Department

Jessica Wilkins, Village of Los Ranchos de Albuquerque Planning and Zoning Coordinator

Joseph Zamora, City of Albuquerque Fire Department

Other Contributors

In addition, funding for the Hazard Mitigation Plan for City of Albuquerque / Bernalillo County, New Mexico, was provided by FEMA through its Region VI offices in Denton, Texas, via a grant to the NMOEM.

Special thanks to Evonne Gantz, Mitigation Specialist, New Mexico Department of Public Safety, Office of Emergency Management (NMOEM).

This section of the ***Bernalillo County / City of Albuquerque Hazard Mitigation Plan*** includes:

- ✓ *Overview* – identifying general background issues for this mitigation planning effort
- ✓ *Mitigation Planning in New Mexico* – providing the specific context for this Plan
- ✓ *Purpose of the Plan* – outlining the benefits to the community
- ✓ *Planning Process* – describing the basic steps in the process
- ✓ *Community Profiles*– identifying relevant characteristics of Bernalillo County and the incorporated municipalities of Albuquerque and the Villages of Tijeras and Los Ranchos de Albuquerque.

OVERVIEW: MITIGATION PLANNING IN NEW MEXICO

Mitigation planning is not a new concept. Bernalillo County has made great strides in reducing potential disasters such as flooding, structure fires, and drought. Both the County and incorporated municipalities have adopted land use regulations and building codes that are effective policies for mitigating hazards. Zoning regulations prevent construction in hazardous areas such as floodplains, and building codes ensure that new buildings are constructed to withstand severe weather and earthquakes. Participation in the National Flood Insurance Program (NFIP) helps identify areas prone to flooding and to reduce potential damage caused by flooding. Many agencies and departments have some responsibility in mitigating hazards but most of the effort is done piecemeal, i.e., there is not a coordinated effort to address hazards in a comprehensive fashion. This plan outlines a strategy for a coordinated effort across jurisdictional and departmental lines.

Comprehensive pre-disaster mitigation planning in New Mexico started after the Cerro Grande Fire in 2000. The fire triggered increasing levels of federal assistance, beginning with an activation of a Federal-State Fire Suppression Assistance Agreement, followed by a Presidential Disaster Declaration, and culminating in an Act of Congress: the Cerro Grande Fire Assistance Act (CGFAA). The CGFAA was established to compensate victims of the Cerro Grande Fire but also provided funding for mitigation efforts in areas impacted by the fire. Neighboring counties of Sandoval and Santa Fe initiated pre-disaster mitigation plans as a result of the Cerro Grande fire.

In 2000, the U.S. Congress also passed the Disaster Mitigation Act (DMA 2000). DMA 2000 encourages local, tribal, and state pre-disaster planning and requires local mitigation plans as a condition of receiving Hazard Mitigation Grant Program project grants. As an incentive to create mitigation plans, the Federal Emergency Management Agency (FEMA) has been funding local and state mitigation planning efforts such as this one. With funding from the New Mexico Office of Emergency Management (NMOEM), the Bernalillo County / City of Albuquerque Mitigation Planning Team, composed of County residents and responsible officials, prepared this *Bernalillo County / City of Albuquerque Hazard Mitigation Plan, New Mexico*. The Plan is the result of months of work to develop a multi-jurisdictional, multi-hazard mitigation plan that will guide the County toward greater disaster resistance in full harmony with the character and needs of the community.

PURPOSE OF THE PLAN

The *Bernalillo County / City of Albuquerque Hazard Mitigation Plan* is intended to serve many purposes. These include the following:

- ✓ *Enhance Public Awareness and Understanding* – to help residents of the County better understand the natural and human-caused hazards that threaten public health, safety, and welfare; economic vitality; and the operational capability of important institutions.
- ✓ *Create a Decision Tool for Management* – to provide information that managers and leaders of local government, business and industry, community associations, and other key institutions and organizations need to take action to address vulnerabilities to future disasters.
- ✓ *Promote Compliance with State and Federal Program Requirements* – to ensure that Bernalillo County and its incorporated communities can take full advantage of state and federal grant programs, policies, and regulations that encourage or mandate that local governments develop comprehensive hazard mitigation plans.
- ✓ *Enhance Local Policies for Hazard Mitigation Capability* – to provide the policy basis for mitigation actions that should be promulgated by participating jurisdictions to create a more disaster-resistant future.
- ✓ *Inter-Jurisdictional Coordination of Mitigation-Related Programming* – to ensure that proposals for mitigation initiatives are reviewed and coordinated among the participating jurisdictions within the County.

PLANNING PROCESS

The approach taken by COA/Bernalillo County relied on sound planning concepts and a methodical process to identify County vulnerabilities, and to propose the mitigation actions necessary to avoid or reduce those vulnerabilities. Each step in the planning process built upon the previous, providing a high level of assurance that the mitigation actions proposed by the participants and the priorities of implementation are valid. Specific steps in the process included:

- ✓ *Project Initiation* – URS, a consulting firm, was selected by the City of Albuquerque and Bernalillo County to assist in creating a hazard mitigation plan. URS worked with Don Scott, the Bernalillo County Emergency Manager, and James Hunter, the City of Albuquerque Emergency Manager to form the City of Albuquerque/Bernalillo County Mitigation Planning Team (the Planning Team). See page xiv for a full list of Planning Team members. The Planning Team solicited public input and drafted this Mitigation Plan. In August 2004, the Planning Team began working on the COA/Bernalillo County Hazard Mitigation Plan (herein after, referred to as the Plan). Public meetings were advertised and held in three representative areas of the County, on September 1st, 2nd, and 8th with representatives from Bernalillo County, the City of Albuquerque, the Village of Tijeras and the Village of Los Ranchos de Albuquerque. The Planning Team developed the content of the Plan using the following step-by-step process to collect information, compile the plan, and review drafts of the plan. The following bullets provide a summary of the process conducted to compile the Plan.

- ✓ *Hazard Identification and Risk Assessment* – The Planning Team identified natural and human-caused hazards that potentially threaten all, or portions of the County. Where possible, specific geographic areas subject to the impacts of the identified hazards were mapped using a Geographic Information System (GIS). The Planning Team considered the

probability of a hazard occurring in an area and its impact on public health and safety, property, the economy, and the environment.

The Planning Team had access to information and resources regarding hazard identification and risk estimation, although the level of detail varied among the participating jurisdictions. Planning team members representing individual jurisdictions provided hazard-specific maps, such as floodplain delineation maps, whenever possible and performed GIS-based analyses of hazard areas and the location of infrastructure, critical facilities, and other properties located within their jurisdictions.

The Planning Team also conducted a methodical, qualitative examination of the vulnerability of important facilities, systems, and neighborhoods to the impacts of future disasters. GIS data were used to identify specific vulnerabilities that could be addressed by specific mitigation actions. The Planning Team also reviewed the history of disasters in the County, and assessed the need for specific mitigation actions based on the type and location of damage caused by past events.

Finally, the assessment of community vulnerabilities included a review of existing codes, plans, policies, programs, and regulations used by local jurisdictions to see if existing provisions and requirements adequately address the hazards that pose the greatest risk to the community. If needed, the participating jurisdictions can now revise existing codes or develop additional codes, plans, or policies that encourage development outside of hazard areas.

- ✓ *Goals, Objectives, and Alternative Mitigation Actions* – Based on this understanding of the problems faced by the County, a series of goals and objectives were identified by the Planning Team to guide subsequent planning activities. In addition, a series of alternative mitigation actions were identified to address these goals and objectives on a community-by-community basis. The Planning Team met on September 16th to accomplish these tasks.

- ✓ *Mitigation Plan and Implementation Strategy* – Finally, the Planning Team met in October 6th to determine the priorities for actions from among the alternatives, and to develop a specific implementation strategy that included details about the organizations responsible for carrying out the action, their estimated cost, possible funding sources, and timelines for implementation.

Three additional areas are important to note regarding the planning process: Community Participation, Public Involvement, and Regulatory Compliance.

- ✓ *Community Participation* – As noted, the incorporated municipalities and sovereign governments of Bernalillo County were contacted to solicit participation in the process. Opportunities were also provided for interested parties and communities to review and comment on the work-in-progress for the Plan. The incorporated municipalities all identified representatives to serve on the Mitigation Planning Team and provided prioritized lists of mitigation actions for their communities. In some cases, these recommendations were incorporated into county-wide efforts.

- ✓ *Public Involvement* – The Planning Team conducted a series of public involvement initiatives to educate stakeholders about their risks, involve them in identifying issues, and educate them about mitigation options available to them. The initiatives included:

- Public Information Meetings to educate citizens, public officials, and business leaders about the hazard mitigation planning process. Topics included hazard mitigation planning and its benefits, steps in the hazard mitigation planning process, and the importance of community input and participation.

  Public information meetings were held in three different, representative locations in the County on September 1, 2, and 8, 2004 (see Appendix C for copies of meeting agendas, attendance lists, and meeting minutes). For each of these meetings, the appropriate neighborhood associations, County Commissioners, City Councilors and neighboring Tribes were contacted and invited to participate in the meetings and draft Plan. These meetings were held at the outset of the planning process to give the public the opportunity for meaningful input.

- Public Response Questionnaires to develop lists of potential mitigation actions by soliciting community input regarding vulnerabilities and potential solutions. Citizens were invited to participate by prioritizing the hazards and suggesting possible solutions, which formed the basis for researching alternatives and developing evaluation criteria for selecting mitigation actions. Questionnaires were distributed at the public meetings (see Appendix D for a copy of the questionnaire).

- Press Releases to announce the availability of the Draft Hazard Mitigation Plan for public review and comment press releases were printed in newspapers as well as posted on the COA and Bernalillo County web sites. The draft plan was made available for two weeks in community centers and libraries in all four jurisdictions. In addition, copies of the draft plan were delivered to Albuquerque Public Schools, Middle Rio Grande Conservancy District, Bernalillo County Planning Department, and other key agencies (see Appendix E for complete list).

- Presentations to the Bernalillo County Commissioners and City of Albuquerque Councilors informing them of the plan, the implementation schedule, and seeking support for adopting the Plan.

- Presentations to the individual jurisdictions to seek approval and adoption of the Plan.

- Monthly newsletters to key stakeholders including, neighboring tribes, key State and Federal agencies, businesses, schools and non-profits.

✓ *Regulatory Compliance* – To qualify for certain forms of federal aid for pre- and post-disaster funding, local jurisdictions must comply with the Federal Disaster Mitigation Act of 2000 (DMA 2000) and its implementing regulations (44 CFR Section 201.6, published February 26, 2002). DMA 2000 intends for hazard mitigation plans to remain relevant and current. Therefore, it requires that State hazard mitigation plans are updated every three years, and that local plans, including Bernalillo County's, be updated every five years. This means that the Bernalillo County / City of Albuquerque Hazard Mitigation Plan uses a five year planning horizon: it is designed to carry the County through the next five years, after which its assumptions, goals, objectives, etc. will be revisited and the plan resubmitted for approval.

The *Bernalillo County / City of Albuquerque Hazard Mitigation Plan* has been prepared to meet FEMA and NMOEM requirements for making the County eligible for funding and technical assistance from State and federal hazard mitigation programs. Appendix A identifies sections of the Plan that address specific requirements in the Interim Final Rule, the regulation implementing DMA 2000.

The following briefly discusses relevant characteristics of Bernalillo County under the categories of Demographics, Physical Features, and Infrastructure. Please see accompanying map of Bernalillo County following this section.

Demographics (Source: U.S. Census 2000)

✓ *Population* – The population of Bernalillo County is 556,678. The City of Albuquerque, with 448,607 residents, is the largest city in the state and accounts for 80% of the total County population. The City of Albuquerque is also the county seat. Neighboring Los Ranchos de Albuquerque has a population of 5,092, and the Village of Tijeras has a population of 474. The remaining 102,505 residents live in unincorporated areas of Bernalillo County. The Bernalillo County Planning Department estimates that 19,229 residents live in the East Mountain Area.

Bernalillo County residents are diverse in their ethnic, cultural, and racial make up. The County's population is compromised of over 40% Hispanics or Latinos, 4% American Indian and Alaska Natives, and 3% African Americans.

The poverty level for people of all ages for the State is over 18% and nearly 14% for both the City and County.

The Median age of Bernalillo County residents is 35 years.

** A metropolitan statistical area (MSA) must have at least one urbanized area of 50,000 or more inhabitants. The Albuquerque MSA includes Bernalillo County, Sandoval County, and Valencia County.*

✓ *Growth Projections* – Bernalillo County has shown dramatic growth in population over the last three decades, with increases in population of nearly 25% from 1970 to 1980, nearly 13% from 1980 to 1990, and almost 16% from 1990 to 2000. The University of New Mexico's Bureau of Business and Economic Research (BBER) estimates population* growth in Bernalillo County from 556,678 in 2000 to 595,954 in 2005 (7% increase), 631,839 by 2010 (6% increase), 698,832 (10% increase) by 2020, and 759,000 by 2030. The total anticipated increase in population within the next 25 years is projected to be nearly 28%.

✓ *Employment* – The Albuquerque metropolitan statistical area (MSA) accounts for nearly half of all the economic activity in New Mexico. In the Albuquerque MSA the combined workforce population is 715,000*. Employment is comprised of 20% Government, 18% Trade, Transportation, and Utilities, 16% Professional and Business Services, 12% Educational and Health Services, and 10% Leisure and Hospitality Services. Table 1 shows the top six employers in the City of Albuquerque MSA.

Table 1: Six Largest Employers in the Albuquerque MSA
Source: Albuquerque Economic Development

Employer	Industry	Number of Employees
Kirtland Air Force Base	337th Air Base Wing	18,508 (Civilian) 5,532 (Military)
University of New Mexico	Higher Education	15,500
Sandia National Laboratories	Federal Government	7,700
Albuquerque Public Schools	Local Government	11,600
City of Albuquerque	Local Government	8,000
Intel	Semiconductor	5,500

Median household income for County residents is $38,788 for individuals, and for a family $46,613. The median household income for Albuquerque is $38,272 for individuals and the median income for a family is $46,979.

- ✓ *Housing* – The number of total households in the County is 220,936 with 183,236 of them located in the City of Albuquerque. The City of Albuquerque Urban Growth Projections (1999-2010) bases housing projections on an analysis of economic and demographic factors, including expected population growth, mortgage interest rates, housing vacancy rates, trends in average household size, and projected housing development in nearby counties. Over the forecast period, single family housing permits are expected to average 3,625 per year and multi-family housing permits are expected to average 1,000 units per year.

Physical Features

- ✓ *Land Area* – Bernalillo County lies in North Central New Mexico and covers approximately 768,000 acres (1,200 square miles). This includes 297,060 acres of federal lands (Bureau of Land Management [BLM], Bureau of Indian Affairs [BIA], Department of Defense, and U.S. Forest Service), 124,160 acres of designated incorporated municipal land, 324,380 acres of non-municipal private land, and 22,400 acres of non-municipal State of New Mexico public land (Wildland Urban Interface Area Inventory Assessment, Bernalillo County, 2002). The City has a total area of 181 square miles.
- ✓ *Topographic Features* – The City of Albuquerque is located at the foothills of the Sandia Mountains with an elevation of 5,280 feet above sea level. The Sandia Mountains highest peak is 10,678 feet. The Sandia Mountains are bordered by the Manzano Mountains to the south of the Tijeras Canyon. The Rio Grande runs north to south through central Bernalillo County, the City of Albuquerque and Village of Los Ranchos de Albuquerque. Tijeras is located on the east side of the Sandia Mountains. See base map at the end of this section.
- ✓ *Geology* - The Albuquerque Basin is in the Rio Grande rift system, a north-south trending structural basin that extends from Southern Colorado to Southern New Mexico, through which the Rio Grande River flows. To the west lies the Llano de Albuquerque, a Quaternary feature that represents the highest level to which the Rio Grande aggraded during the past 500,000 years. Bounding the basin on the east are the uplifted fault blocks of the Sandia and Manzano Mountains (Kelley, 1977).

  Albuquerque Basin deposits consist of up to 3,700 meters (12,140 feet) of Miocene-Pliocene Santa Fe formation, which is typified by unconsolidated, to loosely consolidated fluvial sediments (sandstone, mudstone, and conglomerate) interbedded with volcaniclastic and debris flow deposits. The Santa Fe formation has been divided into lower Zia (or lower gray) member, a unit of quartzose and volcanistic sandstones; the middle red member, consisting of sandstones and mudstones; and the Ceja (or upper buff) member, consisting of sandstones and volcaniclastic material.

  Overlying the Santa Fe Group are 25 to 45 meters (80-190 feet) of Quaternary fan deposits shed from the nearby Sandia and Manzano Mountains and fluvial deposits of the Rio Grande. The fan material is composed of angular material up to several inches in diameter. Fluvial deposits typically consist of clay, silt, sand, and fine gravel (Kelley, 1977).
- ✓ *Hydrology* - The Rio Grande aquifer system is the principal aquifer in a 70,000-square-mile area of southern Colorado, central New Mexico, and western Texas. The aquifer system consists of a network of hydraulically interconnected aquifers in basin-fill deposits located along the Rio Grande Valley and nearby valleys. The aquifer system corresponds to the eastern part of the Southwest alluvial basins aquifer system, as defined by U.S. Geological Survey (USGS) Regional Aquifer-System Analysis studies, and is located in the Southern Rocky Mountains and Basin and Range Physiographic Provinces.

  The Rio Grande is the largest river in the area, and has perennial flow through most of its length in Colorado and New Mexico. South of Santa Fe, the river flows through a series of

broad basins and narrow valleys to the State line in southern New Mexico. Most basins along the Rio Grande have surface drainage to the river and are topographically open basins. Much of the streamflow in the more mountainous northern part of the Rio Grande is derived from snowmelt runoff in the mountains. Streamflow in the southern part of the river system is derived from upstream flow, ground-water discharge, and runoff from summer thunderstorms. Most of the precipitation that falls in the valley is lost to evaporation and transpiration, and little water percolates to a depth sufficient to recharge the aquifer (USGS Ground Water Atlas of the United States). The City of Albuquerque and Bernalillo County depend upon the Middle Grande Basin, also called the Albuquerque Basin.

- ✓ *Hydrogeology* The Rio Grande Rift is the principal geologic feature of the area. The rift affected the configuration of the bounding highlands, which in turn has affected precipitation, runoff, groundwater recharge, source material of the basin fill, aquifer characteristics, and water quality. The rift is a northward-trending series of interconnected, downfaulted, and rotated blocks located between uplifted blocks to the east and west. Various blocks have been displaced downward thousands of feet, and most of the rift has been filled with alluvium and volcanic rocks (basin fill). The thickness of the basin fill is unknown but is estimated to be about 20,000 feet near Albuquerque. Total vertical displacement across some faults that border the rift exceeds 20,000 feet from the crest of the nearby mountains to the top of the equivalent rocks in the rift.

  Virtually all of Bernalillo County residents rely on ground water for drinking water. All of the City of Albuquerque and some of the County residents are served by the Albuquerque Bernalillo County Water Utility Authority. The Authority owns and operates a series of production wells. Most of these wells are located on the east side of the Rio Grande and create a cone of depression in the water table near the wells. Ground water levels have declined with the population growth in the Middle Rio Grande Basin. In the past, the quality and quantity of water underlying the Middle Rio Grande Basin was believed to be virtually limitless, with analogies to Lake Superior in terms of quantity. It is now known that much less water is available for municipal supply than previously believed; at current consumption rates, the high quality water in the aquifer will be depleted within 30 years. As discussed in more detail in Section One, the City has plans to lessen its reliance on groundwater and substitute surface water.

  Agricultural users in Bernalillo County rely primarily on surface water diverted from the Rio Grande via “acequias”, the traditional method for delivering water to farmland adjacent to the Rio Grande. Irrigation-return recharge is an important component of ground-water recharge in areas of extensive irrigated agriculture. Depth to groundwater in the aquifer varies greatly, from less than 2 feet near the Rio Grande, to as much as 1,180 feet in an area west of Albuquerque.

- ✓ *Natural Resources* –Albuquerque's natural environment is a combination of three different geographic features: the Sandia and Manzano Mountains to the east of the city, the Rio Grande and its Bosque (river-side ecosystem) in the valley, and the West Mesa and Petroglyph National Monument to the west. Bernalillo County is unique due the combination of four life zones, and three distinctive geologic regions. The County includes Mountain Uplands, Mountain Lowlands, Alluvial Fans, Volcanic Open Spaces, Sand Plains, Valley Sides and Terraces, and River and Valley Flood Plains. Each ecosystem contains different terrain, climate and air quality, geology, soils, hydrology, vegetation, and wildlife.

- ✓ *Climate* – Albuquerque is located on a semi-arid plateau, resulting in low humidity and warm temperatures. Albuquerque experiences nearly 300 days of sunshine annually. While there are distinctive seasons, the area has a moderate climate with a yearly average of 70°F. Average annual rainfall is 8.7 inches. Snowfall averages nearly 11 inches for the City of

Albuquerque, with much higher annual snowfall in the higher elevations of the Sandia Mountains. The average low temperature in January is approximately 24°F and the average maximum temperature in July is over 92°F.

Figure 1: Rio Grande Bosque

Source: New Mexico Economic Development

Political Jurisdictions

- ✓ ***Bernalillo County*** is located in central New Mexico, and stretches from the Sandia Mountains in the eastern portion of the county, to the high desert grasslands above the Rio Grande Valley on the western edge. The County consists of an area of nearly 1200 square miles and a population of over 556,678. . Bernalillo County is represented by five elected officials and five county commissioners. The Assessor, Clerk, Probate Judge, Sheriff, Treasurer, and commissioners are elected county-wide. A County Manager oversees 25 other departments that range from Animal Regulation to Zoning.
- ✓ ***The City of Albuquerque*** has an ***e***lected mayor and nine city council members. Among the many departments, (the City employs 8,500 people) the city government has an environmental planning commission, and a planning department. The City of Albuquerque was founded in 1706 by the Spanish, and is a city rich in history and tradition. Albuquerque was incorporated in 1891 during the development of railroad infrastructure into New Mexico. In 1926, the federal government officially designated Route 66, which runs through the center of Albuquerque, and the area continued its reputation as a commercial and transportation hub within the Southwest. The area is the commercial and financial center of New Mexico. (http://www.abq.org/)
- ✓ ***Village of Los Ranchos de Albuquerque*** is located in the North Valley of Bernalillo County. The village is semi-rural with just over 4 square miles and a population of approximately 5,100. The governing body consists of a Mayor and Board of Trustees (four) and they serve 4-year terms, the trustee terms are staggered. There are seven Planning and Zoning Commissioners, appointed by the Mayor and approved by the Board of Trustees.
- ✓ The **East Mountain** area encompasses 316 square miles of eastern Bernalillo County. The western and southern portion of the East Mountain Area is primarily under control of the Cibola National Forest. Many unincorporated villages and communities are located in this area, including: Chilili, Juan Tomas, Escobosa, Ponderosa Pine, Cedro, San Antonio, Sandia Park, Cedar Crest, Sedillo, and Carnuel.

- ✓ The **Village of Tijeras** is the only incorporated municipality within the East Mountain Area. The Village of Tijeras has a draft zoning map with accompanying regulations, and a development policy plan. The I-40 corridor splits the area into two subregions. Historic Route 66 traverses the area, and is still emotionally (if not physically) the core roadway for local residents in an east-west direction (East Mountain Area Plan, Bernalillo County 1992).
- ✓ ***Tribal Lands*** - Bernalillo County contains tribal lands for three Pueblos: Isleta Pueblo extends across most of the southern boundary of the county, Sandia Pueblo is on the north side of the county, and Laguna Pueblo has lands on the west side of the County. Sandia, Isleta, and Laguna Pueblos all have major casinos located in Bernalillo County. but virtually no residential population within the County. Tohajiillee, a chapter of the Navaho Nation, has 1,649 residents in the northwestern part of the County. For all three Pueblos, and Tohajiilee, their seats of government are located in adjoining counties.

Infrastructure

- ✓ *Vehicular Transportation Routes* – Bernalillo County and the City of Albuquerque are located at the intersection of Interstate 25 and Interstate 40. I-25 serves north and south travelers, and I-40 serves east and west travelers.
- ✓ *Airports* - Albuquerque's International Sunport serves local, regional, national, and international airlines. The Sunport has over 25 direct flights and 160 daily departures. Albuquerque's International Sunport also has air cargo service with eight air cargo service providers, including Airborne Express, Federal Express, and United Parcel Service. Cutter Aviation adjacent to the Albuquerque International Sunport, and Double Eagle II on the west side of the City, handle general aviation services.
- ✓ *Rail Transportation Routes* – The railroad is the initial reason Albuquerque grew so rapidly at the turn of the 20th century. However, now the majority of the transcontinental east-west cargo passes well south of Albuquerque. The Burlington Northern Santa Fe Railroad serves freight traffic in the Albuquerque metro area. Amtrak also maintains a station in downtown Albuquerque.
- ✓ *Utilities* – Utility providers for Bernalillo County include the Public Service Company of New Mexico (PNM), an investor-owned utility that provides both electricity and natural gas to commercial and industrial customers in the Albuquerque metro area. PNM also offers large gas users the option of purchasing gas from a third party and transporting it over PNM lines. Utility deregulation is scheduled for 2007.
- ✓ *Telecommunication* - Digital technology providers in the area are: Qwest Communications, Time Warner, Telecom, CityNet Telecommunications, Worldcom, and Xspedius. There are also many long distance carriers with T1 capability.
- ✓ *Water Resources* – The water and wastewater utility is jointly operated by the Albuquerque Bernalillo County Water Utility Authority (the Authority). Albuquerque's water currently comes exclusively from an underground aquifer. The City has adopted a plan for water management that includes the use of river water, recycled water, ground water from the shallow aquifer, and water from the deep aquifer to protect the City's water supply. The City also owns 48,200 acre-feet of water from the San Juan-Chama Diversion Project in Northern New Mexico, which will provide water for future development. San Juan-Chama water is now available to be utilized by the City of Albuquerque.
- ✓ *Wastewater* – The Albuquerque Bernalillo County Water Utility Authority is responsible for maintaining Albuquerque's wastewater collection system and wastewater reclamation plant. The Authority serves an area that includes nearly all homes, schools, and businesses within

the Albuquerque city limits, as well as the Village of Tijeras, and some residential areas in Bernalillo County. In all, about 500,000 people, 100 major industries, and 12,000 commercial customers are served.

The sewers carry wastewater to the Southside Water Reclamation Plant. The Southside Plant receives and reclaims about 55 million gallons of wastewater daily. Residential customers produce about 80 %of this wastewater. The Plant recycles about 200 million gallons of water each year, which is used for cleaning and irrigation at the Plant. The Authority is implementing plans to pipe recycled effluent to irrigate major public landscaped areas and public golf courses.

Major area industries participate in programs that monitor, and in some cases pre-treat their wastewater. The Industrial Pretreatment Program (IPP) has recently entered into the Project XL program along with the Environmental Protection Agency (EPA). The Division also operates a Pollution Prevention or "P2" program open to all businesses. The P2 program concentrates on helping small and medium-sized businesses reduce the amount of waste they produce.

Major Institutions and Agencies

There are a number of key agencies and institutions that impact pre-disaster mitigation planning. These agencies can be grouped into two general types:

1. Institutions that have a large physical presence and concentrated population centers. These include the following:
   - Albuquerque Public Schools (APS) has over 86,000 students.
   - University of New Mexico (UNM) has approximately 30,000 students.
   - Central New Mexico Community College (CNM) has over 22,000 students.
   - Sandia National Laboratories (SNL) employs about 7,000 people in Albuquerque. All the facilities are located within the secured perimeter of Kirtland Air Force Base (KAFB). Sandia is a multiprogram lab, primarily doing national defense research and development (R&D), energy, and environment projects. The Labs' original mission of providing engineering design for all non-nuclear components in the nation's nuclear weapons continues today, but Sandia now also performs a wide variety of national security R&D work.
   - KAFB occupies a large area on the south side of Albuquerque and Bernalillo County. KAFB is home to the Air Force Laboratory.
2. Agencies that impact any proposed mitigation efforts and policies. These include the following:
   - Albuquerque Metropolitan Arroyo and Flood Control Authority (AMAFCA). AMAFCA builds and operates major flood control structures in Albuquerque and Bernalillo County. It has a board of directors that are publicly elected and has the authority to issue bonds and collect a portion of property tax in Bernalillo County.
   - Middle Rio Grande Conservancy District (MRGCD). The MRGCD was created to provide flood protection from the Rio Grande, and is responsible for maintaining and operating a network of acequias or conservancy ditches that carry water from the Rio Grande to farmland on either side of the river. MRGCD taxes property that is within the irrigation district along the Rio Grande.

- Mid-Region Council of Governments (MRCOG) provides services to a consortium of local governments. It coordinates infrastructure planning, employment, demographic and housing statistics, and resource management.

These agencies and institutions were invited to participate in the Bernalillo County pre-disaster mitigation planning effort. They were all sent periodic updates to the planning process and invited to public meetings. Some agencies, particularly AMAFCA, contributed information about past events and proposed some mitigation goals and projects.

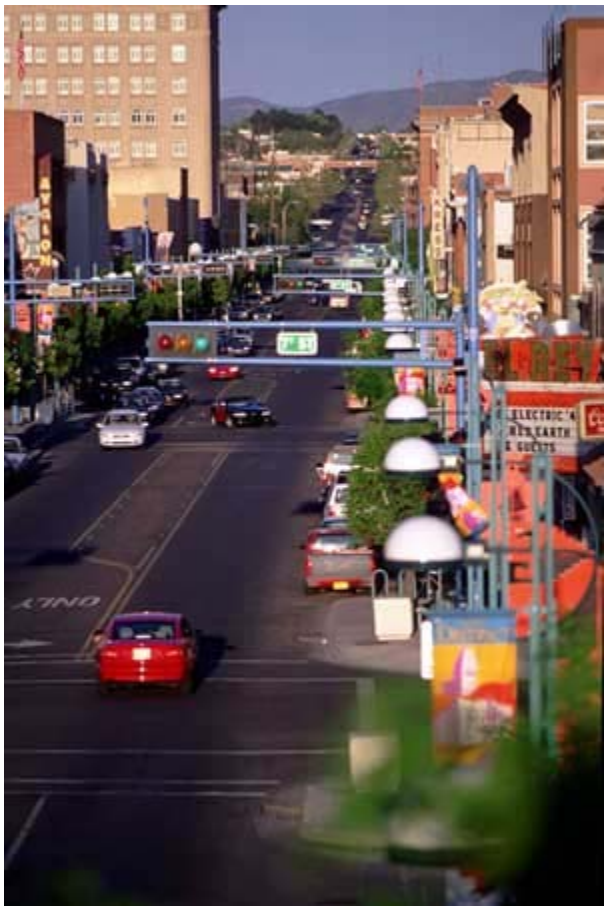
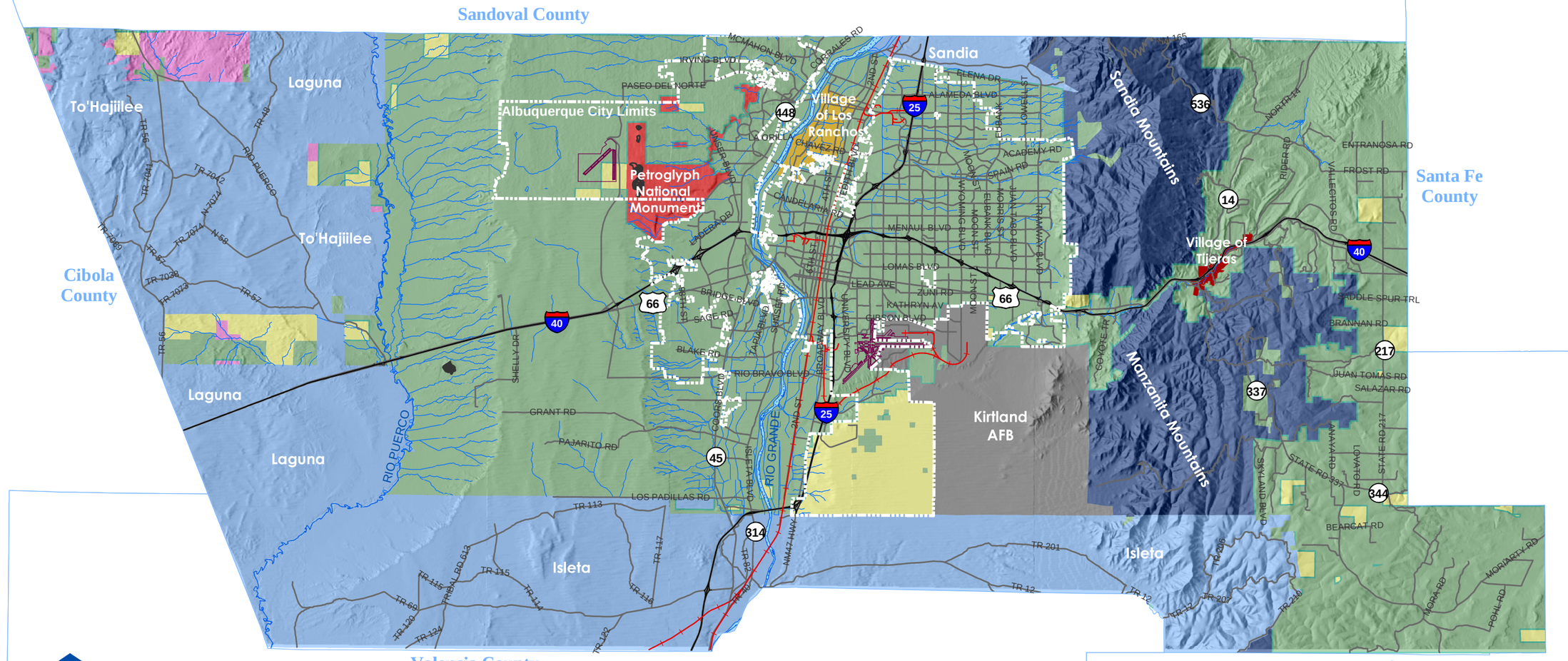


Figure 2: Downtown Albuquerque, NM

Source: Albuquerque Economic Development



1 inch equals 4 miles

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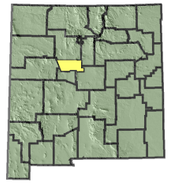


Bernalillo County, New Mexico

Data provided by the Bernalillo County Infrastructure Planning & Geo-Resources Department, the City of Albuquerque Planning Department (AGIS), the City of Albuquerque Information Systems Division and the New Mexico Resource Geographic Information System Program (RGIS).

Bernalillo County Base Map

- Albuquerque City Limits
- Village of Los Ranchos de Albuquerque
- Village of Tijeras
- Interstates
- Major Streets
- Railroad
- Airport
- Rivers
- Arroyos/Channels
- Volcano

Land Ownership

- Bureau of Land Management
- Department of Defense
- US Forest Service
- Tribal Land
- National Park Service
- Private Land
- State Trust Land

OVERVIEW

Section One: Hazard Identification/Risk Assessment summarizes the results of the first fundamental task in the planning process wherein hazards that may affect Bernalillo County are identified, profiled, and their potential effects quantified. It describes previous occurrences, physical characteristics, likelihood of future occurrence, and the potential severity of an occurrence. The steps in the process include:

- ✓ *Hazard Identification* - investigates the existence of certain types of natural and human-caused conditions in and around the County. Hazards that have harmed the County in the past are likely to happen in the future. Consequently, the hazard identification process first included determining whether or not the hazard has occurred previously. In addition, a variety of sources were used to determine the possibility of other hazards within Bernalillo County that may not have occurred in recent history.

- ✓ *Hazard Profiles* - determine the frequency or probability of future events, their severity, and factors that may exacerbate their severity. The Mitigation Planning Team (the Planning Team) and hazard mitigation planners used national maps available online from sources such as the U. S. Geological Survey (USGS), ESRI (a GIS software development firm), and the University of New Mexico to further investigate the possible implications of a range of hazards. The data sets used to generate the assessment were sometimes out of date or lacked sufficient data. In those cases, hazard probabilities and severities identified in this document are discussed in broad terms, reflecting the lack of available detailed information. These data limitations are discussed in the appropriate sections.

- ✓ *Vulnerability Assessment* - uses the information generated in the hazard identification and profiles to identify locations where Bernalillo County residents could suffer the greatest injury or property damage in the event of a disaster. The vulnerability assessment process identified the effects of natural and human-caused hazard events by estimating the relative exposure of people, buildings, and infrastructure to hazardous conditions. The assessment helped the County and its municipalities set mitigation priorities by allowing them to focus attention on areas most likely to be damaged or most likely to require early emergency response during a hazard event. The vulnerabilities identified in this section consist of an inventory of affected structures completed primarily using GIS to overlay the hazard areas with the locations of individual structures, using population data from the 2000 Census.

- ✓ *Risk Assessment* - in hazard events requires a full range of information and accurate data. Several site-specific characteristics—first-floor elevations for flooding, the number of stories, construction type, foundation type, and the age and condition of the structure for multiple hazards—determine a structure's ability to withstand hazards. In Bernalillo County, much of this type of detailed information is not yet available. Projected loss estimates used in this document are based on 2000 U.S. Census data. The percentage of potential damage to structures varies depending upon the specific hazard. For example, drought will have no impact on residential structures, while wildfires typically destroy the entire structure.

HAZARD IDENTIFICATION

Tables 2a and 2b present a description of the hazards that were identified as likely to occur and unlikely to occur, how they were identified, and why they were identified. In 2000, the New Mexico Office of Emergency Management (NMOEM) completed an All Hazards Mitigation Plan

for the State. The NMOEM Plan identified a list of 21 hazards that could be encountered in New Mexico. Using the list as a guide, the Planning Team identified hazards likely to occur in Bernalillo County. As noted, hazard identification involved a combination of input from concerned residents and preliminary research from several state and federal resources.

Table 2a: Summary of Hazard Investigation

Hazard	How Identified	Why Identified
Wildfire	▪ NMOEM 2000 All Hazard Plan List ▪ Residents ▪ Wildlland Urban Interface Area Inventory Assessment	▪ Wildfires in the Bosque in the past two years cost over $14 million.
Human-Caused Hazards, including Hazardous Materials Releases, Nuclear Facility Accidents, and Terrorism	▪ NMOEM 2000 All Hazard Plan List ▪ Review of U.S. Environmental Protection Agency (EPA) website ▪ Emergency Manager's recommendation	▪ Bernalillo County has hundreds of facilities that handle or process hazardous materials. ▪ There have been previous transportation accidents and hazardous materials spills. ▪ The federal and state governments have advised every jurisdiction to consider the terrorism hazard.
Floods, including Flash Floods	▪ NMOEM 2000 All Hazard Plan List ▪ Identification of previous disaster declarations ▪ National Climatic Data Center (NCDC) ▪ Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA)	▪ In the past 10 years flash flood events have caused nearly $1.4 million in property damages. ▪ In April 2004, $3.8 million in damages occurred when a flash flood caused massive sewer line breaks near downtown Albuquerque. Flood waters also deposited 4,500 cubic yards of sand and gravel in the City's wastewater treatment plant, damaging equipment.
Drought	▪ NMOEM 2000 All Hazard Plan List ▪ Residents ▪ New Mexico Department of Natural Resources ▪ NCDC	▪ The County has had droughts in the past. ▪ New Mexico, including Bernalillo County, is in the 6th year of a drought.
Severe Weather, including Tornadoes/Wind Storms, Thunderstorms/ Lightning/Hail, Extreme Heat and Winter Storms/Extreme Cold	▪ NMOEM 2000 All Hazard Plan List ▪ NCDC	▪ Bernalillo County has severe weather including tornadoes, thunderstorms, lightning, and excessive precipitation that caused nearly $500K in property damages over the past 20 years.
Earthquake	▪ NMOEM 2000 All Hazard Plan List USGS seismologic information	▪ Earthquakes have occurred in the State of New Mexico.

Table 2a: Summary of Hazard Investigation

Hazard	How Identified	Why Identified
Other Hazards, including Landslides/Land Subsidence, Dam Failure, and Volcanoes	▪ NMOEM 2000 All Hazard Plan List	▪ Landslides have occurred in the eastern foothills of the Sandia Mountains. ▪ Land Subsidence is not common, but has occurred in Bernalillo County. ▪ The Sandia Pueblo Dam system is located 4 miles north of the City of Albuquerque. The Cochiti Dam is located 50 miles upstream of the City of Albuquerque. ▪ The Albuquerque volcanic fields are located in western Bernalillo County.

Table 2b: Summary of Hazard Investigation

Hazard	How Identified	Why Not Identified
Avalanche	▪ A slope failure composed of a mass of rapidly moving fluidized snow that slides down a mountain.	▪ Snow avalanches only occur in small, localized areas in the United States. ▪ No areas susceptible to snow avalanche are present in Bernalillo County.
Coastal Erosion	▪ A complex process that shapes shorelines by both natural and human-induced factors. The natural factors include sand sources, sand size and density, changes in water level, and the effects of waves, currents, tides, and wind. These factors determine whether a shoreline will recede or accrete.	▪ Bernalillo County is not on a coast and not subject to coastal erosion.
Coastal Storm	▪ Characterized by flooding and high winds. Persistent high wind and changes in air pressure push water toward the shore, causing a storm surge that can raise the level of a large body of water by several feet. Hurricanes and Nor'easters are examples of coastal storms.	▪ Bernalillo County is not on a coast and not subject to coastal storms.
Hurricane	▪ A type of tropical cyclone, the generic term for a low pressure system that generally forms in the tropics. A typical cyclone is accompanied by thunderstorms, and in the Northern Hemisphere, a counterclockwise circulation of winds near the earth's surface.	▪ All Atlantic and Gulf of Mexico coastal areas are subject to hurricanes or tropical storms. ▪ Bernalillo County is not located on either the Atlantic coast or the Gulf of Mexico.
Tsunami	▪ Tsunamis, also known as seismic sea waves, are a series of enormous waves created by an underwater disturbance such as an earthquake, landslide, volcanic eruption, or meteorite.	▪ Bernalillo County is not on a coast and not subject to tsunamis.

HAZARD PROFILES AND VULNERABILITY ASSESSMENT

The remainder of this section presents profiles and vulnerability assessment information for the hazards identified above. The order that these hazards are discussed in the remainder of this report is the order of priority by the majority of jurisdictions (Los Ranchos rates Flood/Flashflood higher than other jurisdictions), as determined by the Mitigation Planning Team. The following table summarizes the comparison of each jurisdiction's vulnerability to each identified hazard, according to the data presented in the remainder of Section One.

Table 3: Multi-Jurisdictional Risk Assessment

Hazard	Bernalillo County	City of Albuquerque	Village of Los Ranchos de Albuquerque	Village of Tijeras
Wildfire	High	High	High	High
Human-Caused Hazards, including Hazardous Materials Releases, Nuclear Facility Accidents, and Terrorism	Medium	Medium	Medium	Medium
Floods/ Flash Floods	Medium	Medium	High	Medium
Drought	High	High	High	High
Severe Weather, including Tornadoes/ Wind Storms, Thunderstorms/Lightning/Hail, Extreme Heat and Winter Storms/Extreme Cold (Note: Severe Weather affects all parts of the county and its jurisdictions.)	Medium	Medium	Medium	High
Earthquake	Low	Low	Low	Low
Other Hazards: Landslides/Land Subsidence	Low	Low	Low	Low
Other Hazards: Dam Failure	Low	Low	Low	Low
Other Hazards: Volcano	Low	Low	Low	Low

High: Extreme probability to hazard, 75% chance of occurrence in any given year
Medium: Average probability to hazard, 50% chance of occurrence in any given year
Low: Small probability to hazard, 25% chance of occurrence in any given year

OVERVIEW – WILDFIRES IN BERNALILLO COUNTY, NEW MEXICO

A wildfire is an uncontrolled fire spreading through vegetative fuels, threatening and possibly consuming structures and other community assets. Wildfires often begin unnoticed and can spread quickly, creating dense smoke that can be seen for miles. A *wildland* fire is a wildfire in an area in which development is essentially nonexistent, except for roads, railroads, power lines, and similar facilities. A *wildland-urban interface* fire is a wildfire in an area where structures and other human development meet, or intermingle, with wildland or vegetative fuels.

During a wildfire, structures will burn, wildlife will die or be injured due to burns or smoke inhalation, and death/injury to humans may occur. Wildfires may also create mudslides and landslides by removing the vegetative covering along slopes and may create floods and flashfloods due to heat damaged soils that can resist water penetration.

PREVIOUS OCCURRENCES – WILDFIRES

The State of New Mexico Energy, Minerals & Natural Resources Department, Forestry Division lists 305 fires in Bernalillo County from August 10, 1993 to August 10, 2004, with over 5,000 acres burned (Table 4). Two wildfires along the Rio Grande in the summer of 2003 cost the State, City, and County almost $14 million, burning nearly 400 acres, and resulting in the temporary closure of Interstate-40.

HAZARD PROFILE – WILDFIRES

Hazard Characteristics

Wildfires can occur at any time of the year, but typically occur during long, dry, hot spells. Any small fire in a wooded area, if not quickly detected and suppressed, can spread out of control. Human carelessness, negligence, and ignorance cause most wildfires. However, some are precipitated by lightning strikes and, in rare instances, spontaneous combustion.

After a fire starts, it can burn as three different types and each fire may be a combination of those types: surface, ground, or crown fires. A surface burn consumes the

Table 4: Wildfires in Bernalillo County: 1993 - 2004

Fire Cause	Number	Acres
Lightning	19	827
Campfire	4	100
Smoking	11	45
Debris Burning	43	1815
Incendiary	16	1684
Equipment Use	14	98
Railroads	1	.5
Children	20	22
Miscellaneous	139	782
Not designated	38	5
Total	305	5,382

Source: NM Energy, Minerals & Natural Resources Department

ground cover and is limited to the surface; a ground fire burns roots and plants beneath the surface in the soil; and the crown fire burns the tops of trees and vegetation (Cohen, 2003).

Potential aftermath of wildfires includes severe erosion and the silting of streambeds and reservoirs, resulting in damage to the watershed and flooding due to a loss of ground cover.

Severity and Probability of Occurrence

Topography, fuel, and weather are the three main factors that influence the behavior of a wildfire. Topography can direct the course of a fire. Depressions, such as canyons, funnel air and act as chimneys, intensifying the fire, causing a faster rate of spread. Saddles on ridge tops draw fires and steep slopes can double the rate of spread, due to the close proximity of fuel (vegetation). The rate of spread is generally stated in chains per hour, feet per minute, or meters per minute.

Fuel type, continuity of fuel, and the moisture content of the fuel all effect wildfire behavior. Continuity of fuel applies both horizontally across the landscape and vertically, from the ground surface up to tree crowns via the understory.

Weather can have a profound influence on wildfires. Wind can direct the course of a fire and increase the rate of spread. High temperatures and low humidity can intensify fire, while low temperatures and high humidity can greatly limit the potential of a fire.

The U.S. Forestry Service has developed a rating system to express the daily potential for wildfires ignition (Table 5).

Table 5: Fire Danger Rating System

Rating	Basic Description	Detailed Description
Low	Fires are not easily started.	▪ Fuels do not ignite readily from small firebrands. ▪ Fires in open cured grassland may burn freely a few hours after rain. ▪ Fires burning in forested areas spread slowly by creeping or smoldering, and burn in irregular fingers ▪ There is little danger of spotting.
Moderate	Fires start easily and spread at a moderate rate.	▪ Fires can start from most accidental causes, but the number of starts is generally low. ▪ Fires in open-cured grassland will burn briskly and spread rapidly on windy days. ▪ Woods fires spread slowly to moderately fast. ▪ The average fire is of moderate intensity, although heavy concentrations of fuel may burn hot. ▪ Short-distance spotting may occur, but is not persistent. ▪ Fires are not likely to become serious, and control is relatively easy.
High	Fires start easily and spread at a fast rate.	▪ All fine dead fuels ignite readily and fires start easily from most causes. ▪ Unattended campfires are likely to escape. ▪ Fires spread rapidly and short-distance spotting is common. ▪ High-intensity burning may develop on slopes, or in concentrations of fine fuel. ▪ Fire may become serious and difficult to control unless they are hit hard and fast while small.
Very High	Fires start very easily and spread at a very fast rate.	▪ Fires start easily from all causes, spread rapidly and intensify quickly. ▪ Spot fires are a constant danger. ▪ Fires burning in heavy fuels may quickly develop high-intensity characteristics, such as long-distance spotting and fire whirlwinds. ▪ Direct attack at the head of such fires is rarely possible after they have been burning more than a few minutes.

Table 5: Fire Danger Rating System		
Rating	**Basic Description**	**Detailed Description**
Extreme	The fire situation is explosive and can result in extensive property damage.	▪ Fires under extreme conditions start quickly, spread furiously, and burn intensely. ▪ All fires are potentially serious. ▪ Development into high-intensity burning will usually be faster and occur from smaller fires than in the very high danger class (item 4). ▪ Direct attack is rarely possible, and may be dangerous, except immediately after ignition. ▪ Fires burning in heavy slash or in conifer stands may be unmanageable while the extreme burning condition lasts. ▪ Under these conditions, the only effective and safe control action is on the flanks until the weather changes or the fuel supply lessens.

Source: http://www.dnr.state.mn.us/forestry/fire/dangerrating.html

Due to the arid climate, recent drought, and degraded timber stands, the probability of catastrophic wildfire occurrence is extremely high in Bernalillo County. Areas especially vulnerable are the western slopes of the Sandia Mountains in the eastern portion of the county (referred to as the East Mountains), and the cottonwood Bosque along the Rio Grande. Wildfires in Bernalillo County can also occur in the grasslands of the western portion of the County, known locally as the West Mesa. In addition, some of the heavily forested areas in the eastern part of the County are located on steep slopes, which aid in the spread of fires and add to the difficulty of fighting a wildfire.

Several factors contribute to the increased risk of catastrophic fires in the Southwest, and Bernalillo County in particular:

Figure 3: Bark Beetle
Source: USFS

- ✓ Increased tree density and decreased grass and forb (broad-leaved herbs that grow in fields, prairies, or meadows) cover.
- ✓ Past forest fire suppression practices and livestock overgrazing that resulted in the unnaturally heavy accumulation of live and dead vegetation and led to "doghair" thickets of ponderosa pine trees in the Sandia Mountains.
- ✓ Fire suppression in the Bosque for many years has resulted in a high fuel load of dry, dead, and dying vegetation.
- ✓ Early logging activity in different regions that creates artificial fuel breaks, alters the local microclimate, and modifies forest composition and age structure (Gilmore, 1998).
- ✓ The Bark Beetle outbreak in Southwest is highly visible in the East Mountains, and greatly increases the risk of wildfire. Populations of several native bark beetle species are increasing dramatically due to several years of extended drought. Many trees are extremely stressed from the drought and are highly susceptible to bark beetle attack. The resulting outbreak has killed millions of ponderosa pine and piñon trees in Arizona and New Mexico. Due to the continued drought and the widespread extent of the bark beetle outbreak, there is little or nothing that can be done on a large scale to prevent the mortality of these trees. Once a stand of piñon trees have been killed as a result of the bark beetle infestation and the trees drop their needles, the intensity of a potential fire is lessened because there is less fuel to burn.

Figure 4: Dead Ponderosa Pine
Source: USFS

- ✓ Drought in the Southwest region of the United States has greatly affected vegetation in Bernalillo County and greatly contributes to the increased risk of wildfire.

Traditional settlement patterns in New Mexico began with concentrated development of homes and farms along the river and within the Bosque. In the past 20 years, development has accelerated in the East Mountains. Wildland-urban interface areas of Bernalillo County, where urban areas meet the natural environment in both the East Mountains and Bosque, contain tree densities that are several times greater than what is considered to be a healthy forest, with thick stands of stunted trees and large accumulations of fuels. The higher than normal tree densities and accumulation of fuels present a significant continued threat of a wildfire to structures located in the wildland-urban interface area.

VULNERABILITY ASSESSMENT – WILDFIRES

Existing Community Assets

The vulnerability assessment portion of this report uses existing studies to estimate potential losses from wildfire. Two areas of concern include the Sandia Mountains and the Bosque corridor along the Rio Grande. Studies utilized in this analysis include the *Wildland-Urban Interface (WUI) Area Inventory Assessment,* the *Bosque Wildfire Risk Assessment Report* and *City of Albuquerque Bosque Wildland Urban Interface Fire Runbook*. The *WUI Area Inventory Assessment* was created by the Bernalillo County Fire Department and the New Mexico State Forestry division and published in 2002. The *Bosque Wildfire Risk Assessment Report* was developed by the Albuquerque Fire Department, Albuquerque Open Space, Albuquerque Public Works Division, and the Bernalillo County Assessors Office and published in 2004. A third consortium of agencies produced the *City of Albuquerque Bosque Wildland Urban Interface Fire Runbook*; a draft version was completed in June 2004.

The *Wildland-Urban Interface Area Inventory Assessment* identified 42 areas of wildland-urban interface within the County. Each area was assessed and rated based on the following conditions:

- ✓ Type and condition of vegetative fuel: classification of hazard class of Low, Medium, or High is based on the National Fire Danger Rating System of 1978
- ✓ Density (population per square mile)
- ✓ Total acres
- ✓ Construction materials used for structures: frame, roof, siding, and decks
- ✓ Quality of defensible space
- ✓ Terrain: slope
- ✓ Access: type, size, material, and condition of roads, bridges, and driveways (gravel or paved, one or two-way, weight carrying capacity and width, slope, locked gates)
- ✓ Water availability: proximity or existence of fire hydrants in the area and alternative water sources available to fire fighters in the absence of fire hydrants
- ✓ Proximity to nearest fire department
- ✓ Potential for increase and special hazards.

Figure 5: Green Firewood Piles Are Often Bark Beetle Breeding Grounds

Source: New Mexico State Forestry

The analysis grouped areas into Extreme, High, or Moderate hazard ratings. In areas where individual ratings were variable within an area, the higher average

hazard rating was assigned. Limited access and water availability were two weighted factors that increased the rating risk.

A map from the WUI Assessment showing locations of the interface areas is included at the end of this section. Copies of the full report are available from the Bernalillo County Fire Department. Of the 179,785 acres identified; 52,480 acres are in Extreme hazard areas, 91,345 acres are rated as High hazard and 35,960 acres are rated Moderate hazard.

Figure 6: WUI and Powerlines in Bosque
Photo: Jeremy Hunter, AFD

The WUI Assessment defines three areas in its analysis: the North Valley, South Valley, and East Mountains. Portions of the North Valley and South Valley are located within the unincorporated areas of Bernalillo County, while other parts are in City of Albuquerque boundaries. The East Mountains region lies east of the City of Albuquerque within the Manzano and Sandia Mountain areas, and includes the Village of Tijeras and unincorporated parts of Bernalillo County. The North Valley includes Los Ranchos de Albuquerque. Table 6 indicates hazard ratings of wildland-urban interface areas for each jurisdiction.

The WUI Assessment Inventory indicates the East Mountains contains the majority of hazardous sites in the WUI (Table 6). Twenty-one sites have been designated with a High hazard rating in this area. The **Village of Tijeras'** High hazard rating is due to narrow winding roads and houses being built in locations that are not easily accessible to emergency operations vehicles. Vegetation fuels in the area are drought stricken or insect infested or diseased. A majority of houses have unprotected wood decks and wood frame type construction. Though there are fire hydrants in the Village, water must be shuttled to locations outside the Village. Access to the area consists of maintained two-lane paved roads, some one-lane gravel, and multiple dead-end roads. Archeological sites, U.S. Forest Service (USFS) land, and wilderness areas bound the area.

The Village of Tijeras also contains two schools and an industrial concrete plant, the Grupo Cemento de Chihuahua (GCC). Infrastructure at-risk includes above-ground high voltage electrical lines and I-40. A large 24-inch diameter natural gas line runs to the GCC.

Table 6: Hazard Rating for WUI Areas

Location	Extreme	High	Moderate	Total
East Mountains (unincorporated Bern. Co.)	1	21	0	22
Village of Tijeras	0	1	0	1
North Valley (unincorporated Bern. Co.)	0	3	5	8
Village of Los Ranchos de Albuquerque	0	0	1	1
South Valley (Unincorporated Bern. Co.)	1	3	6	10
Total	2	28	12	42

Source: Wildland-Urban Interface Area Inventory Assessment, 2002

Sandia Park is located in the East Mountains off North Highway 14. It is one of two Extreme hazard ratings in the Assessment. The area contains 1,000 lots, a total of 1,280 acres, and a density of 2,000 people per square mile. High rating hazard characteristics include slope (20%-60%), no defensible space around structures, limited access, no defensible space around

propane tanks, construction materials, water availability, and fire history. A large amount of fuels in the area are either diseased or insect infested. All homes in the area are wood frame type construction. A majority of houses have unprotected wood decks. Homes are built on ridge tops. There are no fire hydrants in the area. There is only one way in and out of subdivisions, and one subdivision has locked gates. Roads consist of two-lane maintained gravel roads, some one-lane roads, and some private bridges that will not carry the load of a fire fighting equipment.

The North Valley has Low overall ratings, with only three (3) High and five (5) Moderate ratings. The **Village of Los Ranchos de Albuquerque's** hazard rating is Moderate. Fire hydrants are located throughout the area. This area is in close proximity to Bosque and the fuels contained within. A potential source of water for firefighting exists in roadside irrigation ditches and may be available for drafting purposes if needed. Roads are maintained two-lane paved, one-lane paved, or gravel. Several bridges are incapable of carrying weight of firefighting equipment. Narrow winding roads and little defensible space between structures and propane tanks contribute to the hazard rating.

Figure 7: Example of Dead and Non-Native vegetation
Source: USACE

South Valley includes both areas in unincorporated Bernalillo County and the City of Albuquerque. Hazard ratings for the area are six (6) Moderate, three (3) High, and one (1) Extreme – Pajarito Mesa. Potential problems in this area include above-ground electrical lines, propane tanks with no defensible space and narrow winding roads. Agricultural crop fields and dense stands of cottonwoods along the river are located within this area.

Pajarito Mesa is the largest area in the WUI Assessment, at 51,200 acres. This area has the lowest density, with only ten persons per square mile and lowest number of lots, with 30 occupied. Pajarito Mesa's boundaries are Paseo del Vulcan to Isleta Indian Reservation, and Coors to Laguna Indian Reservation. The area is undeveloped, and most of the residents are homesteading. Vegetative fuels in the area consist of grass and sagebrush. Most of the homes in the area are older mobile homes or poorly built wood-frame structures. There are multiple roads in and out of the area, though none of them are marked or maintained. No water is available, except from water tenders, which must travel long distances. Though this area has been assessed as Extreme, the Mitigation Planning Team decided that the small population and low number of structures do not elevate this area to a high priority within this plan.

In addition to the WUI Assessment, the City of Albuquerque has focused efforts to analyze the potential of wildfire in the Bosque. Many years of fire suppression in combination with the current drought dramatically increase the potential of catastrophic fires in the Bosque. The Rio Grande State Park (RGSP) contains 19 miles of Bosque and runs through the center of Albuquerque. The Park's boundaries are the Sandia and Isleta Pueblos to the north and south, and riverside drains to the east and west.

Critical Facilities

There are many Critical Facilities within Bernalillo County that have been identified as vulnerable to wildfire (Tables 7 and 8). Categories of Critical Facilities include infrastructure and public facilities. These facilities have been designated in part by the *Albuquerque Fire Department Wildfire Risk Assessment Report*. Los Ranchos de Albuquerque does not have any identified critical facilities within the wildland-urban interface.

Table 7: Critical Facilities in Bosque WUI (City of Albuquerque/Bernalillo County)

Structure	Estimated Value
Bosque Preparatory School	$10M for building and equipment
Southwestern Indian Polytechnic Institute-SIPI	Structures valued at $46.5M
Hispanic Cultural Center	$55M for building and equipment
Rio Grande Zoological Park, Biological Park, Botanical Garden and Aquarium	$234M structures only Approximately $1.4M for exhibits, but not all exhibits are replaceable
Rio Grande Nature Center	Approximately $4M
Oxbow Geological Site	Cultural Value
Total	$350.9M+

Source: Albuquerque Fire Department Wildfire Risk Assessment Report; Personal communication with Jim Hunter, City of Albuquerque Emergency Manager

Infrastructure: (Jurisdictions are listed in parentheses)

- ✓ I-40 and I-25 cross the Rio Grande and Bosque. The I-40 Bridge is the most commonly used bridge for local east and west travel. During the Bosque fires of 2003, I-40 was temporarily shut down. Other bridges used to pass over the Rio Grande include the Paseo del Norte Bridge, Alameda Boulevard Bridge, Montano Road Bridge, and Barelas Bridge on Bridge Street SW (City of Albuquerque/Bernalillo County).

Table 8: Critical Facilities Located in the East Mountains and Village of Tijeras WUI

Location	Estimated Value
Los Vecinos Community Center	$5M
Vista Grande Community Center	$5M
Village of Tijeras Village Hall	$10M
Public, private, and charter schools	$100M
Village of Tijeras water system and private water cooperatives systems	$10M
PNM electrical sites	$200M
Total	$330M

Source: Albuquerque Fire Department Wildfire Risk Assessment Report; Personal communication with Don Scott, Bernalillo County Emergency Manager

- ✓ Electrical substations, transformers, high voltage transmission lines, and above-ground distribution lines have been identified as at-risk due to wildfire, and are located throughout the County (City of Albuquerque/Bernalillo County/Villages of Los Ranchos de Albuquerque and Tijeras).
- ✓ The City of Albuquerque Bernalillo County Water Utility operates a series of wells, pump stations, and reservoirs that serve over 90% of the County's population (City of Albuquerque/Bernalillo County/Village of Los Ranchos de Albuquerque).
- ✓ A non-potable Water Treatment Plant is located in the northern portion of the county. This facility takes surface water from the Rio Grande and treats it to standards, so that it can be used for irrigating city parks (City of Albuquerque/Bernalillo County/ Village of Los Ranchos de Albuquerque).
- ✓ The Southside Water Reclamation Plant is situated on a 100-acre site and is located in unincorporated area of the County to the south of Albuquerque. It is the largest wastewater treatment facility in New Mexico. The Plant's current capacity is 60 million gallons per day and treats virtually all of the City and County wastewater (City of Albuquerque/Bernalillo County/ Villages of Los Ranchos de Albuquerque).
- ✓ A Wastewater Lift Station is located on Namnaste Road NW; if damaged occurred, it would result in a build-up of wastewater (City of Albuquerque/Bernalillo County/ Villages of Los Ranchos de Albuquerque).
- ✓ Three municipal water pump stations are located in close proximity to the Bosque (City of Albuquerque/Bernalillo County/ Villages of Los Ranchos de Albuquerque).
- ✓ A telecommunications tower is located atop Sandia Mountain peak (Bernalillo County).

Estimating Potential Loss

The wildland-urban interface analyses discussed above show that future wildfires could cause substantial loss of property, along with direct and indirect economic effects for residents and community businesses. According to the WUI Assessment, there are 179,785 acres located in areas vulnerable to fire damages in all areas of the County, but the study did not estimate the value of structures within the study area. For the East Mountain area, this report uses census data and parcel data from the Assessor's Office to estimate the number and value of structures at risk for wildfire. For the Rio Grande Bosque area, the *Bosque Wildfire Risk Assessment Report* and *City of Albuquerque Bosque Wildland Urban Interface Fire Runbook* contain specific information about the value of structures at-risk.

Tables 9 and 10 indicate the number and type of properties adjacent to the Bosque that are in the wildland–urban interface. The total value of residential structures at risk from wildfires in this area is more than $150 million. The total value of critical infrastructure at risk from wildfires in the Bosque can be based upon estimates of potential losses from commercial assets, residential property values, and critical infrastructure. The value of commercial assets and critical facilities is more challenging, as the value is not available or as consistent as it is for residential structural values.

Table 9: Residential Properties Located in the Bosque WUI

Location	Number of Residences	Median Household Value	Total Value of Structures
City of Albuquerque	507	$127,600	$64,693,200
Village of Los Ranchos de Albuquerque	119	$255,500	$30,404,500
Unincorporated Bernalillo County	456	$128,300	$58,504,800
Total	1082		$153,602,500

Source: US Census 2000 and GIS analysis from WUI Assessment 2002

Utilizing GIS data from the Bernalillo County Assessor, the following data was compiled: an overlay of census block data with the identified areas in the East Mountain WUI analysis indicates that 6,200 residential parcels containing structures that have a total value of $611,053,236 are at risk from wildfires. Non-residential structures on 403 parcels are valued at $31,764,018. The total value of all structures in the East Mountains is $642,817,254, with a population of 17,138 persons. In the Village of Tijeras, the population in the WUI area is 481, with 187 residential structures worth $13,949,336 and 26 non-residential structures worth $2,543,000.

Table 10: Commercial Assets* at Risk in Bosque WUI
***** Value of Structure only, Content loss not taken into account

Jurisdiction	Commercial
City of Albuquerque	27
Village of Los Ranchos de Albuquerque	0
Unincorporated Bernalillo County	18
Total	45

Source: Wildfire Mitigation Plan, US Census 2000, Bernalillo County Assessor's Office and GIS/Mapping Department, and AFD

Table 11: Residential and Non-Residential Parcels in East Mountain WUI

	Residential Parcels		Non-Residential Parcels		
Location	**Number**	**Value**	**Number**	**Value**	**Population**
East Mountains (Unincorporated Bernalillo County)	6,200	$611,053,236	403	$31,764,018	17,738
Village of Tijeras	187	$13,949,336	26	$2,543,000	481
Total	6,387	$625,002,572	429	$34,307,018	18,219

Source: Wildfire Mitigation Plan, US Census 2000, Bernalillo County Assessor's Office and GIS/Mapping Department, and AFD

Future Development Trends

Within the Albuquerque Metropolitan Area, growth projections for single-family housing are expected to be concentrated in areas that are outside of the urban-wildland interface. The area averages an annual growth rate of about 6,000 new residential units per year, consisting almost entirely of single-family residential homes. Most of these new homes are being built west of the Rio Grande, on mesa tops that generally have a low danger of wildfires. Areas west of the Rio Grande have accounted for the majority of all single-family housing permits in the last five years, and this trend is expected to continue, as there is still ample developable land. The Southwest Mesa is expected to maintain its 25% share of single-family housing due to available, low cost land and recent improvements to Rio Bravo SW. Another large tract of undeveloped mesa top land, Mesa del Sol, is anticipated to begin development by 2006 and capture a significant portion of new growth (Urban Growth Projections 1999-2010, City of Albuquerque, 2002).

There is relatively little land remaining in the Bosque wildland-urban interface that is suitable for development. Table 12 lists the number of vacant, potentially developable tracts by jurisdiction. There are likely to be constraints to developing many of these tracts as the area is considered built-out and opportunities to create new development are very limited. In addition, the County and the City tax agricultural lands at a much lower rate than land zoned residential to discourage conversion of irrigated, agricultural lands to residential property.

Table 12: Vacant or Non-Developed Parcels Located Adjacent to Bosque

Location	Vacant
City of Albuquerque	293
Village of Los Ranchos de Albuquerque	22
Unincorporated Bernalillo County	170
Total	485

Source: Wildfire Mitigation Plan, Bernalillo County Assessor's Office and GIS/Mapping Department, and AFD

There is great potential for development in the East Mountain area. The East Mountain Area Plan utilized data from the Bernalillo County Assessor's Office and calculated that there are approximately 96,848 acres that have some potential for development. Of this acreage, there are 8,263 platted parcels of five acres or less in size that are still vacant in the East Mountain Area. The supply of developable land in the area is severely constrained by the lack of water availability. Based on past growth trends 289 new housing units per year are expected to be built in the East Mountain area (Bernalillo County Planning Department).

The **Village of Tijeras** is the only incorporated municipality within the East Mountain Area. According to the Village Administrator, there are very few remaining parcels in the Village that have development potential. Environmental considerations, water availability, and wastewater concerns reinforce the low density development pattern and further limit the number of parcels that have potential for development.

The **Village of Los Ranchos de Albuquerque**, according to the 2000 Census, consists of 2,107 housing units, a population density of 1,247 per square mile, and 516.1 housing units per square mile. This information does not include recently annexed properties, which include a large apartment complex and other residential areas that are not adjacent to the Bosque.

In the **City of Albuquerque,** the following sites are being completed in or near the WUI:

- ✓ Tingley Beach Recreation Center, valued at 7 million dollars. This restoration site along the Bosque will be an educational site and example of the past park-like conditions of the Bosque.

- ✓ Montaño Weather Site and weather station near I-40 are both valued at $100,000. These weather stations are being completed to enable scientists, emergency management, and firefighters to prepare for wildfires, depending on weather conditions in the Bosque.
- ✓ Silvery Minnow Hatchery, estimated value of $700,000. Note: these fish are also endangered species and their potential loss cannot be measured in dollars.

Table 13: Bernalillo County Population Projections 2000-2025 (Unincorporated Areas Only)

Jurisdiction	2000 Census	2010 Projection	2025 Projection
North Valley	13,593	13,832	14,278
South Valley	53,002	59,323	76,000
East Mountain Area	16,582	18,578	22,269
North Albuquerque Acres	8,526	9,582	11,887
Total	91,703	1,001,315	124,434

Source: U.S. Census, MRCOG Planned Growth Strategy

CONCLUSIONS – WILDFIRES

Summary of Hazard Identification and Vulnerability Assessment

The two major fires in the Rio Grande Bosque in 2003 demonstrated that wildfires are a significant threat to the citizens, structures, infrastructure, and natural resources within the County. In the Bosque WUI, there are over 1,500 residential structures with a total value of over 150 million dollars. The East Mountain area and the Village of Tijeras also face a threat from wildfires. The County has identified 22 areas in the East Mountains and one area in the Village of Tijeras that have a High or Extremely High rating for potential wildfires. As a result, the Mitigation Planning Team has identified the wildfire hazard as the number one priority in the Plan.

What Can Be Mitigated?

Mitigation options for wildland fire need to address not only the management of fuels, but also the potential for population growth in wildfire threat areas. Traditional wildfire prevention strategies focused on fire suppression. Rather than trying to stop all wildfires, mitigation measures, such as reducing fuel loads and creating defensible spaces, aim to reduce the damage caused by wildfires. More specific mitigation goals and actions are detailed in Sections Two and Three of this document.

A multitude of jurisdictions work within the Bosque: the Bureau of Reclamation, US Army Corps of Engineers (USACE), State of New Mexico, Bernalillo County, City of Albuquerque, and the Middle Rio Grande Conservancy District (MRGCD). The RGSP is managed by the City of Albuquerque. The MRGCD maintains systems of ditches and canals for irrigation and agriculture. Current restoration projects are collaborations between these and additional agencies.

The City of Albuquerque has identified and prioritized 63 sectors along the Rio Grande for fuel reduction, non-native vegetation thinning, Jetty Jack removal, debris removal, burn restoration, re-vegetation, and herbicide treatment to reduce the occurrence of wildfire. To date, many acres of fuel have been reconfigured; ladder fuels have been knocked down, but have not been removed and remain a threat. The USACE is leading many of the projects in the area, including Tingley Wetlands and Rio Grande Nature Center restoration. Restoration projects must weigh the Endangered Species Act and Migratory Bird Treaty Act, and determine the potential for disrupting habitat and species and "intentional take" against the benefits associated with reducing the wildfire risk.

One identified priority is to remove the Jetty Jacks that were built along the shores of the Rio Grande River to contain debris flows during times of flooding. These Jetty Jacks present a hazard to fire fighters and severely limit access to critical parts of the Bosque. Another priority is to coordinate with other agencies to increase access through locked gates, allowing access for City and County Fire Department personnel. Additional access routes for emergency equipment and personnel will be added, and existing access routes in need of improvement will be completed.

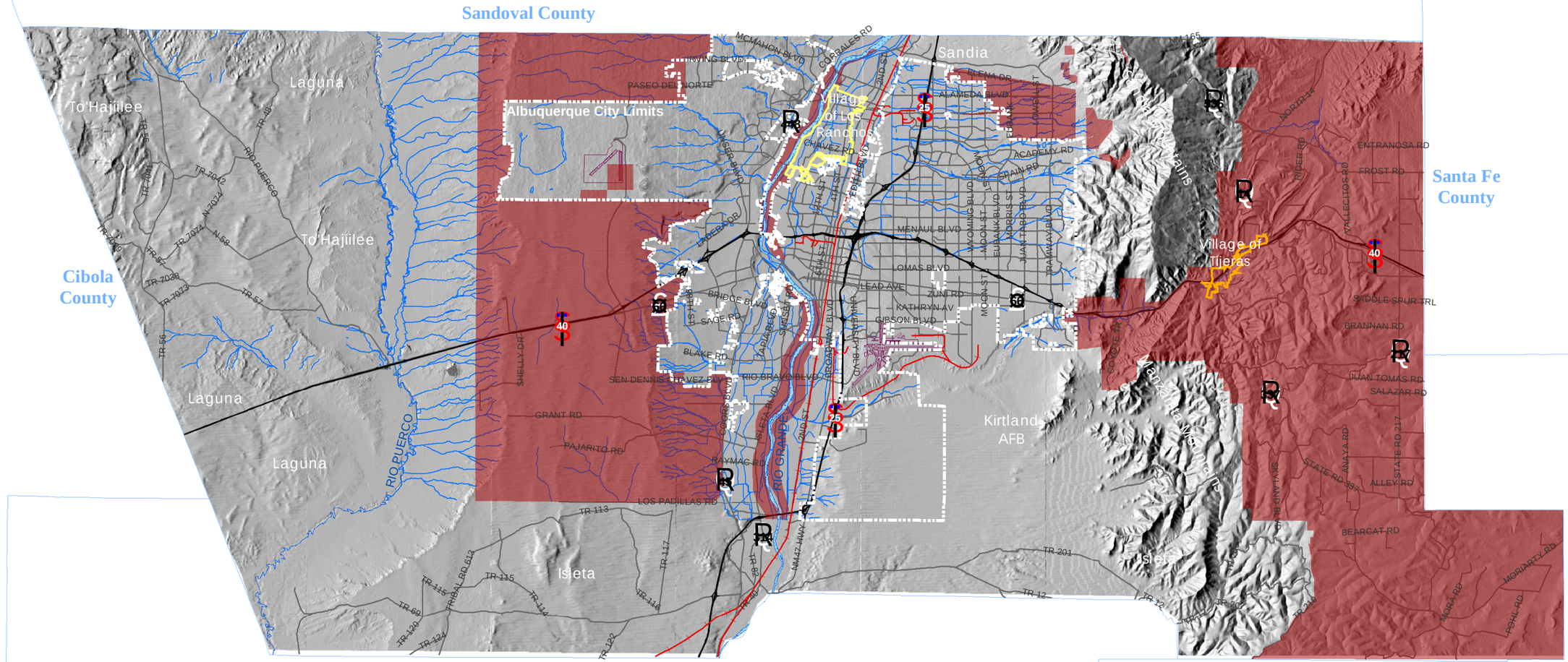
Many thinning efforts in the East Mountain area are ongoing and are funded by the USFS, including prescribed burns and clearing in areas bordering the WUI.

The Village of Tijeras has thinning and debris clean-up initiatives five times a year for residents to thin and clear their own land, bringing slash to the Village for disposal and transport to the transfer station. A Siberian Elm clearing project was recently completed by the Village to create defensible space for the Village Hall.

Figure 8: Rio Grande Valley State Park

Data Limitations

The *Wildland-Urban Interface Area Inventory Assessment* identified the number of parcels at-risk for wildfires in the East Mountain area but did not specify the number of built structures at-risk. More precise loss estimates can be generated from identification of actual structures within the WUI.



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1 inch equals 4 miles

0 2 4 8 12 Miles

Bernalillo County, New Mexico

Data provided by the Bernalillo County Infrastructure Planning & Geo-Resources Department, the City of Albuquerque Planning Department (AGIS), the City of Albuquerque Information Systems Division and the New Mexico Resource Geographic Information System Program (RGIS).

Bernalillo County Wildland Urban Interface Map

- Wildland Urban Interface
- Albuquerque City Limits
- Village of Los Ranchos de Albuquerque
- Village of Tijeras
- Airport
- Railroad
- Interstates
- Major Streets
- Volcano
- Arroyos/Channels
- Rivers

OVERVIEW – HUMAN-CAUSED HAZARDS IN BERNALILLO COUNTY, NEW MEXICO

Human-caused hazards include technological hazards (e.g., hazardous material releases) and terrorism. Both of these are distinct from natural hazards in that they result directly from the actions of people. The term *technological hazard* refers to incidents that can arise from human activities such as the manufacturing, storage, transportation, and use of hazardous materials. Technological hazards are assumed to be accidental and their consequences unintended. The term *terrorism* encompasses intentional, criminal, and malicious acts involving weapons of mass destruction (WMDs). WMDs include biological, chemical, nuclear, and radiological weapons; arson, incendiary, explosive, and armed attacks; industrial sabotage and intentional hazardous material releases; and cyber-terrorism (attacks via computer). Technological and terrorism hazards are interrelated in that facilities that handle hazardous materials or hazardous materials in transit may be potential terrorist targets.

The focus of this section addresses three types of human-caused hazards that are relevant to Bernalillo County: hazardous material releases, terrorism, and nuclear/radiological accidents.

OVERVIEW – HAZARDOUS MATERIAL RELEASES

Hazardous materials can include toxic chemicals, radioactive materials, infectious substances, and hazardous wastes. An accidental hazardous material release can occur wherever hazardous materials are manufactured, stored, transported, or used. Such releases can affect the nearby population and contaminate critical or sensitive environmental areas.

Facilities that use, manufacture, or store hazardous materials in New Mexico must comply with Title III of the Federal Superfund Amendments and Reauthorization Act (SARA), also known as the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA)[1], and the State's reporting requirements under the Hazardous Chemical Information Act [74-4E-1 to 74-4E-9 NMSA 1978]. These right-to-know reporting requirements keep communities abreast of the presence and release of chemicals at individual facilities.

Key information about chemicals handled by manufacturing or processing facilities is contained in the EPA's Toxic Release Inventory (TRI) database. The TRI is a publicly available EPA database that contains information on toxic chemical releases and waste management activities reported annually by certain covered industry groups as well as federal facilities. This inventory was established under EPCRA and expanded by the Pollution Prevention Act of 1990. Facilities that exceed certain threshold levels must report TRI information to the EPA, the federal enforcement agency for SARA Title III, and the NMOEM.

EPCRA's primary purpose is to inform communities and citizens of chemical hazards in their areas. Sections 311 and 312 of EPCRA require businesses to report the locations and quantities of chemicals stored onsite to state and local governments in order to help

[1]In 1986, Congress reauthorized and expanded the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The new act is known as the Superfund Amendments and Reauthorization Act. Title III of SARA addresses emergency planning and community right-to-know reporting on hazardous and toxic chemicals. The purpose of SARA Title III is to promote greater cooperation among government, industry, and citizens to prevent, plan and prepare for, and manage chemical emergencies. SARA Title III has four major components: emergency planning (Section 301 to 303), emergency release notification (Section 304), hazardous chemical inventory (Sections 311 & 312), and toxic chemical release inventory (Section 313).

communities prepare to respond to chemical spills and similar emergencies. EPCRA Section 313 requires EPA and the states to annually collect data on releases and transfers of certain toxic chemicals from industrial facilities, and to make the data available to the public in the TRI. In 1990, Congress passed the Pollution Prevention Act, which requires additional data on waste management and source reduction activities to be reported under TRI. The goal of TRI is to empower citizens, through information, and to hold companies and local governments accountable for their management of toxic chemicals.

Typically, hazardous material releases cause severe damage to transportation routes and facilities. Releases also cause both short- and long-term toxicological harm to humans, wildlife, and plants (terrestrial and aquatic). Dealing with a hazardous release places first responders in danger and may overwhelm state and local resources in dealing with the protecting and helping the public recover and the clean-up and remediation of the release.

PREVIOUS OCCURRENCES – HAZARDOUS MATERIAL RELEASES

Based on the EPA Envirofacts Data Warehouse, there are 1,205 facilities producing and releasing air pollutants. Of this total, 57 facilities have reported toxic releases, 951 facilities have reported hazardous waste activities, 22 are potential hazardous waste sites that are part of Superfund, and 24 facilities generating hazardous waste constitute large quantity generators in Bernalillo County. In addition, a vulnerability assessment completed in 2002 identified 68 facilities that require radiological licenses, seven bulk facilities that store more the 1,000,000 gallons of fuel, two hazardous materials facilities that store more than 100,000,000 units of hazardous materials, 41 locations of explosives (including retail outlets), and 12 facilities that house biological components.

The National Response Center (www.nrc.uscg.mil) has listed 166 reported spills in Bernalillo County since 1989. As of September 2004, 802 SARA Title III facilities in Bernalillo County filed TRI reports (U.S. EPA Toxic Release Inventory Database updated July 2003).

HAZARD PROFILE – HAZARDOUS MATERIAL RELEASES

Hazard Characteristics

Hazardous material releases can occur at facilities (fixed sites) or along transportation routes. They can occur as a result of human carelessness or intentional acts, as well as from natural hazards. When caused by natural hazards, these incidents are known as secondary hazards. Hazardous material releases, depending on the substance involved and type of release, can directly cause injuries and death and can contaminate air, water, and soils. The probability of a release at any particular facility, or at any point along a known transportation corridor, is relatively low.

Severity and Probability of Occurrence

The severity of the incident varies with the distance from and time elapsed since the release. The most immediate areas are generally at greatest risk; yet, depending on the agent, a release can travel great distances or exist over a long time (e.g., nuclear radiation), resulting in far-reaching effects to people and the environment. There are two major interstate highways and a rail line running through Bernalillo County that are used to transport hazardous materials. Interstates 40 and 25 intersect (Big-I) Albuquerque near the geographic center of the City. A 1999 Hazardous Materials Transportation Commodity Flow Survey counted 1,188 hazardous materials placarded trucks traveling through the Big-I within a 24-hour period. Approximately 58% of those trucks were carrying flammable liquids. The 1999 Commodity Flow Study

identified the Big-I as a high-risk corridor for hazardous materials. In addition, transuranic waste is transported to the Waste Isolation Pilot Plant in Carlsbad, New Mexico, along the interstates in Bernalillo County.

The Bernalillo County and the City of Albuquerque Emergency Managers have identified four types of facilities that increase the potential for loss of life and property or could severely hamper emergency response operations in the County/City.

The Burlington Northern and Santa Fe (BNSF) Railway runs north-south through the County and also carries large quantities of hazardous materials. The railway travels through the high-density business area of downtown and also through commercial, industrial, and residential areas of development. A preliminary study of the hazardous materials traffic through the County identified 8,505 railcars containing hazardous materials flowing through Albuquerque from Lamy north of Santa Fe, and 13,832 railcars from Albuquerque to south at Isleta from April 1, 2003, to March 31, 2004. The estimate includes the numbers of rail cars containing hazardous materials, but does not include the quantity of the transported material.

With a hazardous material release, whether accidental or intentional, there are several potentially exacerbating or mitigating circumstances that will affect the severity of the release. Exacerbating conditions can enhance or magnify the effects of a hazard. Mitigating conditions, on the other hand, can reduce the effects of a hazard. These conditions include:

- ✓ Weather conditions that can affect how the released material is dispersed (e.g., high winds can increase the spread of gases or radioactive materials).
- ✓ How the chemical was released (explosion, volatilization, air or water release) and the nature of the substance.
- ✓ Micro-meteorological effects of buildings and terrain that can alter travel and duration of agents.
- ✓ Shielding in the form of sheltering-in-place[2] that protects people and property from harmful effects.
- ✓ Non-compliance with applicable codes (e.g., fire and building codes) and maintenance failures (e.g., fire protection and pipeline maintenance) that can substantially increase the damage to the facility itself and to surrounding buildings.

With the numerous fixed facilities, pipelines, and transportation routes, the probability of a hazardous material releases occurring in Bernalillo County is very high.

VULNERABILITY ASSESSMENT – HAZARDOUS MATERIAL RELEASES

Existing Community Assets

There are 802 facilities in Bernalillo County that have recorded toxic chemical release inventories and/or TRIs. TRI facilities are those facilities in specific industries that manufacture, process, or use more than the threshold amount of one or more of 600 listed toxic chemicals. Most threshold amounts are 10,000 or 25,000 pounds per year, but the thresholds can vary depending on the chemical. 802 facilities in Bernalillo County are *Tier 2 facilities*—businesses that store 10,000 pounds or more of a hazardous chemical or 500 pounds or less, depending on the chemical, of an extremely hazardous chemical (product, not waste) on-site at any one time.

[2] Sheltering-in-place means staying indoors during an emergency.

The Tier 2 facilities are required to report annually to the State Emergency Response Commission, local emergency planning committees, and local fire departments for emergency planning.

Table 14 outlines the known facilities with high-risk potential. This list was generated by a search of the Resource Conservation and Recovery Act (RCRA) Information, and sites identified by the Mitigation Planning Team. Tables 15-17 identify the residential populations and critical facilities at-risk from these facilities. The Village of Los Ranchos de Albuquerque and the Village of Tijeras did not have any identified assets at-risk due to hazardous materials.

Table 14: Known Facilities with High Risk Potential

Facility	Potential Risk	Type	Location
Propane Storage	Explosion, fires, concussion damage	Flammable Fuel Storage	South Valley North Valley
Gasoline Storage	Explosion, fires, concussion damage	Flammable Fuel Storage	South Valley
Waste Water Treatment	Loss of waste treatment capacity	Waste water facility	South Valley
Hazardous Chemicals	Explosion, fires, exposure	Storage facilities	South Valley

Table 15: Populations and Structures within 1 mile of High Risk Facilities

Location-type	Within 1 mile buffer Population	Residential Structures	Building Value	Non residential Structures	Building Value	Critical Facilities
South Valley Waste water treatment plant	1,833	299	$13,539,587	71	$12,789,775	1 fire stations
South Valley Propane distribution center	4,661	1,303	$59,968,316	117	$25,008,898	
South Valley Gasoline storage	944	198	$10,250,695	68	$10,362,124	1 school
South Valley Gasoline storage-pipeline	1,592	249	$10,356,111	82	$17,466,376	1 fire station
North Valley Propane distribution	5,725	1,757	$174,179,265	189	$29,351,37	3 schools
Total	14,755	3,806	$268,293,974	527	$94,978,549	6

Table 16: Populations and Structures within ¼ mile of High Risk Facilities						
Location-type	**Within 1/4 mile buffer Population**	**Residential Structures**	**Building Value**	**Non residential Structures**	**Building Value**	**Critical Facilities**
Resource Conservation and Recovery Act (RCRA) Large Quantity Generator	9,028	1,448	$148,961,864	537	$413,112,823	7 schools
PNM major gas lines	5,481	2,688	$244,267,335	105	$136,569,709	4 schools

Table 17: ¼ mile buffer for Hazardous Materials Transportation Routes						
Location-type	**Within 1/4 mile buffer Population**	**Residential Structures**	**Building Value**	**Non residential Structures**	**Building Value**	**Critical Facilities**
I-25 & I-40 (through the County)	37,716	9,943	$807,190,469	1,737	$1,191,342,999	7 fire stations 12 schools 6 hospitals local, county, and federal government center
BNSF	15,620	3,657	$202,445,087	1,127	$210,666,526	1 school

Estimating Potential Loss

Potential damages due to hazardous materials can include loss of life and structural damages; however, the majority of the costs usually occur in the cleanup. Cleanup costs for a hazardous materials spill or incidents can range from a few thousands dollars for a simple spill on the highway, to hundreds of thousands of dollars for releases to the soil and groundwater. Response costs can vary from $2,000 to clean a small spill that is confined to the roadway, to hundreds of thousands dollars. Clean up costs for a spill in 2004 at Broadway and Rio Bravo in the South Valley were in excess of $700,000.

Table 15 identifies a population of 14,755 within one mile of the five highest risk facilities in the County and structures valued at over $370 million. In addition, approximately 20,000 people and structures valued at $413 million are within the 1/8 mile buffer of the Interstates and the railway. Virtually all of these assets and populations are either within unincorporated areas of Bernalillo County or the City of Albuquerque. The Village of Los Ranchos de Albuquerque and the Village of Tijeras did not identify any potential losses due to hazardous materials.

Critical Facilities

Two fire stations and 11 schools are within 1 mile of a hazardous materials facility in Bernalillo County. The critical facilities searched include both essential facilities (e.g. police and fire stations, hospitals, and banks) and special populations facilities, such as schools and nursing homes. Bernalillo County maintains the list at its Office of Emergency Management. In addition,

seven schools and four fire stations are located within 1/8 of a mile of an Interstate highway or railroad where hazardous materials are transported.

Future Development Trends

The projected growth in Bernalillo County will increase the potential impact of a hazardous material incident. Increased railroad and highway traffic raises the probability of a hazardous material event. In 1995, 383 placarded hazardous materials trucks were reported to have passed through the interstate system within a 24-hour period; four years later, that number had increased to 1,188 in a 1999 study. The amount of hazardous materials traveling through the County and at fixed facilities is expected to continue to grow. The future development trends for Los Ranchos de Albuquerque and the Village of Tijeras are not expected to increase the probability of hazardous materials incidents.

CONCLUSIONS – HAZARDOUS MATERIAL RELEASES

Summary of Hazard Identification and Vulnerability Assessment

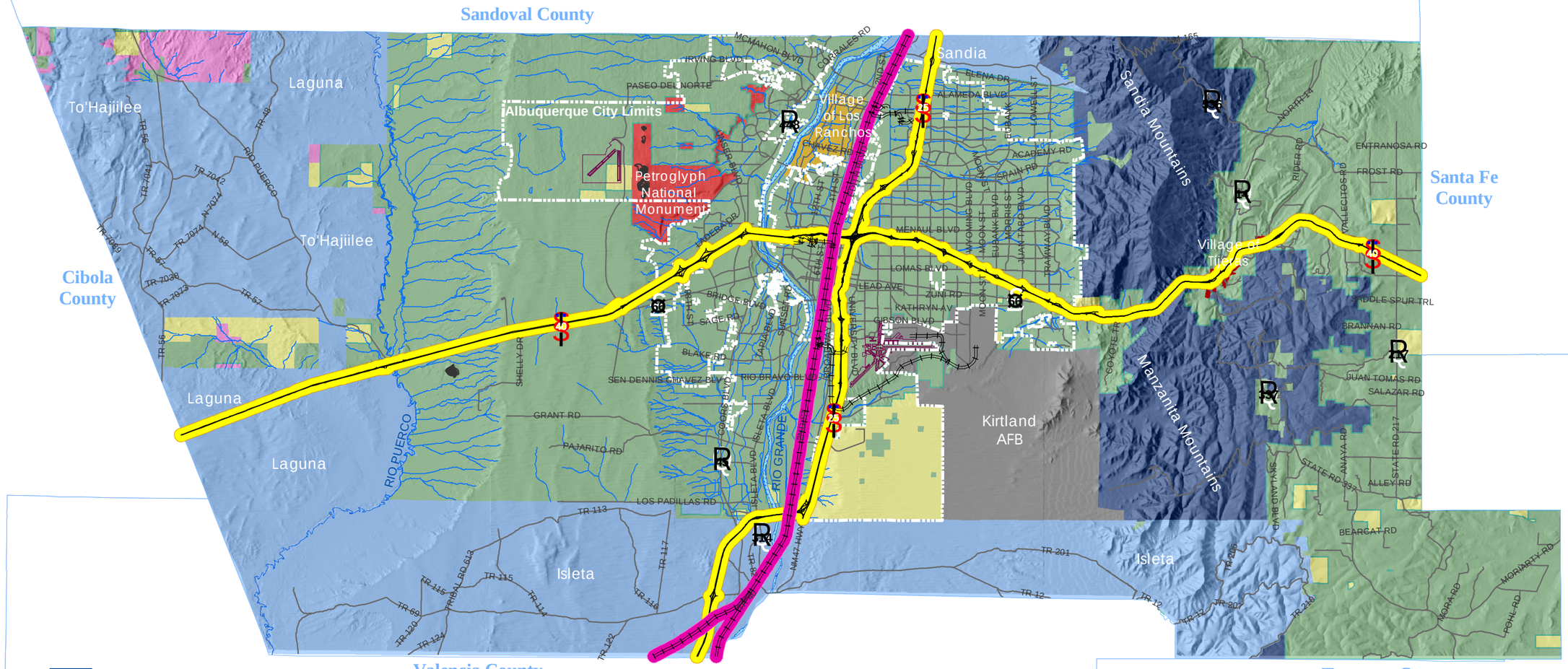
The City of Albuquerque and Bernalillo County constitute the State's most populous area and, consequently, have the most residents at risk of exposure to hazardous material releases. Due to the location of several fixed facilities near residential areas, there is a relatively higher risk of being affected by accidental or intentional releases of hazardous materials in different areas of the community. The Planning Team identified five groups of hazardous material threats and grouped them according to their general location. The "Big-I" intersection in the middle of Albuquerque also presents the biggest potential for a mobile hazardous material release. The anticipated population growth and the related residential and commercial development within the County will mainly impact the potential for mobile hazardous material releases.

What Can Be Mitigated?

Bernalillo County can raise awareness of specific hazardous materials present in their communities and become more informed about specific aspects of these operations. Possible mitigation actions include substituting a less toxic chemical for water and waste water treatment, additional training for responders, training for raising awareness of how to respond to hazardous material events, such as public education, evacuation drills and response exercises, and warning systems. A possible mitigation action for mobile hazardous materials may be to restrict hazardous materials transportation through the most populated portion of the County during peak traffic times. For fixed facilities, future development can be guided in such a way that new facilities are buffered from existing and anticipated development.

Data Limitations

The Planning Team needs more information about past hazardous material releases from fixed sites or materials being transported, the nature of the operations that already exist in the County, and the status of existing emergency action plans.



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1 inch equals 4 miles

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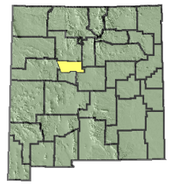


Bernalillo County, New Mexico

Data provided by the Bernalillo County Infrastructure Planning & Geo-Resources Department, the City of Albuquerque Planning Department (AGIS), the City of Albuquerque Information Systems Division and the New Mexico Resource Geographic Information System Program (RGIS).

Bernalillo County Hazardous Material Routes

- Railroad
- 1/4 Mile Buffer @ Railroad
- Interstates
- 1/4 Mile Buffer @ Interstates
- Albuquerque City Limits
- Village of Los Ranchos de Albuquerque
- Village of Tijeras
- Rivers
- Arroyos/Channels
- Volcano

Land Ownership

- Bureau of Land Management
- Department of Defense
- US Forest Service
- Tribal Land
- National Park Service
- Private Land
- State Trust Land

HUMAN-CAUSED HAZARDS – TERRORISM

OVERVIEW – TERRORISM

Following a number of serious international and domestic terrorist incidents during the 1990s and early 2000s, citizens across the United States have an increased awareness of the potential for deliberate, harmful actions by individuals or groups. There is no single, universally-accepted definition of terrorism, and the term can be interpreted in many ways. However, terrorism is defined in the Code of Federal Regulations (CFR) as "...the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives" (28 CFR, Section 0.85).

Generally, terrorist strikes result in loss of life and damage to buildings/facilities, infrastructure, and landmarks. Further injury to the population can occur from the resultant chaos immediately after the strike.

PREVIOUS OCCURRENCES – TERRORISM

Bernalillo County has had incidents of bomb threats to critical facilities such as schools and government facilities in the past. However, no large-scale incidents involving injury or fatalities have occurred in the county.

HAZARD PROFILE – TERRORISM

Hazard Characteristics

The Federal Bureau of Investigation (FBI) characterizes terrorism as either domestic or international, depending on the origin, base, and objectives of the terrorist organization. The origin of the terrorist or person causing the hazard, however, is far less relevant to mitigation planning than the hazard itself and its consequences. For the purposes of this Plan, terrorism refers to the use of WMDs, including biological, chemical, nuclear, and radiological weapons; arson, incendiary, explosive, and armed attacks; industrial sabotage and intentional release of hazardous materials; and cyber-terrorism. Within these general categories, however, there are many variations, particularly in the area of biological and chemical weapons, which comprise a wide variety of agents and delivery systems.

Terrorist methods can take many forms, including:

- Agroterrorism
- Armed attack
- Arson/incendiary attack
- Biological agent
- Chemical agent
- Conventional bomb
- Cyber-terrorism
- Hazardous material release (intentional)
- Nuclear bomb
- Radiological agent ("dirty bomb")

Severity and Probability of Occurrence

The severity of terrorist incidents depends on the method used; the proximity of the device to people, animals, or other assets; and the duration of exposure to the incident or device. For example, chemical agents are poisonous gases, liquids, or solids that have toxic effects on people, animals, and plants. Many chemical agents can cause serious injuries or death.

Biological agents are organisms or toxins that have illness-producing effects on people, livestock, and/or crops. Because some biological agents cannot be easily detected and may take time to incubate, it may be difficult to know that a biological attack has occurred until victims display symptoms. In other cases the effects are immediate. Those affected by a biological agent require immediate medical attention. Some agents are contagious, and victims may need to be quarantined.

An important consideration in estimating the likelihood of a terrorist incident is the existence of facilities, landmarks, or other buildings of national importance. While Bernalillo County has many notable landmarks from a local historic perspective, and an extensive area of dense urban population; the likelihood of a terrorist attack because of the County's *national* significance is unlikely. However, terrorism takes many forms, and terrorists have a wide range of local, state, and national political interests or personal agendas, meaning that even unlikely potential targets cannot be ruled out.

VULNERABILITY ASSESSMENT – TERRORISM

Existing Community Assets

Facilities and populations vulnerable to terrorist attacks in Bernalillo County have been identified as infrastructure, emergency response facilities, hospitals, government offices, and special events. Twenty-three (23) of the 50 most likely terrorist targets in New Mexico have been identified in Bernalillo County; however, due to security issues the list of targets is not made public. Albuquerque hosts several large tourist events each year, including the State Fair and the International Balloon Fiesta, each of which draw over 500,000 visitors.

Estimating Potential Loss

There are no reliable estimates available of potential losses from terrorist incidents. The City of Albuquerque and Bernalillo County Emergency Managers are in the process of developing a Vulnerability Assessment that will assist the County and City in calculating potential losses due to terror incidents.

Critical Facilities

Bernalillo County has identified the emergency operation centers (EOC's), 10 fire stations, 22 joint city/county government facilities, and 138 public venues as vulnerable to terrorism. Some government facilities, as well as other vulnerable privately owned facilities, have constructed physical barriers and increased security measures.

Future Development Trends

Future development does not necessarily increase vulnerability beyond the obvious fact that more development near known sources of potential terrorist targets increases the number of people and property subject to the existing level of vulnerability.

CONCLUSIONS – TERRORISM

Summary of Hazard Identification and Vulnerability Assessment

Terror targets and threats are difficult to predict. Terrorists can target any number of facilities, from transportation corridors to critical facilities, even to the agricultural lands. Additionally, the railroad and the natural gas pipelines that run throughout the County could be possible targets of terrorism.

What Can Be Mitigated?

Due to the uncertainty about where and when attacks can occur, much of the current effort by local emergency management agencies is focused on improving response and recovery capabilities in case such an event occurs. As of January 2003, each region in the state has completed a prioritized risk and vulnerability assessment as part of a Homeland Security Strategic Plan. A copy of the Plan is available in the Bernalillo County or the City of Albuquerque Office of Emergency Management. The State Police Emergency Response Officer (ERO) responds to each hazardous material incident that occurs on transportation routes (defined as a spill of 50 or more gallons, or smaller amounts of highly volatile, explosive, or toxic materials). Currently there are only four or five trained EROs in the Bernalillo County area. Training for more EROs can enhance response time and save money on overtime expenditures.

Data Limitations

Determining the probability of terrorist attacks is difficult, as discussed above. Methods for calculating such probabilities are either being developed or, if available, are not widely accessible to communities. Knowing this information would allow communities to focus mitigation resources more effectively, in particular with regard to critical facilities.

HUMAN-CAUSED HAZARDS
NUCLEAR/RADIOLOGICAL ACCIDENTS

OVERVIEW – NUCLEAR/RADIOLOGICAL ACCIDENTS

The term nuclear facility encompasses all nuclear power plants, nuclear research facilities, uranium and plutonium mining and processing operations, and military installations with nuclear weapons on site. Nuclear facilities are present in virtually every state, including New Mexico. Sandia National Laboratory (SNL), a nuclear research facility is located within Bernalillo County. SNL contains radioactive materials, including reactors, sources and experimental areas, weapons, waste storage, and industrial chemicals. SNL, with local emergency management professionals, have developed an emergency planning procedure to identify impacts from hazardous materials, including nuclear and radiological accidents from SNL, both on and off-site. Areas of the county/city that may be impacted by SNL have been identified by emergency planning zones.

Upon detonation, a nuclear devices cause massive damage to buildings and the population. Fires can result from the initial heat pulse and from the resulting destruction. In addition, individuals not directly affected by the initial explosion may be affected by the radioactive fallout. Wind currents can carry radioactive fallout for hundreds of miles if the right meteorological conditions are extant.

PREVIOUS OCCURRENCES – NUCLEAR/RADIOLOGICAL ACCIDENTS

Between 1945 and 1982, there were eight nuclear-related events in New Mexico. Most of these accidents were associated with the production of nuclear weapons (Table 18).

Table 18: Nuclear Related Events in New Mexico	
Date	**Type of Event**
August 21, 1945	LANL worker killed building weapon
May 25, 1946	LANL worker killed building weapon
April 11, 1950	Plane with nuclear weapon crashed near Manzano Mountains
May 22, 1957	Bomb accidentally dropped on Albuquerque outskirts
December 30, 1958	LANL worker killed building weapon
September 3, 1974	Radioactive liquid escaped, spilling into street in Los Alamos
July 16, 1979	Dam holding uranium tailings failed, 1 million gallons of radioactive liquids released near Church Rock
October 1981	Plutonium leak in Los Alamos contaminated 15 people

HAZARD PROFILE – NUCLEAR/RADIOLOGICAL ACCIDENTS

Hazard Characteristics

After a nuclear incident, the main concern is the effect on the health of the population near the incident. External radiation, inhalation, and ingestion of radioactive isotopes can cause acute health effects (death, severe physical impairment), latent health effects (cancers), and psychological effects. Additional considerations include the long-term impacts on the environment and agriculture.

Radiation is not normally detectable by the senses; instruments are needed to detect small levels of radiation.

Severity and Probability of Occurrence

Several factors affect the severity of radiation exposure:

- ✓ *Time*: Limiting the time spent near the source of radiation reduces the amount of radiation exposure received. Following an accident, local authorities monitor any release of radiation, determine the level of protective actions, and announce when the threat has passed.
- ✓ *Distance*: The more distance that exists between the target and the source of radiation, the less radiation will be received. In the most serious nuclear accidents, local officials will likely call for an evacuation, thereby increasing the distance between people and radiation.
- ✓ *Shielding*: Heavy, dense materials between the target and the source of radiation provide protection from excessive radiation. In some cases, the walls of residential and commercial structures would be sufficient shielding for a short period of time.

The likelihood of structural damage to residences, commercial properties, or critical facilities due to a nuclear accident is extremely low. With such a low probability of damages due to nuclear incidents, there is no information available concerning potential loss.

SNL has created a hazards assessment for the activities and facilities that occur at SNL. The assessment characterizes the hazards and potential impacts to workers and public due to hazardous materials including radioactive materials. The events considered for the assessment include an aircraft crash, natural disaster, fires, spill, explosions, and transportation accidents. The assessment process began with facilities that have enough hazards to potentially produce a hazardous materials emergency. The scenario is a large aircraft crashing into a building with 600-gallons of jet fuel dispersed, the building is destroyed, a fire burns uncontrolled, all containers of all chemicals are breached by impact, all liquid chemicals are spilled, and all

chemicals are released as mixture in plume. Two zones were identified: the first (the minimum) included the area that may result in fatalities; the second zone (the maximum) is the furthest the emergency may impact given the scenario.

VULNERABILITY ASSESSMENT – NUCLEAR/RADIOLOGICAL ACCIDENTS

Critical Facilities

Since SNL is located in Bernalillo County, all critical facilities are potentially vulnerable to nuclear/radiological accidents, especially airborne contaminants. However, risk decreases as distance increases, and most critical facilities are located outside the SNL Emergency Planning Zones minimum circles.

Future Development Trends

Virtually all of the undeveloped areas within the one – mile buffer are not suitable or planned for development.

CONCLUSION – NUCLEAR/RADIOLOGICAL ACCIDENTS

Summary of Hazard Identification, and Vulnerability Assessment

SNL poses potential risks to populated areas. However, most of the City and County population and facilities are located outside the SNL Emergency Planning Zones.

What Can Be Mitigated?

Because of the unpredictability of human-caused hazards, mitigation should focus primarily on the possible targets/victims rather than on the hazard itself. Raising citizen awareness of what to do in the event of an emergency (whether to evacuate or stay inside) and hardening critical facilities are two ways in which pre-disaster actions can limit vulnerability

Data Limitations

Determining the probability of nuclear/radiological accidents is difficult, as discussed above. Methods for calculating such probabilities and the resulting potential dollar loss are either being developed or, if available, are not widely accessible to communities. Knowing this information would allow communities to focus mitigation resources more effectively, in particular with regard to critical facilities.

OVERVIEW – FLASH FLOODS IN BERNALILLO COUNTY, NEW MEXICO

Nationwide, hundreds of floods occur annually, making flooding one of the most common hazards in all 50 states and U.S. territories. Most injuries and deaths from flooding happen when people are swept away by flood currents, and most property damage results from inundation by sediment-filled water. The majority of flood events in the United States involve inundation of floodplains (Figure 9) associated with rivers and streams and shoreline inundation along lakes and coastlines.

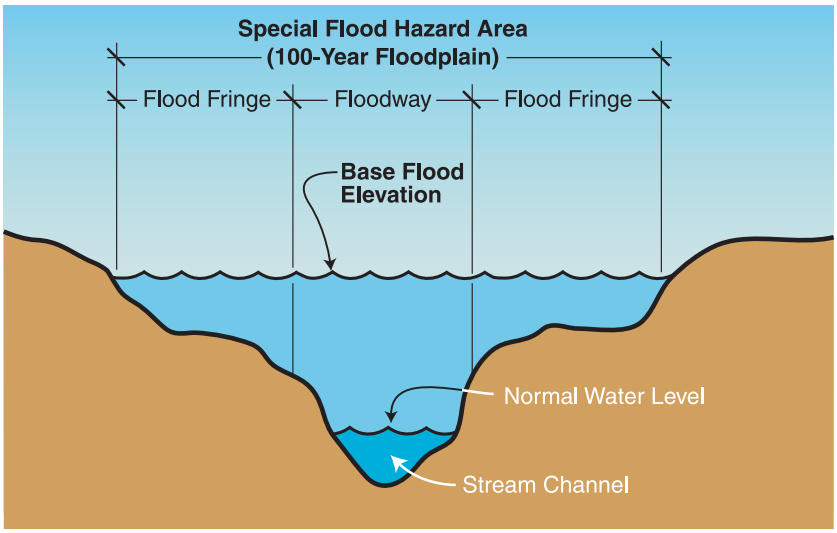


Figure 9: Definition Sketch for Floodplains
Source: Understanding Your Risks – *FEMA Publication 386-2, page 2-12*

This type of flooding typically results from large-scale weather systems generating prolonged rainfall, locally intense storms, or snowmelt. For the purposes of this report, this type of flooding is referred to as "riverine flooding" and is characterized by a gradual and predictable rise in a river or stream due to persistent precipitation. After the stream or river overflows its banks the land nearby remains under water for an extended period of time. Although the State of New Mexico and Bernalillo County experience riverine flooding, *flash flooding* is a more common and more damaging type of flooding.

Flash floods are aptly named: they occur suddenly after a brief but intense downpour; they move quickly and end abruptly. Although the duration of these events is usually brief, the damages can be quite severe. People are often surprised at how quickly a normally dry arroyo can become a raging torrent. Flash floods are the primary weather-related killer, with around 140 deaths recorded in the United States each year. Flash floods are common and frequent in

New Mexico, and, as a result, New Mexico has the tenth highest flash flood fatality rate in the nation.

Flash floods also result as a secondary effect from other types of disasters, including large wildfires and dam breaks. Wildfires remove vegetative cover and alter soil characteristics, increasing the quantity and velocity of stormwater runoff, and dam breaks quickly release large quantities of water into receiving drainage ways.

Floods can cause erosion along riverbanks and undermine buildings and bridges, tear out trees, wash out access roads and cause of loss of life and injuries.

PREVIOUS OCCURRENCES – FLASH FLOODING

New Mexico has a long history of flash flooding problems. Many minor flash flood events occur each year during New Mexico's summer monsoon season. Due to the small scale and localized nature of these events, no consistent records are available; however, Bernalillo County has suffered damage from numerous major floods and localized flash flooding repeatedly since 1893. Two federal declarations for flash flooding have been issued in the past five years. Table 19 lists some of the significant flash flood events in Bernalillo County in the last twenty years.

Table 19: Significant Flash Flood Events in Bernalillo County

Date	Estimated Damages	Damage Description/ Property or Infrastructure Damaged
7/10/1996	$35K property $5K crops	At least one home damaged. Several corrals and goats washed away. Deputies rescued a man just before his car was swept downstream.
7/28/1997	$100K	One city street intersection was closed for about 5 days after flood waters, which burst through the city drain, undercut the pavement.
7/25/1998	$30K	Ten to 15 cars stalled in flooded underpasses. Two women had to be rescued by city fire department crews.
6/16/1999	$1.2M	Over 100 new automobiles on a dealer lot were flooded by rapidly rising water. Poor or clogged drainage was partially to blame for these losses.
4/3/2004	$3.8M	Massive sewer line breaks in downtown Albuquerque. 4,500 cubic yards of sand and gravel were deposited in the City's wastewater/sewage treatment plant, damaging equipment.

The Village of Tijeras has experienced localized flooding along the Tijeras Arroyo. The Village of Los Ranchos de Albuquerque identified the following areas of concern for flooding: Garduño Road west of 4th Street, Ranchitos Road west of 4th Street, and Ortega Road west of 4th Street.

Hazard Characteristics

In Bernalillo County, there are seasonal differences in the causes of floods. In the winter and early spring (February to April), major flooding has occurred as a result of heavy rainfall on dense snow pack throughout contributing watersheds. During most winters, the snow pack is generally moderate and associated flooding is infrequent. Summer floods are more frequent and

generally are the result of summer thunderstorms that deposit large quantities of rainfall over a short period of time, causing localized flooding. Flash floods peak during the "Southwest Monsoon" season of July and August.

Flash floods are more likely to occur in places with steep slopes and narrow stream valleys, and along small tributary streams. In urban areas, parking lots and other impervious surfaces that shed water rapidly contribute to flash floods. In rugged, hilly, and steep terrain, the high-velocity flows and short warning time make flash floods hazardous and very destructive. In the arid environments of the southwest, steep topography, sparse vegetation, and infrequent precipitation in the form of intense thunderstorms typify the flash flood hazard areas.

Erosion can play a large roll in flash floods. Extensive erosion damage can occur with major flooding. Erosion results in access disruption, road closures, driving hazards, drainage facility damage and blockage, and sedimentation. Erosion can occur rapidly during a storm event, or can occur over time due to minor storms or breaks in water lines. Accelerated soil erosion has created problems ranging from loss of productive agricultural soil to displacement of human structures to sediment buildup in water reservoirs. Water erosion is one of the most common geologic phenomena. The detachment and transportation of soil particles by water can cause sheet erosion, rill erosion, or gully erosion. Sheet erosion occurs with soil being removed in a uniform manner across the surface but is often accompanied by tiny channels cut into the surface creating rill erosion. Where the volume of runoff water is further concentrated, the formation of larger channels or gullies may occur within the landscape, creating gully erosion. Rill and gully erosion can cause serious land use problems. Storm events in New Mexico can result in flashfloods and can create serious rill and gully erosion.

Severity and Probability of Occurrence

Bernalillo County has several conditions that may contribute to flash floods and exacerbate their effects:

- ✓ *Steep Slopes* – Sections of Bernalillo County have moderate to steep sloping terrain that can contribute to flash flooding because runoff reaches the receiving arroyos and rivers more rapidly over steeper terrain.
- ✓ *Obstructions* – During floods, obstructions can block flood flow and trap debris, damming floodwaters and potentially causing increased flooding uphill from the obstructions.
- ✓ *Soils* – Soils throughout much of Bernalillo County are derived from underlying parent materials that are rich in carbonate as well as mixed clays. As a result, soils are typically fine-grained, and have low infiltration rates and high runoff potential. Vegetative cover is either mixed shrubs or mixed grasses. Sparse vegetative cover combines with high runoff soil potential to result in significant flooding hazards in ephemeral washes and adjacent areas.

Floods are described in terms of their extent (including the horizontal area affected and the vertical depth of floodwaters) and the related probability of occurrence. Flood studies use historical records to determine the probability of occurrence for different extents of flooding. The probability of occurrence is expressed as the percentage chance that a flood of a specific extent will occur in any given year (Table 20).

Table 20: Flood Probability Terms

Flood Recurrence Intervals	Chance of occurrence in any given year
10-year	10%
50-year	2%
100-year	1%
500-year	0.2%

The determination of the extent of the base flood for Bernalillo County is assumed to account for flash flooding events as well. Therefore, the base flood extent is used for this study as an

approximation of the area that may be affected by a significant flash flood of that recurrence interval. The floodplain map at the end of Section One shows the location of flood hazard areas with the greatest concentration of population in Bernalillo County.

To establish the potential extent of flooding in the planning area, we studied the Bernalillo County, New Mexico and Incorporated Areas, effective Flood Insurance Study dated November 19, 2003. This is the range of potential flood depths within the 100-year Floodplain (Base Flood Elevation).

Table 21: Potential Flood Depth Range within the 100-Year Floodplain

Jurisdiction	Waterway	BFE Depth Range
Albuquerque/County	Arroyo A-B	12-18 inches
Albuquerque/County	Arroyo A-C	3-12 feet
Albuquerque/County	Arroyo B-A	9-12 inches
Albuquerque/County	Arroyo B-B	18-24 inches
Albuquerque/County	Arroyo B-C	11-14 inches
Albuquerque	Arroyo de las Calabacillas	3-17.5 feet
Albuquerque	Bear Arroyo Tributary	5-9 feet
County	Borrega Arroyo	6-26 inches
County	San Pedro Canyon Arroyo	8.5-15 feet
County	Frost Arroyo	3-14.5 feet
County	Rio Grande	3.5-10.5 feet
County	Rio Puerco	19.5-23 feet
County	San Pedro Creek	3-9.5 feet
Albuquerque/County/Tijeras	Tijeras Arroyo	2.5-21.5 feet

VULNERABILITY ASSESSMENT – FLASH FLOODS

Existing Community Assets

Flood vulnerability is described in terms of the community assets that lie in the path of floods. The flood hazard vulnerability assessment for Bernalillo County focused on the 100-year storm event base flood elevation, though floods of both greater and lesser flood depths are possible. Vulnerability to flash floods is difficult to determine because local terrain, soil conditions, and construction play a role in how much stormwater is able to run off, percolate into the soil, or cause flash flooding.

All jurisdictions, including the City of Albuquerque, Bernalillo County, the Village of Tijeras, and Los Ranchos de Albuquerque participate in the National Flood Insurance Program (NFIP).

The areas with the greatest vulnerability are concentrated in the older neighborhoods of the City and along the Rio Grande. There are no records of repetitive losses for properties in the 100-year floodplain, but some areas have been identified as having chronic flooding problems. Downtown Albuquerque has some of the lowest elevations in the City and requires pumping stations to lift stormwater out of the area and towards the river. Several areas in the County that are near the river have inadequate storm sewer capacity to handle flows from large storm events. The City is also concerned about localized flooding that crosses City jurisdiction onto Kirtland Air Force Base near Zuni and Wyoming SE.

Critical Facilities

Critical facilities that lie within the 100-year floodplain include the Southside Water Reclamation Plant that processes all of the City and County wastewater. Also at-risk for flooding is the area

near the City Zoo. Twice in the past year, the pumping station used to drain stormwater from the area has shut down during a storm and caused the area to flood. In all, there are 13 pump stations in the City that are lower than the Rio Grande.

Estimating Potential Loss

Table 22 indicates the population and the total number and value of structures located within the 100-year floodplain. The table was created utilizing GIS information on the 100-year flood zones, overlaid with data from the Bernalillo County Assessor on number and value of structures. Population residing in the 100-year flood zones was determined by overlaying 2000 U.S. Census data over defined 100-year flood zones.

Table 22: Assets in the 100-Year Floodplain

Area	Population	Number of Residential Structures	Value of Residential Structures	Number of Non-Residential Structures	Value of Non-Residential Structures	Total Value of Structures
Unincorporated Areas	4,020	1,894	$206,949,099	159	$41,716,637	248,665,736
Albuquerque	14,977	4,527	$519,735,737	1,088	$588,157,564	$1,107,893,301
Village of Los Ranchos de Albuquerque	108	95	$8,296,288	21	$2,658,600	$10,954,888
Village of Tijeras	3	28	$1,307,500	8	$710,200	$2,017,700
TOTALS	19,108	6,544	$736,288,624	1,276	$633,243,001	$1,369,531,625

Future Development Trends

The City of Albuquerque and Bernalillo County participate in the Flood Insurance Program and do not allow any new construction within defined floodplains without rigorous mitigation measures, such as elevating the building above the floodplain, or through a Letter of Map Revision from FEMA. The City has a series of requirements in the Zoning Code that deal with flood protection (Section 14-5-2-1 through 14-5-2-17 in the City of Albuquerque code). Due to the increased costs associated with ensuring that new structures are either flood proofed or raised up out of the floodplain, virtually all new development is anticipated to occur outside of the 100-year floodplain. With regulatory controls in place that require extensive analysis of potential flooding and stormwater treatment, the projected growth in the City of Albuquerque and Bernalillo County will not significantly increase problems associated with floods and flash floods.

The City and County work closely with Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) on regional flood controls. AMAFCA constructs and maintains the system of channel lined flood control structures that transport stormwater to the Rio Grande and large detention basins, and create new flood control structures in developing areas of the City and County. The majority of flood control work is currently focused on the west side of the City of Albuquerque.

Due to the limited areas that are suitable for development in Tijeras, there will be more pressure for development in marginal areas, such as in or near the Tijeras Arroyo. The Village of Tijeras currently does not have a Floodplain Manager, and as a result, floodplain issues may not have the proper level of scrutiny.

Projected development in Los Ranchos de Albuquerque is expected to occur either out of the floodplain or in areas with drainage control, and will not significantly increase the potential for future flooding.

The City and County are currently in the process of updating all Flood Insurance Rate Maps (FIRMs) for Bernalillo County. Working with a contractor, they are focusing on detailed study areas and some limited detail study areas to better define flood zones, and to identify areas that no longer are within flood zones. The mapping, funded through FEMA and conducted by a consortium of contractors known as MAP VI, was submitted to FEMA for review and approval in 2005.

CONCLUSIONS – FLASH FLOODING

Summary of Hazard Identification and Vulnerability Assessment

Flash floods have been and will continue to be a significant threat to the economic and social well-being of selected areas of the County. The City of Albuquerque has chronic localized flooding in the downtown area, the city and county have localized flooding in neighborhoods along the Rio Grande, and the Village of Tijeras has identified Tijeras Arroyo as a flooding concern.

Due to the vulnerability of the County to flood/flash flood events, the Hazard Mitigation Team has identified flash flood hazard mitigation as one of its priorities.

What Can Be Mitigated?

Determining the aspects of Bernalillo County flood vulnerability that can be mitigated requires a review of the causal factors for floods and the assets that can be affected. In Bernalillo County, most flash flood events are due to a lack of conveyance to the Rio Grande or to detention basins. Most of the pumping stations in-place have low volume output and limited detention pond areas. As a result, available alternatives for mitigation actions should focus on property protection, localized corrective measures for drainage and erosion in developed areas, and ensuring that future development is sited out of the floodplain. AMAFCA funds flood control projects through General Obligation Bonds. In the 2004 election, the County's voters passed a $20 million bond to finance new flood-control projects.

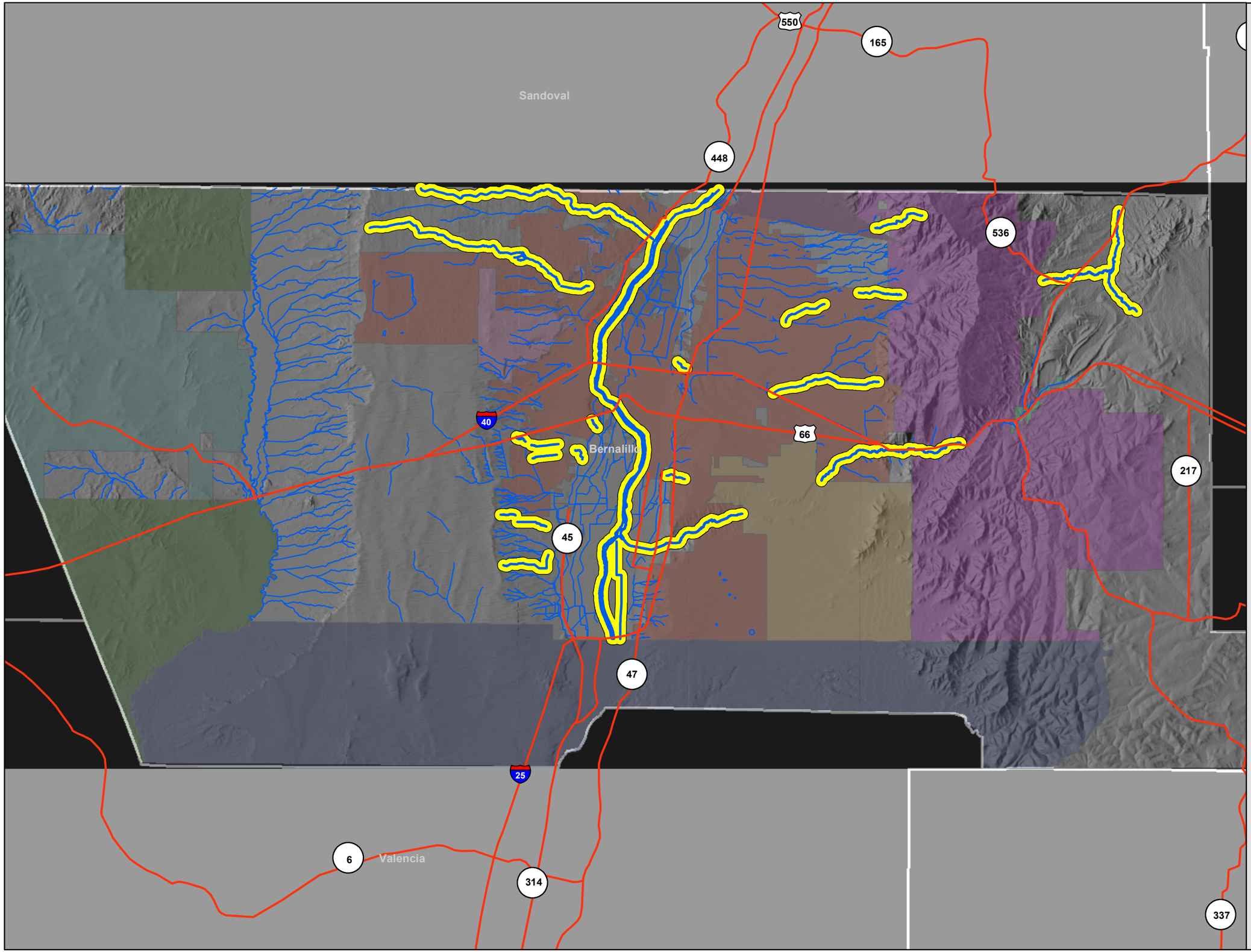
There are many existing programs that deal with mitigating problems associated with flash flooding. Two programs focus on education and public awareness:

- ✓ The New Mexico Wellhead Protection Program is part of the Drinking Water Bureau of the New Mexico Environment Department. They work with communities to protect and manage wellhead areas to prevent pollution during flooding.
- ✓ The Ditch and Water Safety Task Force has "Ditches are Deadly, Stay Away" signage near drainage arroyos to warn people of the tremendous force of flash flood waters in arroyos. The task force is made up of the City of Albuquerque, Bernalillo County, MRGCD, AMAFCA, and the Sandoval County Arroyo Flood Control Authority.

Data Limitations

The flood vulnerability analysis has the following limitations:

- ✓ *Flash Flood Predictability*: The location and occurrence of flash floods are difficult to predict and dependent on local conditions of terrain, land use, and extent of impervious cover.
- ✓ *Data for Structures – Attributes*: First-floor elevations and structure replacement values are useful for loss estimation. Replacement value (the cost to rebuild) is a necessary component in estimating the dollar amount of losses in a flood and, when coupled with a range of flood probabilities from the 10-year to 500-year flood depths, can help in describing the benefits and costs of mitigation actions in monetary terms. The City of Albuquerque has information on parcel data for flood zones, but does not have structure data. The City does not have reliable information about the quantity and type of structures at-risk for flooding.
- ✓ *Data for Structures – Coverage*: The figures for homes and businesses vulnerable to flood in Table 22 are based on an analysis done with Bernalillo County Assessor data and underlying flood zones. The current coverage does not adequately identify the number of structures on each parcel of land and does not provide an adequate basis to perform detailed risk assessments.



Bernalillo County Floodplain Map

- Highways
- High Risk Flood Areas*
- Arroyos/Streams
- County Boundaries

Land Ownership

- Canoncito Navajo Indian Reservation
- Cibola National Forest
- City of Albuquerque
- City of Rio Rancho
- Isleta Indian Reservation
- Kirtland Air Force Base
- Laguna Pueblo Indian Reservation
- Petroglyph National Monument
- Sandia Indian Reservation
- Village of Los Ranchos de Albuquerque
- Village of Tijeras

*1/4 Mile Buffer is around flood prone, high risk areas.

N

1 inch equals 20,000 feet

0 2 4 8 Miles

Data provided by the New Mexico Resource Geographic Information System (RGIS) Program and the USGS National Hydrography Dataset (NHD).

NAD83 State Plane
New Mexico Central
FIPS 3002 Feet

OVERVIEW – DROUGHT IN BERNALILLO COUNTY, NEW MEXICO

Simply put, drought conditions exist when the demand for water exceeds the available supply. Droughts are common in New Mexico and Bernalillo County. The climate in Bernalillo County is semiarid with average annual precipitation that ranges from about 8.7 inches in lower areas to over 16 inches in higher elevations. Snowfall averages about 9.9 inches annually. The uppermost elevations of the Sandia and Manzano Mountains in the eastern portion of the county generally receive more snowfall than lower elevations.

Drought damages agricultural crops, causes injury and possibly death to livestock and wildlife through undernourishment, and in general forces a decline in land values. Droughts can also cause a water shortage, affecting both humans (lessened potable water supply) and hydroelectric power generators, as well as negatively impacting riverine navigation and recreation.

PREVIOUS OCCURRENCES – DROUGHT

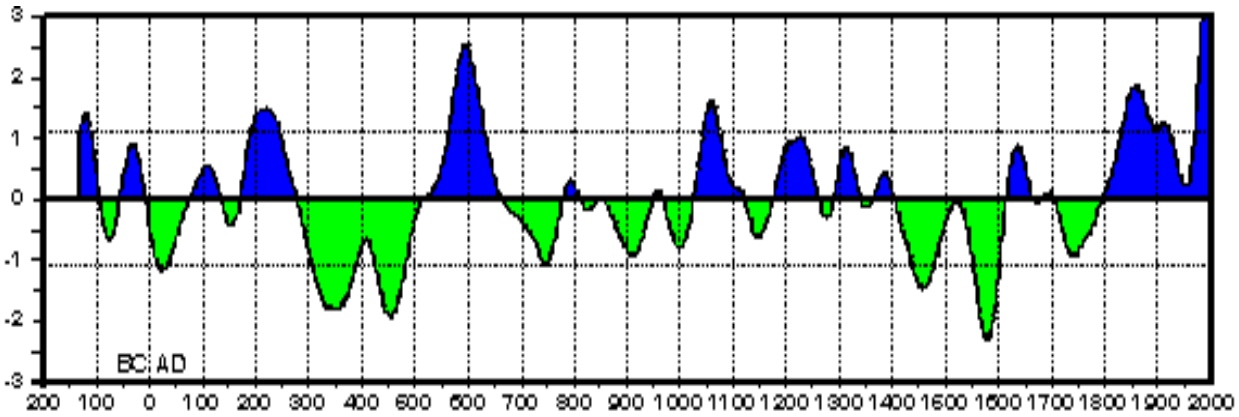
New Mexico has always known drought. Archeological records indicate that drought has led to the collapse of early civilizations in New Mexico, most notably the abandonment of Chaco Canyon by the Anasazi around 1300 A.D. (Annenberg/CPB Learner.Org). As illustrated in Figure 10, severe, sustained drought has occurred periodically in New Mexico for the past 2,000 years. Figure 10 is based upon patterns of rainfall in New Mexico that are based upon dendrology analyses by Henri D. Grissino-Mayer. The graph indicates previous droughts in green, and high amounts of rainfall in blue. Despite short cycles of severe drought, the latter part of the 20th century was the wettest period in the last 2,000 years. The previous 200 years have been extremely wet, compared to historical rainfall and drought cycles.

Despite the relatively wet cycle of the past 100 years, New Mexico has suffered from four devastating periods of drought; 1900-1910, 1931-1941, 1942-1956, and 1974-1979. The drought during the 1950s greatly affected non-irrigated agricultural areas in New Mexico. Up to that time, many farmers still practiced dry land farming for crops such as wheat and beans. Wheat production in the 1950s was the smallest since 1909 (Cockril, 1959). By the end of the 1950s, about 2,000 wells had been drilled to supplement surface-water irrigation allotments, which had decreased as a result of the drought. Since the 1950s, most agricultural production in New Mexico has been irrigated with surface water or groundwater, thus alleviating the severity of short-term drought conditions.

The last short duration drought ended in 1996 (New Mexico Drought Task Force, May 2002). In June of 2003, a State of Emergency was declared in New Mexico due to drought conditions. In November of 2003 all counties in New Mexico were declared Agriculture Disaster areas due to the losses caused by drought. As seen in Figures 11 and 12, as of June 16, 2004, most of

Bernalillo County is currently designated as being in a severe hydrologic (long term) and a moderate meteorological drought (New Mexico Natural Resources, 2004).

Figure 10: 2000 + Year Pattern of Rainfall in New Mexico Based upon Dendrology Analyses



Source: Henri D. Grissino-Mayer

HAZARD PROFILE – DROUGHT

Hazard Characteristics

A drought is a period of prolonged dryness that contributes to depletion of groundwater and surface-water yields. Defining the exact start of a drought is difficult, as short wet cycles may occur. Climatologists and drought experts at the New Mexico Drought Summit, held in Albuquerque in September 2004, estimate that the current drought the county is experiencing started in 1997 or 1998.

Severity and Probability of Occurrence

The probability of drought in New Mexico is very high. The severity of drought in New Mexico in general, and in Bernalillo County in particular, is somewhat lessened because drought is such a common, persistent condition. With an average annual rainfall of less than 10 inches in most parts of the County, the term "drought" is relative. Even in wet years, Bernalillo County's rainfall is significantly less than what other areas of the country receive and would consider drought conditions. From the analysis of historical patterns of rainfall in the area, a prolonged, severe drought is possible (Table 23). If the area experiences a drought similar in magnitude to historical droughts indicated in Figure 10, then the impact on surface and groundwater supplies could be devastating. The probability and severity of drought is the same for all the jurisdictions of Bernalillo County.

When drought begins, agriculture is usually first to be affected because of its heavy dependence on stored moisture in the soil. Soil moisture can be rapidly depleted during extended dry periods. Dry land farming and ranching are most at risk from drought. Impact on these activities can be seen during a short-term drought. Since there is virtually no dry land farming in Bernalillo County, the impact of a short-term drought on agriculture is small.

Water uses depending on in-stream flows, such as irrigated farmlands and riparian environmental communities, are less exposed to the immediate impacts of drought. For centuries, irrigated farmland along the Rio Grande corridor has relied upon the diversion of river water to nurture crops. The entire settlement pattern along the Rio Grande is built around the system of "acequias," a complex system of irrigation ditches that extends out from the river to irrigate fields. Many of these local acequia associations still self-manage their water use,

however, the Middle Rio Grande Conservancy District (MRGCD) is now in charge of maintaining and monitoring the use of ditch water in the Middle Rio Grande Valley.

Recently, the City of Albuquerque and Bernalillo County have begun to divert water from the river for non-agricultural uses, including watering public parks and for non-potable industrial uses.

Urban and agricultural water uses that rely on reservoirs and wells that are not dependent on high rates of aquifer recharge are the last to feel the effects (New Mexico Drought Task Force, 2002). As explained in the Community Profiles, nearly all of Bernalillo County currently relies upon groundwater for potable water. The severity of the drought is lessened due to the reliance on the sizeable aquifer underlying Bernalillo County. At current consumption rates, the aquifer will continue to yield good water for another 25-30 years. A severe prolonged drought would greatly impact the entire County's ability to provide potable water from groundwater sources. However, the impact of a drought on the underlying aquifer could be lessened by the City's planned diversification of its water sources.

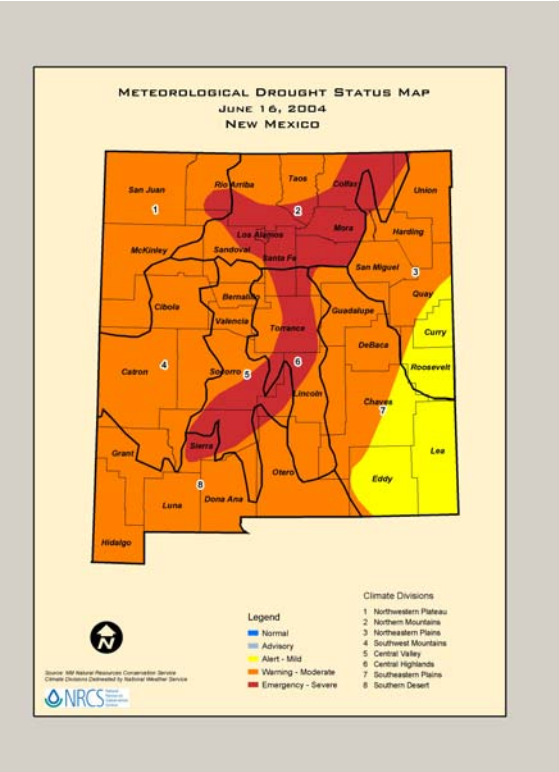


Figure 11: New Mexico Meteorological Drought Map

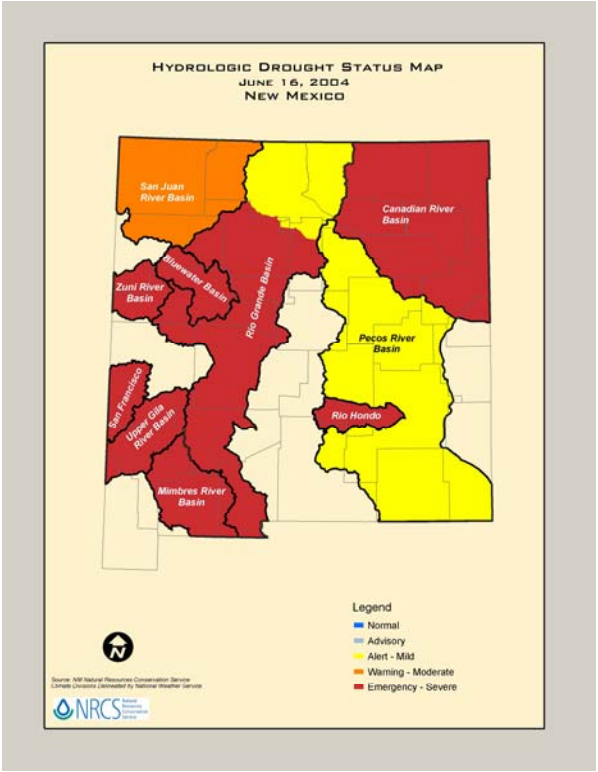


Figure 12: New Mexico Hydrologic Drought Map

In the 1960s, the City of Albuquerque began work on a strategy to reduce their reliance upon groundwater. The City purchased the rights to 48,200 acre-feet of water from the San Juan River. To access this water, the City had to divert the water and carry it across the Continental Divide and into the Rio Grande basin. The San Juan-Chama Diversion Project consists of diversion structures on the Colorado River Basin in southern Colorado that capture part of New Mexico's share of the Colorado River and channel it through 26 miles of tunnels under the Continental Divide into the Rio Grande Basin. Heron Reservoir is a storage facility for this water.

The City has invested more than $40 million in this water system. The City will begin to use this water for potable water demand beginning in 2008. Once the diversion and treatment of this water source is in place, the City and County will derive the majority of its potable water from surface water and thereby reduce its reliance on groundwater.

Table 23: Drought Severity Classification

Level of Notification	Level of Drought	Description
Alert	Mild Drought	Abnormally dry; begins with short-term dryness causing slow-growing pastures or crops and above average fire risk. This period ends with lingering water deficits with pastures and crops not fully recovered. Could indicate less than 75% of normal precipitation for three months.
Warning	Moderate Drought	Some damage to pastures and crops; high fire risk; streams, reservoirs, or wells low; and water shortages developing or imminent with voluntary water use restrictions requested. Could indicate less than 70% of normal precipitation for three months.
Emergency	Severe Drought	Apparent crop or pasture losses; fire risk very high; water shortages common; and water restrictions imposed. Could indicate less than 65% of normal precipitation for six months.

Drought increases the probability and severity of wildfire. Drought also increases the severity of flash flooding due to soils becoming hydrophobic, repelling, or incapable of dissolving in water, resulting in erosion due to increased runoff.

VULNERABILITY ASSESSMENT – DROUGHT

Existing Community Assets

As indicated in Figure 13, agriculture use accounts for more than one-quarter of the total water demand in the Middle Rio Grande Region. This sector of the economy is also the most straightforward for which to estimate losses. During the current drought, water allocations to farmers along the Rio Grande have been cut by more than half. This is due to reduced river flows and requirements to keep a minimum flow in the river for fish and wildlife.

There are 468 farms in Bernalillo County, with a total of 10,630 acres in agricultural use. The locations of these farms are not broken down by jurisdiction. The top five farm commodities of the County are dairy products, cattle and calves, hay and silage, chile, and sheep. The market value of agricultural products sold in Bernalillo County for 2000 was over $31,257,000 million, ranking 12th in the state in agricultural receipts (New Mexico Agriculture Statistics Book, 2002). All farms in Bernalillo County require some irrigation; 6,810 acres use surface irrigation, 630 acres utilize ground irrigation and 3,460 acres depend on a combination of surface and ground irrigation. The use of groundwater and surface water from the Rio Grande moderates the impact of short-term droughts on agricultural production.

Except for the East Mountains area, drinking water for the residents of Bernalillo County come principally from the Albuquerque Bernalillo County Water Utility Authority.

The Village of Tijeras operates two wells for the Village's residents. Potable water for the remainder of East Mountain residents comes principally from private water providers or cooperatives.

The Village of Los Ranchos de Albuquerque is part of the larger City of Albuquerque Bernalillo County Water Utility Authority.

New Mexico's Source Water Assessment and Protection Program (SWAPP) is a federally funded program created to protect communities' drinking water supplies. They assist communities through identifying potential sources of contamination, evaluating susceptibility of wells and surface water intakes to contamination. They work with communities, water utilities, and service providers to protect water quality.

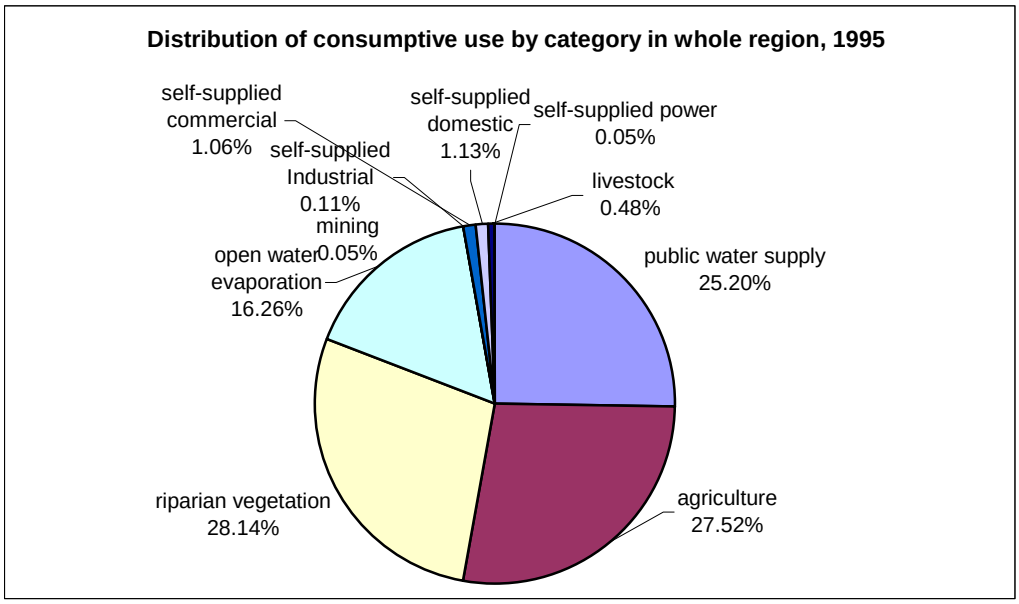


Figure 13: Percentages of Consumptive Use by Category in Middle Rio Grande Region

Source: Future Water Use Projections for the Middle Rio Grande Water Planning Region, MRCOG 2001.

Critical Facilities

Depending on the nature of the operation, critical facilities need water for multiple purposes, from potable water to fire suppression. In the City of Albuquerque, all critical facilities are connected to the municipal water system. The City's groundwater supply provides a buffer from the impact of short-term droughts. In the county, rural fire stations rely on either relatively shallow wells that are sensitive to the impact of moderate droughts, resulting in slower recharge rates for storage tanks and sometimes necessitating drilling new wells to a greater depth. One municipal well in the Village of Tijeras failed in 2002. The replacement cost of the new well was over $100K.

Estimating Potential Loss

Since 1998, there have been 2 reports of drought conditions in Bernalillo County totaling $18K in property damages, according to the National Climate Data Center. The locations of these property damages are assumed to be in the unincorporated portion of the County.

The City of Albuquerque and most parts of Bernalillo County currently obtain 100% of their drinking water from groundwater. An indirect cost of the drought and the area's lack of surface water is the on-going effort to diversify the area's water supply. The Albuquerque Bernalillo

County Water Utility Authority estimates that the effort to implement the San Juan – Chama Water Project has cost $40 million (www.cabq.gov).

Some domestic wells in the East Mountain have dried up, resulting in homeowners having to haul water from offsite for daily and emergency uses. There are no reliable estimates for the overall cost of hauling water versus having access to centralized, municipal water. Due to the unpredictable and oftentimes limited aquifer underlying areas in the East Mountains, homeowners are frequently unable to drill productive wells, either due to the lack of water in the underlying aquifer or due to cost, sometimes as high as $3,000. Homeowners that cannot drill new, productive wells face significant declines in the value of their property due to the lack of water.

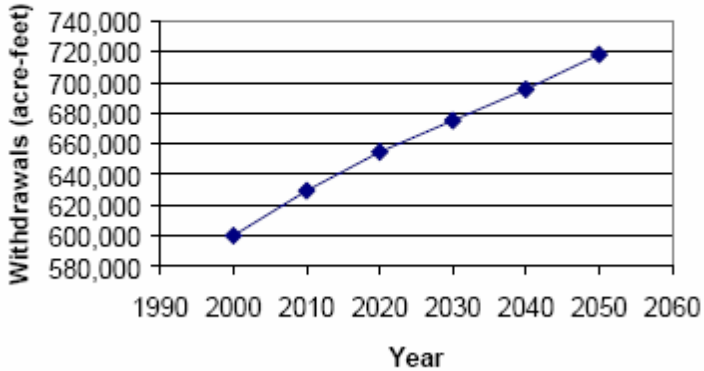
In the northeast quadrant of Albuquerque, subsidence has resulted from groundwater withdrawal from the aquifer. While subsidence has yet not become a major issue or resulted in significant damage, it could pose an increasing threat as groundwater levels drop.

Future Development Trends

As illustrated in Figure 14, the potential impacts of prolonged drought increase significantly with an expanding population. Growth in Bernalillo County is expected to continue; population estimates based on April 2004 data indicates an overall increase of 163,046 persons, or a 27.4% change from 2005 to 2030. Data projections indicate that from the estimated population in 2005 of 595,954, there will be an increase of 35,885 people for 2010, and an increase of 66,993 from 2010-2020, and from 2020-2030 an increase of 60,168 -- for a total population of 759,000 in 2030.

Because groundwater in the City of Albuquerque is typically recharged by surface water from the Rio Grande and its tributaries, a continuation of the current drought and lower water levels in the Rio Grande will lower the water table even farther and require deeper wells. Some wells in the Village of Tijeras have already experienced a water level drop due to the current drought conditions and mining of groundwater. Deeper groundwater also requires more intensive treatment to filter out arsenic and minerals.

Figure 14: Projected Growth in Water Withdrawals in the Planning Region



Source: Future Water Use Projections for the Middle Rio Grande Water Planning Region. MRGCOG, 2001.

The City of Albuquerque and Bernalillo County are expanding a pilot program that uses treated effluent for public irrigation. The Albuquerque Bernalillo County Water Utility Authority is in the process of extending water re-use lines from the Southside Reclamation Plant to major public parks and golf courses on the south end of the County. There is also a similar initiative on the north side of the City that uses reclaimed water to irrigate the Balloon Fiesta Park and provides water for some industrial uses as well. The initial phase of the re-use program is expected to use up to 50,000 acre-feet of reclaimed water annually.

Bernalillo County and the City of Albuquerque have begun to feel the pressure of downstream demands for Rio Grande water. The Rio Grande Compact obligates the State as a whole to deliver a minimum amount of water to Texas from the Rio Grande. During times of drought, the State must leave some of the water that would have been used for irrigation in the river to meet its obligations to deliver water to Texas.

The State has also taken initiatives designed to increase regional cooperation on water plans. The State Legislature directed regional Water Plans in 1987, in part due to a critical lawsuit on water resources appropriation by out of state parties (El Paso v. Reynolds 597 F. Supp. 694 (D.N.M. 1984). The legislation created a regionally-based water resources planning program (§§72-14-43 & 44 NMSA 1978), in 16 state-wide regions, administered by the Interstate Stream Commission.

CONCLUSIONS – DROUGHT

Summary of Hazard Identification and Vulnerability Assessment

All of Bernalillo County is currently in a severe drought situation. Given that drought is a slow-moving hazard without an event to mark its arrival, a one-time drought can be difficult to define. However, the consequences of a moderate to severe drought in Bernalillo County pose significant challenges. Long term solutions for coping with a limited water supply will require increased cooperation between urban users and agricultural use. Critical facilities in rural parts of Bernalillo County may need to increase or diversify their sources of water.

A prolonged drought also increases the probability of other hazards. Forests become more susceptible to wildfires and native vegetation dies, leaving exposed soils susceptible to erosion, flash flooding, and dust storms. The Mitigation Planning Team has identified drought as a priority hazard in Bernalillo County.

What Can Be Mitigated?

The best practices include early assessment, public education, water conservation programs, and diversifying sources of water. Identifying the first phases of the drought and reacting with water conservation at the earliest time will help to mitigate drought later in the disaster. Mitigation management for drought is a proactive process. However, most of the process has been at the local and State level since there is no federal water conservation or drought policy.

The long-term future of water is a fundamental concern to all local governments in the area. Water use projections indicate that depletion of regional water resources will continue unless actions are taken to conserve and utilize water more efficiently, with the ideal goal of balancing supply with demand. The utilization of the San Juan-Chama water will dramatically lessen the City and County reliance upon groundwater.

Governor Richardson signed an executive order to create a State Drought Task Force due to the state of emergency declared in 2003. Experts in financing, water project construction, water rights, conservation, and water quality are drafting strategies for dealing with the State's continuing drought conditions.

Bernalillo, along with Sandoval and Valencia counties, make up the Mid-Region Council of Governments (MRCOG). MRCOG, through its Water Resources Board, has collaborated with the Water Assembly, an all-volunteer non-profit organization, to develop a Middle Rio Grande Regional Water Plan. The Plan addresses the region's available water supply, the region's future water demand and examines alternatives the region may undertake to supply increased demand. Funding for Middle Rio Grande regional water planning is being provided through the

Interstate Stream Commission and by direct contributions from MRCOG member governments. The Middle Rio Grande Water Assembly has created a Middle Rio Grande Water Budget, which details "where water comes, from, and goes, and how much."

The following section is excerpted from the City of Albuquerque website to illustrate the extent of the City's efforts on water conservation, excerpted from www. cabq.gov.

The City of Albuquerque has initiated an extensive water conservation program with a goal to reduce water usage by 40% by 2014. A program started in 1994 had a goal of a 30% reduction in water use in ten years, has resulted with residential customers reducing their usage by 32% since the program began.

The City has implemented programs to instruct wise water use and reduction or elimination of water waste. Surcharges are applied to customer's accounts for exceedingly high use. Voluntary programs include an even/odd day watering schedule and the *WaterWatch Program* which instructs residents watering by following yellow, red, or green water drop days, which are widely advertised.

They have also passed mandatory policies regarding new landscaping and watering on municipal properties. Mandatory rules for new construction also have been implemented regarding planting and water use on slopes, regulations on high water use plants, and low flow plumbing fixtures are required in all residential construction.

A few examples of actual water reduction include: the Southside Water Reclamation Plant's recycling facility changing using treated wastewater rather than drinking water for irrigation, low flow fixtures have been installed in public housing units and in community centers, and Rio Grande Zoo exhibits have been converted to recycled water.

The City's incentive programs include rebates and free high-efficiency products and retrofits for conserving water for businesses and residents. Rebates for rainwater harvesting barrels, hot water recirculation units, sprinkler timers, and dishwashers are available. The City also provides free templates for homeowners to *xeriscape* or landscape with low water use and native plants.

Industrial, commercial, institutional, and residential water audits provide an analysis of water use patterns to assist in developing target areas where water conservation improvements can be effectively implemented and are available at no charge from the City. The City also hosts free water conservation seminars and has additional information on the City webpage.

Data Limitations

It is difficult to determine when a drought hazard event starts. In most cases, the dry weather conditions that cause droughts will need to persist for a while before it becomes clear that drought conditions exist. There are also data limitations in determining the available quantity and quality of groundwater. The costs associated with the drought are difficult to quantify. Crop losses are straightforward, but losses from tourism dollars due to all uncertainty about availability of water are more difficult to define.

It is difficult to estimate indirect losses such as loss of businesses that decide not to locate or expand in Bernalillo County due to uncertainty about water availability

The potential loss of acequias cannot be calculated in monetary terms, but rather as a historical, environmental, and cultural loss.

SEVERE WEATHER

OVERVIEW – SEVERE WEATHER IN BERNALILLO COUNTY, NEW MEXICO

Bernalillo County experiences some form of severe weather activity annually, based on seasonal meteorological patterns and local topographical conditions. The County is susceptible to a full range of weather conditions, including: tornadoes and high winds, thunderstorms, extreme temperatures, and winter storms. All areas of Bernalillo County are susceptible to severe weather conditions, although local topography, such as elevation and land contours, plays a significant part in how weather affects a particular area. At the time of storm occurrence, one community may experience severe damage while another, located nearby, escapes with minimal impact.

The effects of severe weather vary according to the type of hazard. Tornadoes and wind storms can topple manufactured homes, destroy buildings, lift cars, snap trees (which create roadblocks), topple power lines (can cause an electrocution hazard and cripple local infrastructure), and cause injury and death. Thunderstorms can cause substantial rainfall leading to localized flash flooding. Additionally, thunderstorms cause lightning strikes which may start wildfires and lead to injury and death. Hailstorms are another potential result of thunderstorms. Hailstorms can damage agricultural crops and cause property damage. Extreme temperatures generally affect at risk sectors of the population: the elderly, the young, the sick/infirmed, those living below the poverty level and outdoor laborers. Winter storms often have the effect of disrupting transportation and commerce. Injury to people and property result from heavy loads of snow and ice causing collapse of roofs of buildings, felling trees and telephone poles, knocking down electrical lines, and creating slippery conditions for pedestrians and vehicles.

PREVIOUS OCCURRENCES – SEVERE WEATHER

Bernalillo County experiences a variety of severe weather events. In the past 20 years, heavy precipitation, high winds, thunderstorms, lightning, hail, and winters storms have resulted in death, injuries and damage to personal property (Table 24). Other types of thunderstorm events that affect Bernalillo County include dry microbursts, tornadoes, and lightning. The five tornadoes reported in Bernalillo County between 1984 and 2003 were all classified as low intensity or “Gale Tornadoes” due to wind speed.

Table 24: Severe Weather Occurrences from 01/01/1950 to 07/31/2006					
Event Type	**Number of Occurrences**	**Magnitude**	**Deaths**	**Injury**	**Property Damage**
Hail	26	1" and greater	0	0	4 M
Lightning	13	N/A	1	12	17K
Precipitation	8	N/A	0	1	1.05M
Snow & Ice	0	0	0	0	0
Temperature Extremes	0	0	0	0	0
Thunderstorms & Wind Storms	46	50 to 78 kts	0	5	102K
Tornadoes	11	F0 – F1*	0	0	278K
Totals	104	N/A	1	18	$5,447,000

Source: http://www.4ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms
Notes: In 1965, a tornado was recorded at a magnitude of F1, all other tornadoes in Bernalillo County were at F0.

HAZARD PROFILE – SEVERE WEATHER

Hazard Characteristics

The complex terrain of New Mexico, ranging from the eastern plains, to the high mountains across the northern and western regions, to the Rio Grande valley, creates weather regimes that change quickly over relatively short distances. Highway travelers may find themselves in light snow or rainy conditions, then suddenly in heavy snow conditions, as the highway climbs through a mountain pass. The weather may be relatively mild and sunny along the Rio Grande valley in Albuquerque, while winter conditions are found in the eastern, higher elevation part of the county.

Tornadoes/Wind Storms

Tornadoes are rapidly rotating funnels of wind extending from storm clouds to the ground. They are created during severe weather events, such as thunderstorms and hurricanes, when cold air overrides a layer of warm air, causing the warm air to rise rapidly. Among the most unpredictable of weather phenomena, tornadoes can occur at any time of day, in any season. While a majority of tornadoes cause little or no damage, some are capable of tremendous destruction, reaching wind speeds of 250 mph or more. Tornadoes are most dangerous when they occur in populated areas, toppling mobile homes, lifting cars, snapping trees, and turning objects into destructive missiles.

Tornado intensity is measured by the Fujita Tornado Measurement Scale (Table 25). This scale determines likely wind speeds based on the severity of tornado damage and assigns a scale category, F0 – F6. The table shows the tornado categories, corresponding wind speed, and types of damage possible.

Table 25: Fujita Tornado Measurement Scale			
F-Scale Number	**Intensity Phrase**	**Wind Speed (mph)**	**Effects**
F0	Gale Tornado	40 – 72	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.
F1	Moderate Tornado	73 – 112	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	Significant Tornado	113 –157	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.
F3	Severe Tornado	158 –206	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
F4	Devastating Tornado	207 –260	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
F5	Incredible Tornado	261 –318	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile-sized missiles fly through the air in excess of 100 meters; trees debarked; steel-reinforced concrete structures badly damaged.
F6	Inconceivable Tornado	319 –379	These winds are very unlikely. The small area of damage they might produce would probably not be recognizable along with the mess produced by F4 and F5 wind that would surround the F6 winds. Missiles, such as cars and refrigerators would do serious secondary damage that could not be directly identified as F6 damage. If this level is ever achieved, evidence for it might only be found in some manner of ground swirl pattern, for it may never be identifiable through engineering studies.

Source: http://www.tornadoproject.com/fscale/fscale.htm

Tornadoes are rare in Bernalillo County. While the occurrence and location of tornadoes are unpredictable, all tornadoes that have occurred in Bernalillo County in the past 20 years have been classified as low intensity (F0) and have done little damage.

Wind storms have sustained winds of 40 mph or gusts of 58 mph or greater, are not caused by thunderstorms, and are expected to last for an hour or more. High wind/wind storms may down trees and power lines and cause structural damage to homes and businesses.

Wind storms are classified according to the Beaufort Wind Force Scale for measuring wind intensity, and are rated on a scale of 0 to 12 (Table 26). The one-minute average wind speed is the determining factor in the Beaufort scale.

Table 26: Beaufort Wind Force Scale			
Beaufort Number	**Wind Speed (mph)**	**Wave Height (feet)**	**Land Conditions**
Force 0	0	0	Calm. Smoke rises vertically.
Force 1	1 – 3	0.25	Wind motion visible in smoke.
Force 2	4 – 7	0.5 – 1	Wind felt on exposed skin. Leaves rustle.
Force 3	8 – 12	2 – 3	Leaves and smaller twigs in constant motion.
Force 4	13 – 18	3.5 – 5	Dust and loose paper raised. Small branches begin to move.
Force 5	19 – 24	6 – 8	Smaller trees sway.

Table 26: Beaufort Wind Force Scale			
Beaufort Number	**Wind Speed (mph)**	**Wave Height (feet)**	**Land Conditions**
Force 6	25 – 31	9.5 – 13	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult.
Force 7	32 – 38	13.5 – 19	Whole trees in motion. Effort needed to walk against the wind.
Force 8	39 – 46	18 – 25	Twigs broken from trees. Cars veer on road.
Force 9	47 – 54	23 – 32	Light structural damage.
Force 10	55 – 63	29 – 41	Trees uprooted. Considerable structural damage.
Force 11	64 – 72	37 – 52	Widespread structural damage.
Force 12	>72	46+	Massive and widespread damage to structures.

Source: http://www.srh.noaa.gov/bro/beau.htm

Wind storms are frequent in Bernalillo County. Twelve storms have occurred since February 2000, with wind speeds between 58 and 90 mph (National Climatic Data Center, NOAA). The most recent wind storm occurred on June 26, 2006, with winds up to almost 90 mph, however, no injuries, deaths or property damage resulted from the storm (National Climatic Data Center, NOAA).

Thunderstorms/Lightning/Hail

Thunderstorms develop when air masses of varying temperatures collide. Rapidly rising humid air fuels thunderstorms. The storms can occur alone, in clusters or in a line. Thunderstorms are classified as severe when they produce hail at least 0.75 inches in diameter, have winds of up to 58 mph or higher, or if they produce a tornado.

Thunderstorms are responsible for much of the severe weather across New Mexico. The storms are capable of producing lightning, flash flood events, hail, tornadoes, and strong winds (see "Flash Floods" subsection of this Plan for more information about flooding in Bernalillo County). The thunderstorm (or monsoon) season in New Mexico is well defined, from early July to September. Thunderstorms are almost a daily occurrence during July and August, especially over the northwest and north central mountains of New Mexico.

Lightning is the electrical discharge resulting from the accumulation of electrical energy between positively and negatively charged areas in the atmosphere. A cloud-to-ground lightning strike occurs when a channel of electrically charged air moving from the cloud to the ground nears an object on the ground; the electricity surges from the ground up to the clouds, producing a visible lightning strike.

Lightning usually occurs as a result of thunderstorms that move through New Mexico during the summer months, with peak lightning strikes occurring in July and August. Lightning does not normally cause significant damage to property; however, it is responsible for numerous power outages, and is the leading cause of weather-related injuries and fatalities in New Mexico.

Hail is an annual weather event in Bernalillo County. A hailstorm is a severe thunderstorm in which balls or irregularly shaped lumps of ice greater than 0.75 inches (3/4-inch) in diameter fall with rain. Hail size and hailstorm intensity is measured by the TORRO Scale (Table 27). The size of the hail is directly related to the size and severity of the storm. As a hail storm develops, ice crystals form in a low-pressure front due to rapidly rising warm air into the upper atmosphere and subsequent cooling of that air mass. Water droplets freeze to the surface of the ice crystal,

gradually increasing their size and weight. When the ice crystals become too heavy to remain aloft, they fall as precipitation.

Table 27: TORRO Hailstorm Intensity Scale

Intensity Code	Intensity Category	Maximum Diameter – Inches (mm)	Description	Typical Damage Impacts
H0	Hard Hail	1/8" – 3/8" (5-9)	Pea	No damage.
H1	Potentially Damaging	3/8" – 1/2" (10-15)	Mothball	Slight damage to plants, crops.
H2	Potentially Damaging	5/8" – 3/4" (16-20)	Grape	Significant damage to fruit, crops, vegetation.
H3	Severe	3/4" – 1 1/8" (21-30)	Walnut	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored.
H4	Severe	1 1/4" – 1 1/2" (31-40)	Robin's Egg	Widespread glass damage, vehicle bodywork damage.
H5	Destructive	1 5/8" – 2" (41-50)	Golf Ball	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries.
H6	Destructive	2" – 2 3/8" (51-60)	Chicken Egg	Aircraft bodywork dented, brick walls pitted.
H7	Very Destructive	2 3/8" – 3" (61-75)	Tennis Ball	Severe roof damage, risk of serious injuries.
H8	Very Destructive	3" – 3 1/2" (76-90)	Softball	Severe damage to aircraft bodywork.
H9	Super Hailstorm	3 1/2" – 4" (91-100)	Grapefruit	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open.
H10	Super Hailstorm	>4" (>100)	Melon	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open.

Source: http://www.torro.org.uk/TORRO/severeweather/hailscale.php

In Bernalillo County, the average hail size is one inch, roughly corresponding to H3, Severe, on the TORRO Scale (Table 27). No property, crop, or personal damages had been reported by the NCDC due to this type of weather in the past 20 years; however, a hailstorm in October of 2004 caused nearly $40 million dollars of damage.

Extreme Heat

Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. In an average year, extreme heat kills 175 people (FEMA Extreme Heat Backgrounder). Young children, the elderly, outdoor laborers, and sick people are the most likely to suffer the effects of extreme heat.

The heat index measures the severity of hot weather by estimating the apparent temperature: how hot it feels (Table 28). Skin resistance to heat and moisture transfer is directly related to skin temperature, therefore the ambient temperature can be quantified by examining the relation between relative humidity versus skin temperature. If the relative humidity is higher/lower than the base value, the apparent temperature is higher/lower than the ambient temperature.

Table 28: Heat Index/Heat Disorders		
Danger Category	**Heat Disorders**	**Apparent Temperature (°F)**
I Caution	Fatigue possible with prolonged exposure and physical activity.	80-90
II Extreme Caution	Sunstroke, heat cramps, and heat exhaustion possible with prolonged exposure and physical activity.	90-105
III Danger	Sunstroke, heat cramps, and heat exhaustion likely; heatstroke possible with prolonged exposure and physical activity.	105-130
IV Extreme Danger	Heatstroke or sunstroke imminent.	>130

Source: National Weather Service

In New Mexico at elevations below 5,000 feet, individual day-time temperatures often exceed 100°F during the summer months. However, during July, the warmest month, temperatures range from slightly above 90°F in the lower elevations to 70°F in the higher elevations (Western Region Climate Center, www.wrcc.dri.edu/narratives/newmexico.htm).

Winter Storms/Extreme Cold

Winter storms have significant snowfall, ice, and/or freezing rain, with the quantity of precipitation variable by elevation. According to the National Weather Service, heavy snowfall is four inches or more in a 12-hour period, or six or more inches in a 24-hour period in non-mountainous areas; and 12 inches or more in a 12-hour period or 18 inches or more in a 24-hour period in mountainous areas. Winter storms vary in size and strength and include heavy snowfalls, blizzards, freezing rain, sleet, ice storms, blowing and drifting snow conditions, and extreme cold.

A blizzard is a winter storm with considerable falling and/or blowing snow combined with sustained winds or frequent gusts of 35 mph or greater that frequently reduces visibility to less than one-quarter mile. Extremely cold temperatures accompanied by strong winds can result in wind chills that cause bodily injury such as frostbite and death.

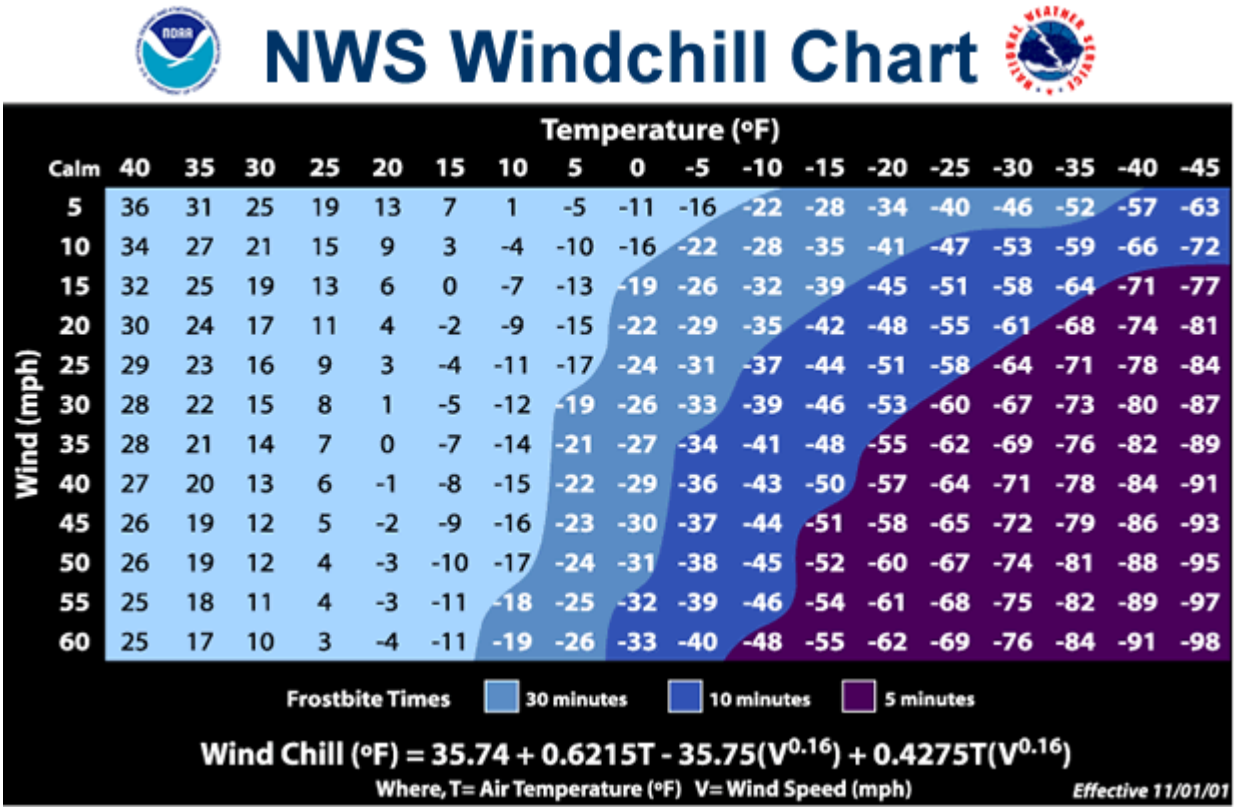
Winter storm occurrences tend to be very disruptive to transportation and commerce. Trees, cars, roads, and other surfaces develop a coating or glaze of ice, making even small accumulations of ice extremely hazardous to motorists and pedestrians. The most prevalent impacts of heavy accumulations of ice are slippery roads and walkways that lead to vehicle and pedestrian accidents; collapsed roofs from fallen trees and limbs; heavy ice and snow loads; and downed telephone poles and lines, electrical wires, and communication towers. Such storms can also cause exceptionally high rainfall that persists for days, resulting in heavy flooding.

Winter storms that affect Bernalillo County begin as low-pressure systems that move through New Mexico following the jet stream. These storms may include heavy snowstorms, sleet storms, ice storms, blizzards, and severe blizzards.

Extreme cold occurs when temperatures drop below normal and wind speeds increase, as this occurs, the body is cooled at a faster rate than normal, causing the skin temperature to drop,

which can lead to frostbite (when body tissues freeze) and hypothermia (abnormally low body temperature, <95°F). Extreme cold is measured by the wind chill temperature index (Table 29). The index is based on heat loss from exposed skin and includes a frostbite indicator. Three shaded areas show how long a person can be exposed before frostbite develops.

Table 29: Wind Chill Temperature Index



Source: National Weather Service New! Wind Chill Temperature Index Brochure, 2001.

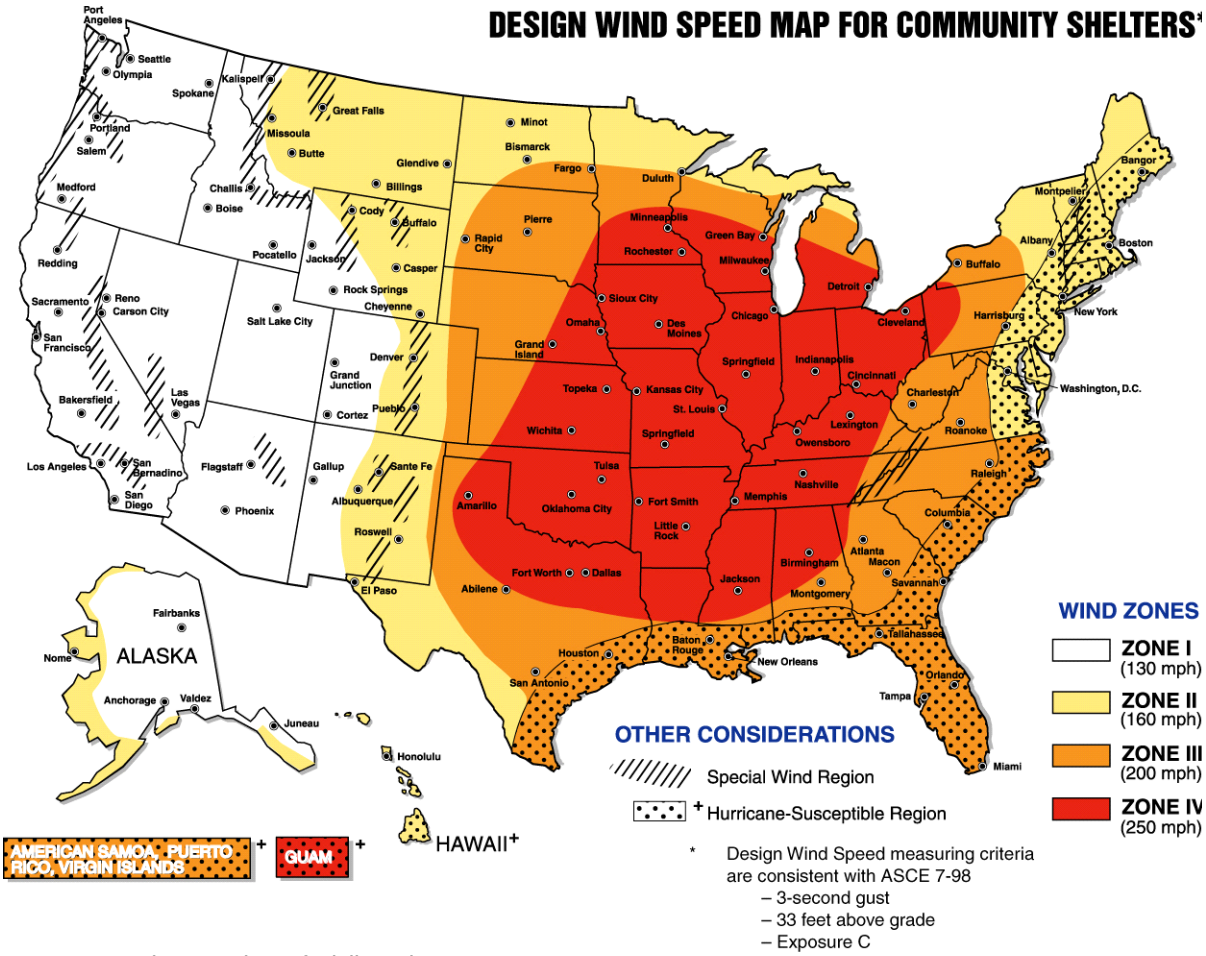
In New Mexico, January is the coldest month. Day-time temperatures range from the mid-50s in the southern and central valleys to the mid-30s in the north's higher elevations. Minimum temperatures below freezing are common throughout the state, however subzero temperatures are rare, even in the mountains (Western Region Climate Center, www.wrcc.dri.edu/narratives/newmexico.htm).

Severity and Probability of Occurrence

Tornadoes/Wind Storms

High winds occur frequently in Bernalillo County. According to the Design Wind Speed Map for Community Shelters (Figure 15), Bernalillo County lays within wind speed Zone II, with possible extreme wind speeds of 160 mph, and an annual probability of exceedance of 0.02 (i.e., 50-year mean recurrence interval). Due to occasional abnormally high wind velocities and the age of some structures, damage is likely to continue to occur.

Figure 15: Design Wind Speed Map for Community Shelters



Source: American Society of Civil Engineers, 7-98

Thunderstorms/Lightning/Hail

Nearly half of the annual precipitation in the City of Albuquerque results from afternoon and evening thunderstorms during the summer. Thunderstorm frequency increases rapidly around July 1st, peaks during August, and tapers off by the end of September. Thunderstorms are usually brief, sometimes produce heavy rainfall, and often lower afternoon temperatures noticeably.

Hail and intense lightning are common. Hailstorms in the past 50 years have caused roughly 4 million dollars in property damage; however no deaths or injuries have been reported (Table 24). Damage during hailstorms is likely to occur to automobiles and structures. There have been 7 recorded deaths due to lighting in New Mexico between 1995 and 2004 (NOAA Lightning Safety). In 2004, there were 985,025 cloud-to-ground flashes in New Mexico. On average, New Mexico experienced 919,464 cloud-to-ground flashes from 1996 to 2005 (National Lightning Detection Network). Injury due to lightning strikes is possible, though not a large risk. However, lightning strikes have been responsible for starting 19 wildfires between 1992 and 2003, resulting in 827 acres burned (Table 4). The danger of wildfire starting from a lightning strike is medium to high (Table 3) and will likely result in the loss of structures and death or injury to humans and wildlife.

Extreme Heat

Summer temperatures in Bernalillo County are generally between 70°F and 90°F, with day-time temperatures often exceeding 100°F. In temperatures exceeding 90°F, young children, the elderly, outdoor laborers, and sick people are the most likely to suffer from sunstroke, heat cramps, heat exhaustion, and possibly heatstroke.

Winter Storms/Extreme Cold

Due to differences in altitude and terrain, the severity of winter storms and extreme cold varies in the different communities in Bernalillo County. The majority of the population and development in Bernalillo County lies within the central portion of the County and the City of Albuquerque. Winter storm events in these areas are usually short-lived and average only a few inches of snowfall. The eastern portion of the County and the Village of Tijeras experience more severe storms and significant accumulations of snow. Tijeras Canyon and unincorporated parts of Bernalillo County experience high winds and winter storms with up to 24 inches of snow, and routinely result in I-40 closures. Snow cover on the east slopes of the Sandia Mountains is sufficient for skiing during most winters.

VULNERABILITY ASSESSMENT – SEVERE WEATHER

Estimating Potential Losses

- ✓ *Tornadoes and High Winds* - The Wind Speed Map for Community Shelters (Figure 15) is a useful tool for determining vulnerability to high wind events like tornadoes. It identifies wind speeds that occur frequently enough in different parts of the U.S. to be used as the basis for the design of buildings and facilities, such as utility transmission towers and the evaluation of their structural integrity. While these design wind speeds refer to the wind loads necessary for community emergency shelters, the map shows that, compared to the rest of the United States, New Mexico and Bernalillo County generally have relatively low wind dangers.

  Since high wind events may affect the entire County, it is important to identify specific critical facilities and assets that are most vulnerable to the hazard. Evaluation criteria include age of the building (and what building codes may have been in effect at the time of construction), type of construction, and condition of the structure (how well has the structure been maintained). Data for individual structures were not available for this study, so it was difficult to determine the exact number and types of structures in Bernalillo County that have a heightened vulnerability to wind hazards.

Table 30: Manufactured Housing in Bernalillo County

	Percent	Number
City of Albuquerque	4.4 %	8,653
Village of Tijeras	21.3 %	43
Village of Los Ranchos de Albuquerque	9.6 %	201
Bernalillo County (all areas)	6.5 %	15,582

Table 31: All Housing Built Prior to 1969 in Bernalillo County		
	% Structures	**# Structures**
City of Albuquerque	37.9%	75,427
Village of Tijeras	39.5%	80
Village of Los Ranchos De Albuquerque	48.8%	1,019
Bernalillo County (Total)	37.9%	90,577

However, according to U.S. Census 2000, 15,582 housing units in Bernalillo County (6.5 percent of the housing) have been identified as manufactured or mobile homes. Additionally, nearly 50% of the housing structures (144,693 structures) were built prior to 1970 and are in conditions that vary depending on maintenance and quality of the original workmanship (see Tables 30 and 31).

- ✓ *Thunderstorms/Hail/Lightning* – Thunderstorms in Bernalillo County can produce heavy rainfall in a short period of time, resulting in flash flooding. The vulnerability assessment of the results of flash flooding is presented under the hazard "Flash Floods" elsewhere in this report. Hailstorms are generally most damaging to agricultural crops and vehicles. Protecting vehicles from hail involves decreasing the vehicle's exposure to hail by housing the vehicle in a garage or another covered structure, however, this is not an option for protecting crops. Data for crop protection from hailstorms was not available for study. Manufactured housing (Table 30) and structures in poor condition may also be vulnerable to hail damage. All golf courses in the City of Albuquerque have lightning warning systems, which read the ionic levels in the atmosphere and signal a warning prior to a lightning striking in the area.
- ✓ *Extreme Heat* – Roughly one third of the population of Bernalillo County are at risk from the effects of extreme heat, excluding outdoor laborers and the sick/injured, as information on their numbers was not available at the time of the study (Table 32).

Table 32: Population of Bernalillo County at Risk to Effects of Extreme Heat		
	Percentage of County's Total Population	Population Sector
	11.6	Persons over 65 Years of Age
	7	Persons under 5 Years of Age
	14.8*	Persons Living Below the Poverty Level
Total	33.4%	
Total County Population	603,562	
Total Number Persons at Risk	201,187	

Source: http://www.census.gov State & County QuickFacts, 2005
*A portion of this population may intersect with persons over 65 and persons under 5 years of age.

Persons living below the poverty level are included in the estimation of the at risk population because they are less likely to have air conditioning and to have the means to seek relief from extreme heat.

- ✓ *Winter Storms and Extreme Cold* - Disruptions of emergency and other essential services are the main impacts of snowstorms; limited snow removal equipment exacerbates those impacts in isolated communities like Tijeras. Vulnerability to the effects of winter storms on buildings is dependent on the age of the building, building codes in effect at the time it was built, type of construction, and condition of the structure. Data for individual structures was not available for this study, so it was difficult to determine the exact number and types of structures within Bernalillo County that have heightened vulnerability to snow loads. Tijeras Canyon experiences road closures and accidents due to ice, snow, and high winds from winter storms.

Critical Facilities

Of all the severe weather hazards, critical facilities are typically vulnerable to wind damage and the effects of winter storms. Critical facilities that are vulnerable to wind damage are mainly those of older construction and in poor condition, especially in the more rural and isolated areas of the County. No specific critical facilities have been identified as particularly vulnerable to high winds.

Several critical facilities in the County are vulnerable to the effects of severe winter storms, such as potential disruption of services and public transportation systems, specifically Interstates 40 and 25, as well as possible structure failure due to heavy snow loads. Because of security issues, the list of critical facilities is not included in this document; however, Bernalillo County maintains the list at its Office of Emergency Management.

Future Development Trends

The majority of population growth and business development is anticipated in the urban center of Albuquerque and adjacent unincorporated county lands. Current building code regulations have rigorous standards for roof loads and wind shear, so new structures do not measurably increase the risk associated with severe storms. Lightning surge protection is included in the 2000 National Electric Code, the current code in force in the County.

CONCLUSIONS – SEVERE WEATHER

Summary of Hazard Identification and Vulnerability Assessment

Bernalillo County has occasional high winds, thunderstorms, hailstorms, and extreme summer and winter temperatures and winter storms. Generally, winter storms have a higher impact on the eastern portion of Bernalillo County and the Village of Tijeras. Winter storms routinely result in the closure of I-40 through Tijeras Canyon. The Mitigation Planning Team lists severe weather as the fourth priority hazard in this Plan.

What Can Be Mitigated?

Severe weather indicators and instructions are needed in large venues such as the State Fair Grounds and Journal Pavilion. Community input to the Plan suggested posting severe weather instructions at all professional, collegiate, and community recreational/ball fields to educate the public on what to do in the case of severe weather.

One important part of mitigating severe weather hazards is forecasting and warning so that people can prepare. Communities can prepare for disruptions of utilities and transportation due to severe weather by advising people to stay home or to use caution if they must go out and by recommending that people stock up on food, water, batteries, and other supplies. The National Weather Service, combined with local television stations, have an effective strategy for notifying residents about impending storms.

To mitigate damage to structures, consistently enforcing building codes provides the greatest benefit for new construction. For existing structures and critical facilities, follow-up inspections and retrofits will provide effective mitigation.

Data Limitations

Manufactured homes that are not adequately anchored are the most vulnerable structures for damage from severe weather. The information necessary to determine the location and condition of manufactured homes and aged or dilapidated structures was not available through the County Assessor's Office. Consequently, the Mitigation Planning Team could not quantify vulnerability to damage from severe storms. The Mitigation Planning Team could also not specify which critical facilities were vulnerable to severe weather. Subsequent versions of this Plan will need to incorporate and respond to these data.

OVERVIEW – EARTHQUAKES IN BERNALILLO COUNTY

Earthquakes result from sudden ground motion or trembling caused by a release of strain accumulated within or along the edge of the Earth's crustal plates. Earthquakes occur most frequently in the boundaries between the great crustal plates that form the earth's outer shell. As these plates move, stress accumulates. Eventually, when faults along or near plate boundaries slip abruptly, an earthquake occurs. Although earthquakes in the United States have caused less economic loss annually than other hazards, they have the potential to cause great, sudden loss in proximity to the epicenter. Within one to two minutes, an earthquake can devastate a city through ground-shaking, surface-fault ruptures, and ground failures. Seismic hazards often trigger other devastating events, such as landslides, fires, and damage to dams and levees. Bernalillo County lies within a rift valley with dormant volcanoes on the west escarpment and the Sandia Mountains on the east rising almost 7,000 feet from the valley floor. The underlying geology of the area is still gradually pulling the area apart from east to west.

Commercial and residential buildings, as well as critical care and first responder facilities can be toppled or severely damaged during an earthquake. Transportation routes (roads, railroads, bridges, tunnels) can be damaged or destroyed. Utilities and infrastructure are also vulnerable to damage/destruction by earthquakes: sewer lines, water lines, utility lines, and gas lines. Death and injuries that directly result from earthquakes are unlikely, but they can occur indirectly when structures/infrastructure/transportation routes collapse.

PREVIOUS OCCURRENCES – EARTHQUAKES

Though not nearly as big or as numerous as in some other parts of the world, earthquakes have rattled New Mexico over the years. Figure 16 depicts the approximate epicenters for past earthquakes in New Mexico and its surrounding areas between 1962 and 1995. Seismologists of the Geophysics Program at the New Mexico Institute of Mining and Technology prepared the map. Historical data on earthquakes in the Albuquerque area documented at USGS Earthquake Hazards Program states the following:

> *Albuquerque has been the center of several moderately strong shocks. On July 12, 1893, three intensity V earthquakes shook every house in the city. Clocks stopped, and one report told of a chandelier swinging for 10 minutes. On December 3, 1930, two distinct shocks cracked plaster and dishes. A strong localized shock of intensity VI on February 4, 1931, caused people to leave houses and created a near panic situation in theaters. Many people reported they were thrown from bed. Some building damage and landslides occurred. On November 6, 1947, Zamora, slightly east of Albuquerque, was shaken by an earthquake. Cracks were reported in plaster and a fireplace.*
>
> *Minor plaster cracks in a bank building in Albuquerque were reported from an intensity V earthquake on November 3, 1954. The shock was also felt at Bernalillo, Sandoval, and Sandia Pueblo. A lighter shock on November 2 was felt over the same area. An earthquake, measured at 3.8, on November 28, 1970, awakened thousands at Albuquerque. The shock had a felt area of 3,000 square kilometers. The roof of a barn collapsed and a rooftop air-conditioner shook loose and fell through a skylight. Plaster cracks, broken windows, and many other instances of minor damage were reported. Many burglar alarms were activated. On January 4, 1971, another shock caused considerable minor damage in Albuquerque, principally at the University of Albuquerque.*

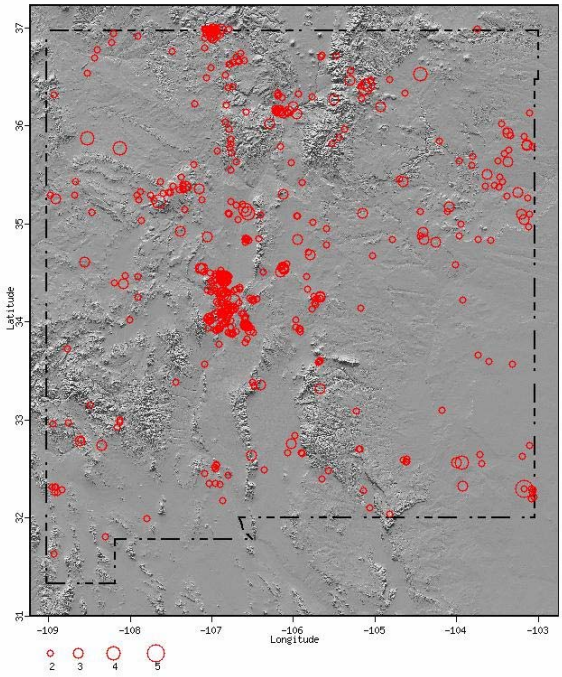


Figure 16: Past Earthquake Epicenters In New Mexico

Source: http://tremor.nmt.edu/EqMap.html

HAZARD PROFILE – EARTHQUAKES

Hazard Characteristics

The dense cluster of earthquakes in the very center of the state seen in the figure above is related to the activity of a body of magma (molten rock) about 12 miles deep within the Earth's crust. Seismologists cannot see the magma body directly, but careful measurements and studies of the way seismic waves move through the Earth's crust has allowed seismologists to map out its location.

Severity and Probability of Occurrence

The severity of an earthquake depends on the amount of energy released from the fault or epicenter of the earthquake. The severity is described in terms of magnitude and intensity. *Magnitude* characterizes the total energy released, and *intensity* subjectively describes effects at a particular place. While an earthquake has only one magnitude, its intensity varies throughout the affected region.

The Richter Scale is a logarithmic magnitude scale that defines magnitude in terms of the motion that would be measured by a standard type of seismograph. On the Richter Scale, magnitude is expressed in whole numbers and decimals. For every increase of 1.0 on the Richter Scale, the energy released by the earthquake increases 10-fold. In more qualitative terms, an earthquake of 5.0 is a moderate event, 6.0 is a strong event, 7.0 is a major earthquake, and 8.0 or higher is catastrophic. The effect of an earthquake on the Earth's surface is called the intensity. In the United States, the most commonly used intensity scale is the Modified Mercalli Intensity Scale (MMI).

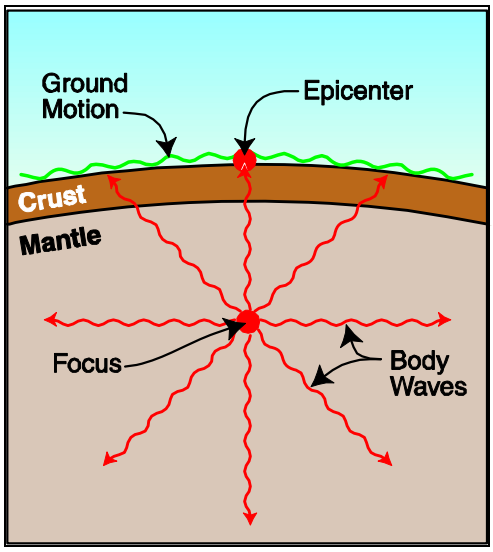


Figure 17: Definition Sketch for Earthquake

Source: Understanding Your Risks – FEMA Publication 386-2, page 2-16

Another way to express earthquake severity is to compare the rate at which the ground surface accelerates due to an earthquake's force, with the rate of acceleration experienced by a falling object due to gravity. Peak ground acceleration (PGA) measures the strength of ground movements in this manner. PGA represents the rate in change of motion of the Earth's surface during an earthquake as a percent of the established rate of acceleration due to gravity (where g = 980 cm/sec2 or 32 ft/sec2). Although the specific damages caused by different magnitudes of earthquakes are listed in Table 33 below, as a rule of thumb, ground acceleration must exceed 15 PGA (or 15% of the gravitational acceleration rate) for significant damage to occur. Table 33 shows the relationship among PGA, magnitude, and intensity. The relationship is, at best, approximate and also depends on such variables as the distance from the epicenter and depth of the epicenter.

Plate 7 shows that an earthquake in Bernalillo County has the potential for a magnitude of VIII to IX on the MMI, which translates to 6.0 –6.9 on the Richter scale. The chance of this magnitude earthquake occurring is very low: A recent study characterizes the chances as follows: *The probability of such an event occurring is on the order from one chance in several thousand to more than one chance in 10,000 on an annual basis* (*Earthquake scenario and probabilistic ground-shaking hazard maps for the Albuquerque-Belen-Santa Fe, New Mexico corridor*). If this magnitude earthquake did occur, it could result in considerable damage to specially-designed structures, and great damage in buildings not designed for seismic conditions. Table 33 shows the relationship between the three measurements for seismic activity and the extent of damage that can be anticipated with each level of intensity.

Table 33: Earthquake Magnitude / Intensity Comparison			
PGA (% g)	**Magnitude (Richter)**	**Intensity (MMI)**	**Description**
<0.17	1.0 - 3.0	I	I. Not felt except by a very few under especially favorable conditions.
0.17 - 1.4	3.0 - 3.9	II - III	II. Felt only by a few persons at rest, especially on upper floors of buildings. III. Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motorcars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
1.4 - 9.2	4.0 - 4.9	IV - V	IV. Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motorcars rocked noticeably. V. Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
9.2 - 34	5.0 - 5.9	VI - VII	VI. Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight. VII. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; chimneys broken.
34 - 124	6.0 - 6.9	VIII - IX	VIII. Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, and walls. Heavy furniture overturned. IX. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
>124	7.0 and higher	X or higher	X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent. XI. Few, if any (masonry), structures remain standing. Bridges destroyed. Rails bent greatly. XII. Damage total. Lines of sight and level are distorted. Objects thrown into the air.
Source: Wald, D., et al., 1999, "Relationship between Peak Ground Acceleration, Peak Ground Motion, and Modified Mercalli Intensity in California," Earthquake Spectra, v. 15, p. 557 – 564. *Community Internet Intensity, USGS Modified Mercalli Intensity, and Instrumental Intensity. 1999. http://www-socal.wr.usgs.gov/ciim/pubs/ciim/node5.html accessed July 27, 2002.*			

VULNERABILITY ASSESSMENT – EARTHQUAKES

Estimating Potential Loss

The Bernalillo County Earthquake Zones plate (following page p. 70) displays data for the different zones that are depicted on the map at the end of this section—Bernalillo County Earthquake Zones—(referred to as EQ Zones) within Bernalillo County corresponding to the different PGA values that are associated with a 10% exceedance in 50 years. The most

vulnerable area is the eastern side of the City of Albuquerque, from I- 40 north to the County line and east of I-25. There are no credible seismic damage estimates for this area. The Mitigation Planning Team needs more information on the types of structures —their age, condition, and construction type—in order to rate their relative vulnerability. For example, un-reinforced masonry structures built before current building codes are more susceptible to damage than others built to seismic-resistant codes. The Mitigation Planning Team could not generate accurate estimates of the number of vulnerable buildings.

Critical Facilities

150 individual critical facilities are listed as vulnerable to damage from earthquakes. More information on these facilities—their age, condition, and construction type, for example—is needed to rate their relative vulnerability.

Future Development Trends

The area with the highest potential for earthquakes (north of I-40 and east of I-25 within the City of Albuquerque) is an established, fully built-out area, with little potential for new development. New buildings constructed in the City and County must conform to the 2003 IBC (see discussion later in this section under Capabilities and Resources) and will be less vulnerable to potential earthquake damage than most existing structures.

CONCLUSIONS – EARTHQUAKES

Summary of Hazard Identification and Vulnerability Assessment

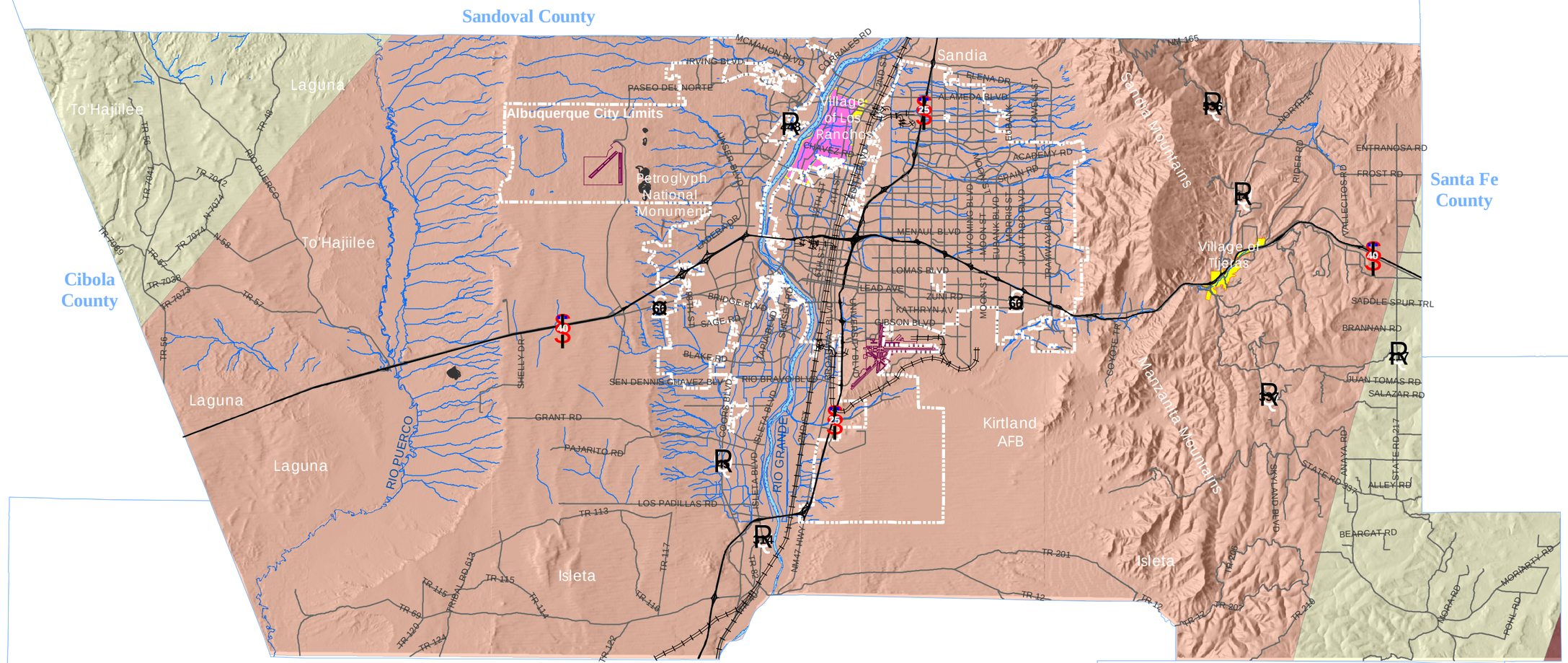
Significant earthquakes with epicenters in the County have not been detected in recent history, but the area has numerous faults with the potential for a large magnitude earthquake. The potential for such a disaster is low to moderate, as illustrated on the map at the end of this section: Bernalillo County Earthquake Zones. As explained in the Severity and Vulnerability sections, the greatest threat is to the eastern side of the City of Albuquerque. More detailed information on critical facilities and residential structures in the City is required to identify vulnerable structures.

What Can Be Mitigated?

Damage from earthquakes can be mitigated for existing buildings by structural retrofits. Structures erected before standard building codes, such as un-reinforced masonry buildings, are typically more vulnerable to earthquake damage. More detailed information on structures in the City and the County is required to identify those that are highly vulnerable. New buildings can be built stronger, according to the most recent seismic design specifications found in contemporary building codes, to minimize their vulnerability to earthquake damage.

Data Limitations

The information on the probability and severity of a possible earthquake event is based on the relationship between PGA, magnitude, and intensity, which is approximate and depends upon such specifics as the distance from the epicenter and the depth of the epicenter. With very few damaging tremblors in the past one hundred years, there is not much historical data to suggest which areas and specific structures would be most susceptible to damage. More information on the type and number of vulnerable buildings would help the Mitigation Planning Team assess specific vulnerability and risk issues more accurately.



F

1 inch equals 4 miles

0 2 4 8 12 Miles

Bernalillo County, New Mexico

Data provided by the Bernalillo County Infrastructure Planning & Geo-Resources Department, the City of Albuquerque Planning Department (AGIS), the City of Albuquerque Information Systems Division and the New Mexico Resource Geographic Information System Program (RGIS).

Bernalillo County Earthquake Zones

Acceleration Value*

- 8
- 9
- 10
- Albuquerque City Limits
- Village of Los Ranchos de Albuquerque
- Village of Tijeras
- Interstates
- Railroad
- Rivers
- Arroyos/Channels
- Volcano

* PGA (Peak ground acceleration) with 10% PE (probability of exceedance) in 50 years. Data provided by the USGS National Seismic Hazard Mapping Project.

OTHER HAZARDS

Three other hazards reviewed by the Mitigation Planning Team present relatively less immediate risk to Bernalillo County. The Mitigation Planning Team decided not to address these hazards in this Plan, as they are considered to be of lower priority to the County, and the effort required to respond to the other hazard issues will require all existing and anticipated resources during the 5-year planning horizon of this Plan. These hazards include: landslides/land subsidence, dam failures, and volcanoes.

The following is a brief summary of some of the issues related to these hazards for reference in future updates of this Plan.

OTHER HAZARDS – LANDSLIDES/LAND SUBSIDENCE

OVERVIEW – LANDSLIDES AND LAND SUBSIDENCE IN BERNALILLO COUNTY, NEW MEXICO

The term *landslide* describes the downward and outward movement of slope-forming materials (dirt, trees, and rocks) under the force of gravity. The term covers a broad array of events, including mudflows, mudslides, debris flows, rock falls, rock slides, debris avalanches, debris slides, and earthflows.

Land subsidence, the loss of surface elevation due to the removal of subsurface support, ranges from broad, regional lowering of the land surface to localized collapse. Land subsidence can occur slowly and continuously over time or abruptly, such as in the sudden formation of sinkholes. A sinkhole can be defined as a subsidence feature that can form rapidly and is characterized by a distinct break in the land surface and the downward movement of surface material into the resulting hole or cavity.

Landslides and land subsidence can damage or destroy infrastructure (pipelines, power lines, mines, oil wells), transportation routes (roads, railroads), dams, farmland, and buildings. Depreciation of land values, business and personal losses are possible direct results of this hazard.

PREVIOUS OCCURRENCES – LANDSLIDES AND LAND SUBSIDENCE

Landslides have occurred in the eastern foothills of the Sandia Mountains. Land subsidence is not common but has occurred in Bernalillo County.

HAZARD PROFILE – LANDSLIDES AND LAND SUBSIDENCE

Hazard Characteristics

There are four types of landslides: slides, flows, lateral spreads, and falls and topples. Slides involve the downward displacement of soil or rock along one or more failure surfaces. The material of a slide can either be one intact mass or several pieces. Flows generally consist of a rapid mass movement in which loose soils, rock, water, and air are combined to form slurry that flows downhill. They differ from slides in that flows contain high water content and their distribution velocities behave like viscous fluids. Lateral spreads are characterized by the displacement of a large, distributed mass of materials moving horizontally over the ground's surface. They can occur in rock, in fine-grained soils (due to disturbance by construction or grading) and in loose, granular soils through liquefaction (usually produced by the strong

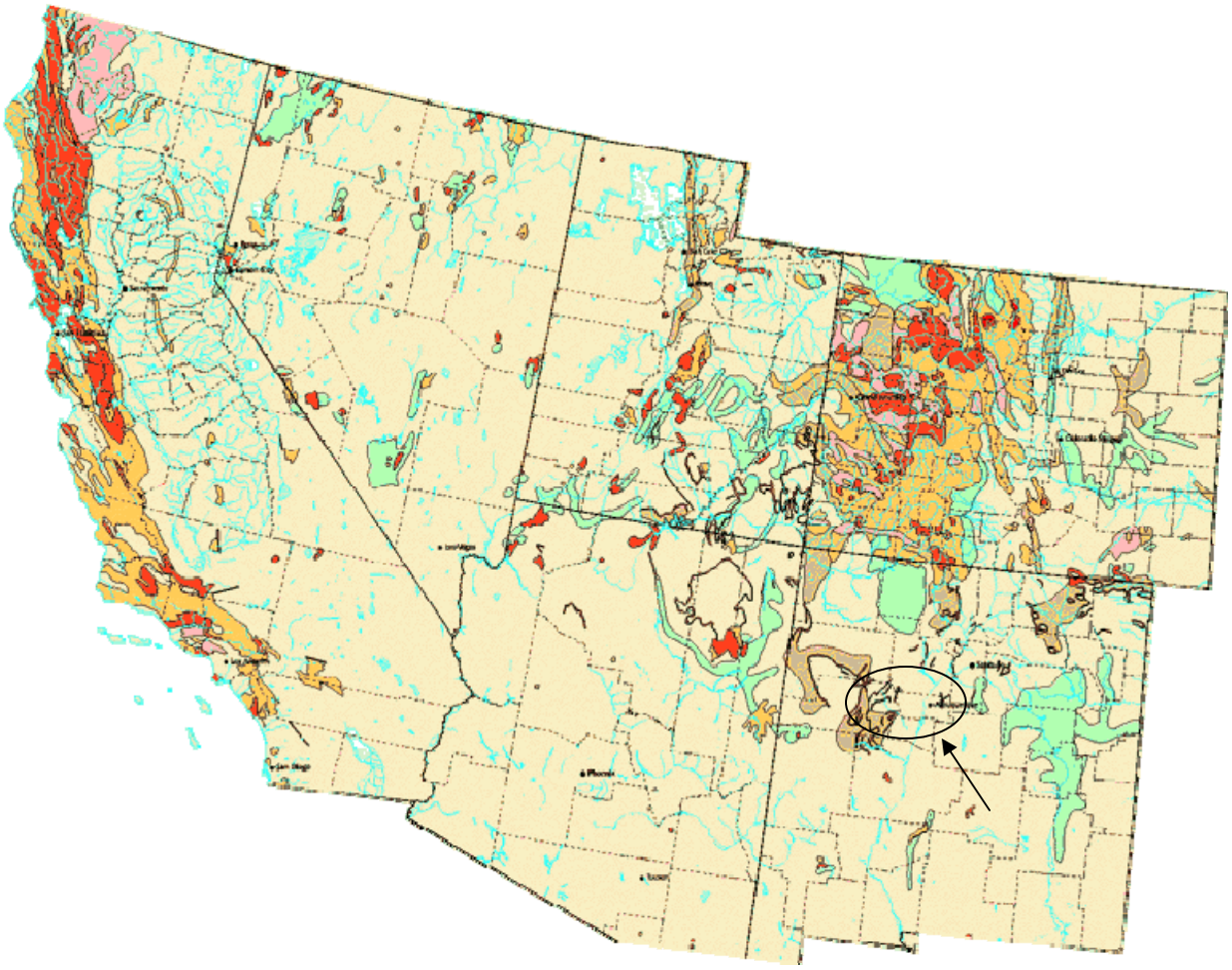
vibrations of an earthquake). Falls are caused by a mass of rock or other material becoming detached from a cliff or steep slope and descending rapidly via free fall, rolling, or bouncing. Falls occur extremely rapidly and are generally triggered by earthquakes. Topples result in abrupt falls or slides through tilting, not collapse. They consist of the forward rotation of a mass of material moving around a pivot point on a hillside.

Several natural and human factors may contribute to landslides. The principal natural factors are topography, geology, and precipitation—either periods of sustained above-average precipitation, specific rainstorms, or snowmelt events. Other elements that determine slope stability are vegetative cover and slope aspect. The principal human activities that can contribute to slope failure include altering the slope gradient, increasing the soil water content, and removing vegetative cover. Mining and the construction of highways, buildings, and railroads are some of those activities.

Subsidence is caused by a diverse set of human activities and natural processes that include the mining of coal, metallic ores, limestone, salt, and sulfur; the withdrawal of groundwater, petroleum, and geothermal fluids; the dewatering of organic soils; the wetting of dry, low-density deposits known as hydrocompaction; the dissolution of underground strata; natural sediment compaction; liquefaction; and crustal deformation. These causes can be generally distilled into causing three different kinds of subsidence: collapsing into voids, sediment compaction, and drainage of organic soils. Collapse of surface materials into an underground void is most often caused by mining. This type of collapse is generally limited to those areas where past mining operations have occurred. Collapse into voids can also occur naturally where surface materials collapse into naturally formed cavities in bedrock. Sediment compaction is typified by a broad regional subsidence, resulting in a generally a low rate of loss usually no more than several inches per year. Drainage of organic soils reduces soil volume naturally through biological oxidation, compaction, and desiccation. Biological oxidation is usually dominate in warm climates.

Severity and Probability of Occurrence

Bernalillo County has a low probably of susceptibility to landslides and land subsidence (Figure 18). However, where subsidence has occurred, the main cause has been the drop in the water table of the underlying aquifer. As the water table drops from groundwater pumping, the risk of subsidence increases, especially in the northeastern portion of the City of Albuquerque where municipal water production wells are resulting in a cone of depression in the underlying water table. The City hopes to stabilize, or possibly even increase the groundwater levels, once it begins to use surface water for residential potable water consumption, thus lessening the potential for land subsidence (Albuquerque Bernalillo County Water Utility Authority).



Landslide Susceptibility/Incidence		Landslide Incidence	
	Moderate susceptibility/low incidence		Low (less than 1.5% of area involved)
	High susceptibility/low incidence		Moderate (1.5%-15% of area involved)
	High susceptibility/moderate incidence		High (greater than 15% of area involved)

Source: http://landslides.usgs.gov/learningeducation/nationalmap/index.php

Figure 18: USGS National Landslide Overview Map of the Western United States

VULNERABILITY ASSESSMENT – LANDSLIDES AND LAND SUBSIDENCE

Estimating Potential Loss

The most vulnerable area is the northeast quadrant of the City of Albuquerque, from I-40 north to the County line and east of I-25. There is no information on land subsidence damage estimates for this area. The Mitigation Planning Team needs more information on the types of structures—their age, condition, and construction type—in order to rate their relative vulnerability. For example, un-reinforced masonry structures built before current building codes

are more susceptible to damage than others built to seismic-resistant codes. The Mitigation Planning Team could not generate accurate estimates of the number of vulnerable buildings.

Critical Facilities

Critical facilities that are vulnerable to land subsidence are mainly those of older construction and in potentially poor condition.

Future Development Trends

The area with the highest potential for land subsidence, the northeast section of the City of Albuquerque (north of I-40 and east of I-25) is an established, fully built-out area, with little potential for new development.

CONCLUSIONS – LANDSLIDES AND LAND SUBSIDENCE

Summary of Hazard Identification and Vulnerability Assessment

Landslides and sinkholes are possible in Bernalillo County. Continued groundwater pumping lowers the water table and increases the potential for ground subsidence. The potential for subsidence is greatest in the northeast heights of Albuquerque.

What Can Be Mitigated?

Mitigation options for landslides and land subsidence should address the lack of specific information on these hazards as they relate to Bernalillo County. A possible mitigation action may be for the local government to participate in the USGS Landslide Hazard Program and conduct mapping and delineation of landslide and land subsidence areas in the county.

Vulnerability to landslides and land subsidence can be addressed through land-use regulations, zoning, and building codes. Zoning can mitigate land subsidence hazards by banning development in vulnerable areas. Land-use regulations can reduce vulnerability by regulating construction practices and controlling how materials are mined. Through enforcement of the building codes, new buildings can be built stronger, according to the most recent seismic design specifications found in contemporary building codes, to minimize their vulnerability to land subsidence damage.

Information regarding insurance programs available to provide relief from subsidence damages should be communicated to the at-risk sector of the public. These programs distribute losses equitably and encourage mitigation activities. The National Flood Insurance Program offers insurance in areas impacted by flooding aggravated by land subsidence.

Data Limitations

Information on landslides and land subsidence in general is limited. Although research on landslides and subsidence has been conducted by several different government agencies, little research has been conducted at the county or local government level.

OVERVIEW – DAM FAILURE IN BERNALILLO COUNTY, NEW MEXICO

Dam failure can occur when a dam is overtopped (overflows). Overtopping is especially dangerous for an earthen dam because the down rush of water will erode the dam face and could breach the dam. Bernalillo County has one major dam system: the Sandia Pueblo Dams, located on the Sandia Pueblo in the northern portion of Bernalillo County. Additionally, the City of Albuquerque is located 50 miles downstream of the Cochiti Dam and may be at-risk if the dam fails.

People, livestock, property and infrastructure downstream of the dam can be subjected to heavy damage, injury, or death if the dam fails.

PREVIOUS OCCURRENCES – DAM FAILURE

There has been no previous occurrence of dam failure in Bernalillo County.

HAZARD PROFILE – DAM FAILURE

Hazard Characteristics

A dam is a barrier constructed across a watercourse for the purpose of storage, control, or diversion of water. Dams are typically constructed of earth, rock, concrete, or mine tailings. A dam failure is a collapse, breach, or other damage (failure) resulting in downstream flooding.

When a dam failure occurs due to structural deficiencies, the subsequent flooding is characterized by a sudden rise in stream level, much like a flash flood from a thunderstorm. Dam failures can occur at any time; however, the risk of structural failure is increased during winter and spring because of increased precipitation and the runoff of melting mountain snow.

Severity and Probability of Occurrence

The Sandia Pueblo Dams are four miles north of the City of Albuquerque. The dam system consists of five dams on three arroyos that drain portions of the Sandia Mountain watershed. All five are earthen dams and were constructed for flood and erosion control. Some of the reservoirs created by the dams are used for watering cattle. The dams are not intended for long-term reservoir storage. The Sandia Pueblo Dams were constructed and are operated and maintained by the Bureau of Indian Affairs (BIA). The dams range in height from 14 feet to 23 ½ feet and 295 to 1,350 feet in length. The reservoir capabilities for the dams are from 6.5 to 50 acre-feet.

The Sandia Pueblo Dams Emergency Action Plan (Draft, July 2004) estimates shallow flooding of less than 3 feet in the potentially affected areas. I-25 may experience flooding of less than two feet.

Operated and maintained by the U.S. Army Corps of Engineers, the Cochiti Dam is one of the ten largest earthfill dams in the United States, containing more than 65,000,000 cubic yards of earth and rock. The dam is located in Sandoval County, 50 miles upstream from the City of Albuquerque. It rises 251 feet above the Rio Grande streambed and stretches out more than 5 miles to impound waters of the Rio Grande and the Santa Fe Rivers. Originally, Cochiti was authorized only for flood and sediment control. However, officials of the State of New Mexico and the counties surrounding the site expressed interest in a permanent pool for fish and wildlife

and recreation. Congress then modified its authorization for Cochiti Lake to include a 1,200-acre lake for recreation. Water for this lake is imported from the Colorado River Basin to the Rio Grande Basin via the San Juan Diversion Project across the Continental Divide. Construction of Cochiti Lake began in 1965; the main embankment was completed in 1975; and the lake opened to the public in July 1975. Cochiti Lake is a federal project constructed at a cost of $94.4 million. The project controls water from a drainage area of 11,695 square miles.

Cochiti Dam is one of over 100 dams in the state that has a "high" hazard rating, meaning that one or more persons could be affected by inundation in case of dam failure. However, it is considered to be maintained satisfactorily, and failures during normal operation are unlikely; therefore, vulnerability in Bernalillo due to dam failures is considered to be very low. A structural assessment of this dam resulted in a satisfactory rating, which is the highest of the three structural assessment ratings. The state of repair assessment has four ratings: excellent, good, poor, and unacceptable. The Cochiti Dam is rated "good." The excellent rating is given only to those dams that are maintained in essentially new or original condition.

Dams are rated according to three hazard classifications:

- ✓ Hazard Classification 1 - High Hazard; Failure or misoperation of dam will probably cause loss of human life and major property damage. As stated previously, Cochiti Dam is classified as High Hazard.
- ✓ Hazard Classification 2 - Significant Hazard; Failure or misoperation of dam could possibly cause some loss of human life and property damage.
- ✓ Hazard Classification 3 - Low Hazard; Failure or misoperation is unlikely to result in loss of life or property damage. The Sandia Pueblo Dams are classified as Low Hazard.

VULNERABILITY ASSESSMENT – DAM FAILURE

Estimating Potential Loss

Flood vulnerability is described in terms of the community assets that lie in the path of floods. The areas with the greatest vulnerability are concentrated in the older neighborhoods in the northwest quadrant of the City near the Sandia Indian Reservation and along the Rio Grande.

Future Development Trends

Within the Albuquerque Metropolitan Area, the area averages an annual growth rate of about 6,000 new residential units per year, consisting almost entirely of single-family residential homes. Most of these new homes are being built west of the Rio Grande, on mesa tops. Areas west of the Rio Grande have accounted for the majority of all single-family housing permits in the last five years, and this trend is expected to continue, as there is still ample developable land (Urban Growth Projections 1999-2010, City of Albuquerque, 2002).

The City of Albuquerque and Bernalillo County participate in the Flood Insurance Program and do not allow any new construction within defined floodplains without rigorous mitigation measures, such as elevating the building above the floodplain, or through a Letter of Map Revision from FEMA. The City has a series of requirements in the Zoning Code that deal with flood protection (Section 14-5-2-1 through 14-5-2-17 in the City of Albuquerque code). Due to the increased costs associated with ensuring that new structures are either flood proofed or raised up out of the floodplain, virtually all new development is anticipated to occur outside of the 100-year floodplain. With regulatory controls in place that require extensive analysis of potential flooding and stormwater treatment, the projected growth in the City of Albuquerque

and Bernalillo County will not significantly increase problems associated with floods and flash floods.

Projected development in Los Ranchos de Albuquerque is expected to occur either out of the floodplain or in areas with drainage control, and will not significantly increase the potential for future flooding due to flash floods.

CONCLUSIONS – DAM FAILURE

Summary of Hazard Identification and Vulnerability Assessment

The Sandia Pueblo Dams and the Cochiti Dam pose a low risk to existing communities in Bernalillo County due to the condition of the dams and the on-going drought in the area. The Cochiti Dam is located 50 miles upstream from the City of Albuquerque and is operated and maintained by the USACE. The dam is maintained in good condition and not likely to pose a threat to Bernalillo County.

What Can Be Mitigated?

The Sandia Pueblo Dams are required to complete Emergency Action Plans (EAP). These Plans includes inundation maps, as well as lists of critical facilities that may be threatened by the dams. Copies of the EAPs are located at the Bernalillo County Emergency Manager's Office.

OVERVIEW – VOLCANOES IN BERNALILLO COUNTY, NEW MEXICO

Volcanic eruptions are among the Earth's most dramatic and violent agents of change. Not only can powerful, explosive eruptions drastically alter land and water for many kilometers around a volcano, but tiny liquid droplets of sulfuric acid erupted into the stratosphere can change our planet's climate temporarily. The Albuquerque volcanic field is located in the western portion of the county.

Eruptions often force people living near volcanoes to abandon their land and homes, sometimes forever. Those living farther away are likely to avoid complete destruction, but their cities and towns, crops, industrial plants, transportation systems, and electrical grids can be damaged by tephra (volcanic debris from explosions), lahars (mudslides or landslides caused by lava flows), and flooding.

PREVIOUS OCCURRENCES – VOLCANOES

The Albuquerque volcanic field was active from 170,000 to 70,000 years ago (Volcano World).

Figure 19: Albuquerque Volcano
Photo by Geoffrey Johnson, Volcano World

HAZARD PROFILE – VOLCANOES

Hazard Characteristics

Volcanic eruptions are classified as either nonexplosive or explosive. Nonexplosive eruptions are usually caused by iron- or magnesium-rich magma (molten rock) that is somewhat fluid and allows gases to escape. Explosive eruptions are caused by silica-rich magma that is not fluid and produce a great amount of fragmental debris (air-borne ash, pyroclastic flows and surges, debris flows, lava domes, and other hazards, such as flooding).

Lava flows and domes are composed of molten rock generally move slowly and crush, bury, and burn whatever they touch.

Pyroclastic flows and surges are composed of hot, dry rock fragments, hot debris, gases and air. They move quickly and kill/injure people and animals by contact.

Volcanic ash, also known as “tephra,” is composed of lava or rock fragments forced into the air by either an explosion or carried upwards by a rising columns of Volcanic ash is extremely hot and heavy. Structures covered by volcanic ash are likely to collapse under the weight of the ash. Machinery is susceptible to the corrosive and abrasive effects of the ash. People and animals who breathe in the ash will suffer respiratory problems that may lead to death.

Volcanic gases are composed of steam, carbon dioxide, sulfur compounds, and chlorine compounds. Gases are primarily wind driven. People and animals will suffer damage to their eyes and respiratory tracts upon contact with volcanic gases. Volcanic gas accumulations are heavier than air and can lead to suffocation.

Lateral blasts are one of the most destructive volcanic forces: they can move extremely quickly across the ground surface with no regard to topography and they consist of hot rock debris, ash, and gases upwards of 100 feet thick. A lateral blast can devastate a large area in minutes,

killing virtually all peoples and animals that come into contact with it by abrasion, impact, burial, and heat.

Debris avalanches and flows are destructive masses of unconsolidated rock and soil that move rapidly down slope of the volcano, crushing and burying anything in their path. In addition, debris flows can carry away buildings, manufactured homes, vehicles, and other personal property.

Severity and Probability of Occurrence

Volcanic activity since 1700 A.D. has killed more than 260,000 people, destroyed cities and forests, and severely disrupted local economies for months or years. Around the world, even with our improved ability to identify hazardous areas and warn of impending eruptions, increasing numbers of people face certain danger.

Volcano monitoring in the United States is conducted by five observatories across the country, operated by the USGS Volcanic Hazards Program. The USGS issues volcano alerts to Federal and State emergency management agencies, which then disseminate the information to county and local governments. The volcano alert system is composed of four levels that identify the level of the threat:

- ✓ Normal: Typical background activity of a volcano in a non-eruptive state.
- ✓ Advisory: Elevated unrest above known background activity.
- ✓ Watch: Heightened/escalating unrest with potential for eruptive activity or a minor eruption underway that poses limited hazard.
- ✓ Warning: Major or highly hazardous eruption underway or imminent.

Volcanic eruptions affect conditions on the ground and in the air. In conjunction with the volcano alert system, an aviation alert system was also developed to warn aircraft of debris plumes and ash clouds. The aviation color codes are:

- ✓ **Green**: Volcano is in a normal, non-eruptive state; Volcanic activity considered to have ceased, and volcano reverted back to its normal, non-eruptive state (after a change from a higher level).
- ✓ **Yellow**: Volcano is exhibiting signs of elevated unrest above known background levels; Volcanic activity has decreased significantly but continues to be closely monitored for possible renewed increase (after a change from a higher level).
- ✓ **Orange**: Volcano is exhibiting heightened unrest with increased likelihood of eruption Volcanic eruption underway with no or minor ash emission *[specify ash-plume height if possible]*.
- ✓ **Red**: Eruption is forecast to be imminent with significant emission of ash into the atmosphere likely *or* eruption is underway with significant emission of ash into the atmosphere *[specify ash-plume height if possible]*.

The Albuquerque volcanic field is made of monogenetic volcanoes that produced lava flows, cinder cones, and cinder and spatter cones. It is located about 11 km west-northwest of the City. The oldest lava flows cover about 60 square km. The cones are aligned and possibly formed above two roughly north-south trending fissures. J cone (also called Vulcan) is the highest feature. Its base is made of cinder, but the crater contains a lava dome that was cut by an explosive eruption. Figure 19 presents a photo of a J cone, and is from the west looking across the old quarry.

The area around Albuquerque remains potentially active because of its location in the Rio Grande Rift. A new volcano could erupt, if not along the Albuquerque Volcanoes, at least somewhere within the rift; however, the risk of eruption is low.

VULNERABILITY ASSESSMENT – VOLCANOES

Estimating Potential Loss

The Albuquerque Volcanic Fields are located west of the City of Albuquerque. Petroglyph National Monument contains the "volcanic cliffs" and five of the vents. The fields themselves are largely undeveloped, however, development is encroaching along the north and east border of the fields. The fields are bounded on the west by the Double Eagle II Airport.

Future Development Trends

Within the Albuquerque Metropolitan Area, the area averages an annual growth rate of about 6,000 new residential units per year, consisting almost entirely of single-family residential homes. Most of these new homes are being built west of the Rio Grande, on mesa tops. Areas west of the Rio Grande have accounted for the majority of all single-family housing permits in the last five years, and this trend is expected to continue, as there is still ample developable land (Urban Growth Projections 1999-2010, City of Albuquerque, 2002).

CONCLUSION – VOLCANOES

Summary of Hazard Identification and Vulnerability Assessment

Due to the antiquity of known volcanism and the absence of related historical seismic activity in Bernalillo County, the Mitigation Planning Team concludes that the near-term risk of volcanic eruption in the County is low (Kues, Barry S., and Callender, John, F., 1986, *Geologic History, Contribution to New Mexico in maps*, edited by Jerry L. Williams: University of New Mexico Press.).

What Can Be Mitigated?

Mitigation options for volcano eruptions should address the lack of specific information on these hazards as they relate to Bernalillo County. A possible mitigation action may be to conduct mapping and delineation of areas vulnerable to volcano eruption in the county.

Educating the public about the volcano alert system and the aviation color code warning systems is another possible mitigation action item.

Data Limitations

Due to the prolonged inactivity of the Albuquerque volcanic fields, it is believed that they are not likely to erupt in the foreseeable future. Studies of the fields center more around their formation and past events, rather than focusing on potential future events.

CAPABILITIES

Bernalillo County and the incorporated jurisdictions have a number of resources that can be called on to help implement hazard mitigation actions. These resources are both private and public and exist at the local, state, and federal levels. The regulatory framework for each jurisdiction in Bernalillo County is summarized in Table 34, and relevant aspects of each regulatory component are discussed below.

Table 34: Bernalillo County/Incorporated Municipalities Capability Assessment Matrix

Name of Jurisdiction	Comprehensive Plan	Capital Improvements Plan	Zoning	Emergency Operations Plan	Subdivision Regulations	Planning Commission	Building Code[1]	Post-Disaster Recovery Ordinance	Stream Maintenance Program	Wildfire Prevention Ordinance	Participation in NFIP & Floodplain Ordinance	Local Law Enforcement	Fire Department
City of Albuquerque	X	X	X	X	X	X	X				X	X	X
Village of Los Ranchos de Albuquerque	X	X	X	Draft	X	X	X				X	X	X
Village of Tijeras	X	X	X	Draft	X	Draft	X				X	X	X
Bernalillo County	X	X	X	X	X	X	X				X	X	X

[1] In 2004, the State of New Mexico will adopt the 2003 IBC as the minimum standard for all communities in the State.

- ✓ Building Codes – Starting July 1, 2004, New Mexico's Construction Industries Division, which has oversight and provides inspection services for unincorporated areas of the state, switched from the 1997 Uniform Building Code (UBC) to the 2003 International Building Code (IBC). The City of Albuquerque and Bernalillo County will also adopt this new code. Building codes are important mitigation tools because they can be tailored to fit specific hazards present in each region. Bernalillo County should pay particular attention to the specific measures in the IBC that target high wind, hail, and earthquake, and flood hazards.
- ✓ Land Use Regulations – The City of Albuquerque and Bernalillo County have a combined Comprehensive Plan that all lower ranked Sector Plans and Area Plans must follow.
- ✓ Floodplain Ordinances – Through administration of floodplain ordinances, the municipalities ensure that all new construction or substantial improvements to existing structures located in the 100-year floodplain are built with first-floor elevations above the base flood elevation.

The County and its municipalities also undertook several important planning initiatives prior to the development of this Hazard Mitigation Plan. These initiatives are detailed below.

Wildfire Initiatives

Many initiatives are in place and planned for the future to lessen the occurrence and severity of catastrophic fires in the Bosque. Programs to reduce fuel load and improve access for emergency personnel are in progress. Active management and continued maintenance are necessary to keep this threat at a minimum. Because the Rio Grande flows through many jurisdictions, programs to reduce the threat of wildfire include multiple agencies, ranging from the federal level to local non-profit organizations.

Total funding for restoration projects is approximately $80 million, $10 million per year from Congress.

- ✓ The Middle Rio Grande Bosque Initiative (MRGBI) is an ongoing, congressionally supported, interagency ecosystem management effort to coordinate activities related to the ecological restoration and management of the Middle Rio Grande.
- ✓ The USACE's Environmental Assessment for the Bosque Wildfire Project for Bernalillo and Sandoval Counties, New Mexico completed in September 2004 details project locations and costs for Jetty Jack removal, non-native vegetation and fuel wood thinning, burn restoration, debris removal, herbicide treatment, reseeding, re-vegetation, and access improvement.
- ✓ Two new weather stations are in the works by the United States Army Corps of Engineers (USACE) and will be placed in the Albuquerque reach of the Bosque to monitor characteristics such as temperature, humidity, and rainfall to determine the level of fire danger.
- ✓ Insurance companies are promoting defensible spaces, fire-resistant building materials, and water sources for fire fighting in close proximity to homes without access to fire hydrants for homes in the Wildland Urban Interface. Homeowners who do not take precautionary measures against wildfire will face increased insurance premiums in the future.
- ✓ East Mountain Interagency Fire Protection Association (EMIFPA) partners include the USDA Forest Service, NM State Forestry Division, NM State Inmate Work Camp, Sandia Peak Ski Area and Tramway, Bernalillo County Fire and Rescue, Bernalillo County Sheriff's Department, American Red Cross, Sandoval County Fire and Rescue, Bureau of Indian Affairs, Department of Energy, Department of Defense, the Salvation Army, and the fire departments of Rio Rancho, Village of Tijeras, La Madera, local volunteer fire departments, and local neighborhood associations.
- ✓ Federal and State wildfire mitigation efforts continue in the Cibola National Forest area, in the East Mountain region.
- ✓ Village of Tijeras is a Firewise Community. The village also makes dumpsters available for debris hauling for residents a few times every year.

Flood/Flash Floods Initiatives

- ✓ The New Mexico Wellhead Protection Program (see Conclusions – Flash Flooding).
- ✓ The Ditch and Water Safety Task Force "Ditches are Deadly, Stay Away" programs (see Conclusions – Flash Flooding).

Drought Initiatives

- ✓ New Mexico's Source Water Assessment and Protection Program (SWAPP) is a federally funded program created to protect communities' drinking water supplies.
- ✓ Governor Richardson's State Drought Task Force (see Conclusions – Drought).
- ✓ The Middle Rio Grande Water Assembly, an all-volunteer non-profit organization, has developed a Middle Rio Grande Regional Water Plan. And a Middle Rio Grande Water Budget which details "where water comes, from, and goes, and how much."
- ✓ The City of Albuquerque's Water Conservation programs (see Conclusions – Drought).

Severe Weather

Severe weather alerts are now more frequent due to County Emergency Management personnel request.

RESOURCES

Additional community-based, technical, and funding resources currently available for Bernalillo County include the following:

Community-based Organizations

- ✓ Firewise Communities/USA: a Team for firewise educational opportunities within the community (www.firewise.org).

Technical Resources – to help in future decision making:

- ✓ GIS capabilities at the Cities of Albuquerque and Bernalillo County.

Funding Opportunities – for possible support of mitigation or multiple objective actions including:

- ✓ Community Development Block Grants (CDBG): The Community Service Department administers the CDBG program for the County.
- ✓ Debt Capacity: Authority to incur debt through special tax, general obligation bonds, revenue bonds, and private activity bonds.
- ✓ Capital Improvement Projects. Albuquerque, the Village of Tijeras, Los Ranchos de Albuquerque and Bernalillo County all have CIP programs in place.
- ✓ Taxes: The County and municipalities have the authority to levy sales taxes and property taxes. The County is responsible for all property tax assessment and collection.
- ✓ Fees: The County and municipalities have the authority to levy fees for water, sewer, gas, trash collection, landfills, and electric service.
- ✓ Community Rating System (CRS): This is the NFIP established in 1990 for recognizing and encouraging community floodplain management that exceeds the minimum NFIP standards. Under the CRS, flood insurance premium rates are adjusted to reflect the reduced flood risk resulting from community actions that meet the requirements of CRS: (1) reduce flood losses; (2) facilitate accurate insurance rating; and (3) promote awareness of flood insurance. Tijeras is in the NFIP. Bernalillo County is a CRS Class Nine, and Albuquerque is a Class Eight.
- ✓ Emergency Management Strategy: Adopted in 1999.

SUMMARY OF CAPABILITIES AND RESOURCES

The Capabilities and Resources of Bernalillo County related to mitigation planning can be summarized in term of opportunities and deficiencies to be addressed in the mitigation plan and implementation strategy as follows:

Opportunities

- ✓ Periodic updates to the Comprehensive Plans for the City of Albuquerque and Bernalillo County, Villages of Los Ranchos de Albuquerque, and Tijeras provide opportunities to integrate information about hazard vulnerability into the land use subdivision and approval process. This integration will help develop appropriate long-range strategies to combat drought, fire, earthquake, and flood hazards.
- ✓ CRS planning is consistent with and complementary to the mitigation planning process undertaken for the Disaster Mitigation Act of 2000 and can help develop more detailed mitigation activities for flood-related disasters in Bernalillo County.
- ✓ FEMA funding available for Citizens Emergency Response Team (CERT) to train public to respond to large disaster both locally and nationally.

Deficiencies

- ✓ Lack of awareness on part of public of hazards and mitigation efforts.
- ✓ Communities in Bernalillo County do not have wildfire prevention ordinances.
- ✓ There is a relatively low subscription rate to the flood insurance program.
- ✓ Lack of coordination between land use planning and hazard planning.
- ✓ Not taking advantage of access to federal and state funding opportunities.
- ✓ Inadequate numbers of State Police EROs trained in hazard materials response.
- ✓ Lack of communication and coordination with the largest public school system in the state and the County and City Emergency Managers.

This section presents a series of goals, objectives, and mitigation actions to help guide the City of Albuquerque, Bernalillo County, Village of Los Ranchos de Albuquerque, and Village of Tijeras in addressing hazard vulnerabilities. The identified mitigation actions reflect the vulnerabilities discussed in Section One by identifying measures that may help the City, County, and included municipalities to avoid, prevent, or otherwise reduce damages from hazards.

TERMINOLOGY

Goals are general guidelines that explain what you want to achieve. Goals are usually expressed as broad policy statements representing desired long-term results. In this Plan, the stated goals respond directly to the results of the hazard identification and risk assessment.

Objectives describe strategies or implementation steps to attain the identified goals. Objectives are more specific statements than goals; the described steps are usually measurable and can have a defined completion date.

Actions provide more detailed descriptions of specific work tasks to help a community achieve the goals and objectives. For each objective statement, there are alternatives for mitigation actions that must be evaluated to determine the best choices for each situation.

Mitigation Plans include a listing and description of the preferred mitigation actions and the strategy for implementation, i.e., who is responsible, how they will proceed, and when the action should be initiated and/or completed.

MITIGATION GOALS AND OBJECTIVES

The goals and objectives presented below were developed in light of the risk assessment findings presented in Section One, with direction and guidance provided by the Mitigation Planning Team and NMOEM.

Current criteria under DMA 2000 recommends that local mitigation plans be consistent with and support their State's Hazard Mitigation Plan. The State of New Mexico's existing State Hazard Mitigation Plan, created prior to the DMA 2000 planning criteria, details the mitigation goals, objectives, and strategies based on the state's risk assessment. The state's hazard mitigation goals are presented in Table 35.

The mitigation objectives and actions identified by the Mitigation Planning Team are presented below. The information is presented according to hazard type, and in the same order as Section One; however, this listing does not reflect the order in which the projects will be implemented. Section Three prioritizes the recommended projects and implementation as resources become available.

Table 35: State of New Mexico Hazard Mitigation Goals

State and Local Governments
▪ Develop strategic mitigation plans and identify funding sources to support them.
▪ Adopt and enforce all-hazards building codes.
▪ Adopt incentives and disincentives to encourage mitigation.
▪ Develop administrative structures to support implementation of mitigation programs and priorities.
▪ Incorporate mitigation of natural hazards into land use management plans and programs.
▪ Develop, support, and conduct ongoing public information campaigns on natural hazard mitigation.
The Private Sector
▪ Develop business interruption plans and implement mitigation to minimize loss of jobs and business activity.
▪ Develop incentives for mitigation with insurance and banking institutions.
▪ Promote awareness of hazard risk and mitigation solutions among customers and the public.
Individual Citizens
▪ Learn about natural hazards that may affect them and their communities.
▪ Support adoption and enforcement of measures designed to reduce their vulnerability.
▪ Take other appropriate actions to protect their lives and property against the impacts of natural hazards.

WILDFIRE MITIGATION ACTIONS

Wildfires pose a significant threat to Bernalillo County, especially to the urban areas located in and around the Rio Grande Bosque. The East Mountains are at risk due to the lack of access and water availability. The threat has worsened in recent years due to drought and the bark-beetle infestation.

Goal I: *Reduce possibility of damage and loss to existing community assets including structures, critical facilities, and infrastructure due to* ***wildfires****.*

Goal I Objectives:

I.A Reduce the exposure of structures and critical facilities to wildfires.

- ✓ Action 1: Reduce fuel loads and create defensible space around structures in the WUI areas, specifically in the Village of Tijeras, Village of Los Ranchos de Albuquerque, the City of Albuquerque, and unincorporated areas of the County.
- ✓ Action 2: Create and maintain defensible space around critical facilities located in high or extreme wildfire hazard areas.
- ✓ Action 3: Create and adopt a WUI code to address defensible spaces, construction materials, roads, and fire suppression for all new and existing development in of Bernalillo County.
- ✓ Action 4: Participate in the implementation of the New Mexico Forest and Watershed Plan.
- ✓ Action 5: Explore feasibility of and, if cost effective, develop and implement a program to use bio mass fuels to dispose of tree thinning debris in East Mountains and Bosque.

I.B Educate the public in defensible space and other preventative measures to minimize wildfire risk.

- ✓ Action 1: Create Firewise Communities through the National Wildland-Urban Interface Fire Program in Los Ranchos de Albuquerque (in progress).
- ✓ Action 2: Create and educate communities through the National Wildland-Urban Interface Fire Program in/near WUI (via neighborhood associations) and encourage participation in Firewise Communities.
- ✓ Action 3: Continue support to Village of Tijeras as a Firewise Community.
- ✓ Action 4: Air monthly public information programs about WUI measures and awareness through GOV TV media.
- ✓ Action 5: Educate public on evacuation routes and evacuation procedures. Build upon existing evacuation routes established in East Mountain areas.

I.C Increase Response Capabilities.

- ✓ Action 1: Improve access for emergency vehicles in the Bosque and unincorporated areas of the East Mountains.
- ✓ Action 2: Increase water availability for fire suppression in the Bosque and in the East Mountains by increasing capability for water storage and accessibility.

- ✓ Action 3: Remove Jetty Jacks from along the Rio Grande in targeted high risk areas, to aid in access to the Bosque during wildfires.
- ✓ Action 4: Continue training of fire fighters in advanced wildland fire fighting techniques to respond and control wildfires.

HUMAN-CAUSED HAZARDS MITIGATION ACTIONS

Human-caused hazards are difficult to mitigate because they either do not occur in predictable locations (such as hazardous material spills along major transportation routes), or they result from the actions of unstable individuals, such as terrorists. However, as detailed in Section One, in some cases, the location of accidental or intentional releases of hazardous materials can be identified, and programs for protecting lives and property can be established. This can be accomplished by hazardous material handling sites complying with State and Federal regulations, meeting design standards, and having emergency response plans in place.

In the case of Bernalillo County, the initial focus is on areas where relative risk is higher and where an accidental or intentional release would result in greater relative impacts.

Goal II: *Reduce possibility of death, injury, and loss to existing community assets, including structures, critical facilities, and infrastructure due to* ***human-caused hazards****.*

Goal II Objectives:

II.A Develop a comprehensive approach to reduce the highest relative vulnerability to the effects of hazardous material releases from discrete and mobile locations.

- ✓ Action 1: Study feasibility of and, if cost effective, develop and implement a program to use alternate chemical treatments at the waste water treatment plant.
- ✓ Action 2: Establish hazardous materials routes that are located at a safe distance from critical facilities, schools, and population centers.
- ✓ Action 3: Inspect facilities identified in Section One as having the greatest potential impact (based on population in the immediate vicinity) to ensure compliance with all relevant local, State, and Federal requirements.
- ✓ Action 4: Target and coordinate any discrepancies between local and state reporting.

II.B Increase awareness of hazards and actions to take during an emergency.

- ✓ Action 1: Educate individuals and business owners about how to prepare for hazardous material releases though coordination with the Local Emergency Planning Committee (LEPC).

II.C Protect the general population and special populations from terrorist attacks

- ✓ Action 1: Train additional Emergency Response Officers (EROs) to increase response capability after an attack.
- ✓ Action 2: Educate county, city, and local officials on the areas of risk and vulnerability assessment presented in the region's Homeland Security Strategic Plan.

II.D Protect the general population and special populations from nuclear/radiological accidents

- ✓ Action 1: Educate citizens on what to do in the event of a nuclear/radiological accident though coordination with the Local Emergency Planning Committee (LEPC).
- ✓ Action 2: Harden critical facilities to protect them from damage due to nuclear/radiological accidents.

FLOOD MITIGATION ACTIONS

As detailed in Section One, Bernalillo County is highly susceptible to flash floods, with occurrences nearly every year. Rapid runoff of large volumes of water result from heavy thunderstorms in the summer, sparse vegetative cover, and fine-grained soils, and the situation is exacerbated by wildfire and drought, which reduce vegetative cover and expose the soil to even greater runoff.

Goal III: *Reduce possibility of damage and loss to existing community assets, including structures, critical facilities, and infrastructure due to* ***flooding****.*

Goal III Objectives:

III. A Identify and build flood control structures in vulnerable areas.

- ✓ Action 1: Village of Tijeras – Identify improvements in low-lying areas that have experienced chronic flooding to aid in the creation of flood control projects at arroyo crossing points. Reduce erosion in the Tijeras arroyo.
- ✓ Action 2: Village of Los Ranchos de Albuquerque – Identify improvements to Garduño Road west of 4th St., Ranchitos Road west of 4th St., and Ortega Road west of 4th St. Identify additional improvements in other low lying areas that are vulnerable to flooding.
- ✓ Action 3: Continue efforts to encourage developers and residents to use landscaping techniques that capture stormwater runoff.
- ✓ Action 4: Modify municipal and county subdivision, and building regulations to promote water-catchment landscaping.

III.B *Increase community participation in New Mexico Wellhead Program*

- ✓ Action 1: Educate targeted communities in the County, the Village of Los Ranchos de Albuquerque, and the Village of Tijeras with domestic wells and how to protect wells from actual and potential sources of contamination during flooding from pollution, and wellhead management.
- ✓ Action 2: City of Albuquerque – Educate residents with domestic wells and how to protect wells from actual and potential sources of contamination during flooding, and wellhead management through GOV TV media.

DROUGHT MITIGATION ACTIONS

Droughts in Bernalillo County affect the entire County and can disrupt public and rural water supplies for human and livestock consumption; water quality; natural soil water or irrigation water for agriculture; water for forests and for fighting forest fires; and water for recreation. The following actions are focused to reduce the effects of droughts in the county.

Goal IV: *Reduce possibility of damage and loss due to* ***drought.***

Goal IV Objectives:

IV.A Continue efforts to promote and enforce water conservation.

- ✓ Action 1: Continue City of Albuquerque and Village of Los Ranchos de Albuquerque water conservation programs to encourage and provide incentives for residents to use water-saving landscaping techniques.
- ✓ Action 2: Continue Village of Los Ranchos de Albuquerque business ordinance to use water-saving landscaping techniques and explore additional water conservation/drought measures.
- ✓ Action 3: Employ municipal and county, subdivision, and building regulations to promote water conservation.
- ✓ Action 4: Expand City Water Awareness Programs and Water Audits to all parts of the County.
- ✓ Action 5: Expand projects to use City and County treated effluent for non-potable uses.
- ✓ Action 6: Implement aggressive program to repair significant leaks in existing municipal water system.
- ✓ Action 7: Investigate alternative and efficient farming irrigation techniques and implement techniques where cost-effective.
- ✓ Action 8: Implement drought emergency plan to impose residential and business watering restrictions, water use violation fees, and a drought emergency surcharge for excessive water usage.
- ✓ Action 9: Continue studies to determine effectiveness of exotic plant species removal and implement a cost-effective program to remove exotic plant species.

IV.B Utilize existing plans and task forces for "active water resource management."

- ✓ Action 1: Identify City, County, and village officials and require their participation in the creation and implementation of Drought Management Plan as part of the Interstate Stream Commission, MRCOG, and Office of the State Engineer's 2003 State Water Plan strategies.
- ✓ Action 2: Identify City, County, and village officials that will coordinate efforts with the Governor's Drought Task Force and Work Groups.

SEVERE WEATHER MITIGATION ACTIONS

There are a number of actions that can be used to mitigate wind and weather hazards. Unlike flood and wildfire, which have limited geographic extents, severe weather potentially affects the entire County. Therefore, strategies for identifying wind and weather mitigation actions usually involve identifying individual structures with known/assumed vulnerability or particular critical facilities. Additional efforts might include actions that can reach the entire County through public education or that improve County implementation capabilities and strengthening regulations.

Goal V: *Reduce possibility of injury and death due to* ***severe weather.***

***Goal* V Objectives:**

V.A Increase public awareness of actions to take during all types of severe weather.

- ✓ Action 1: Increase number of sirens and warning signal capabilities in public buildings, parks, and recreational areas to announce alerts from the Emergency Alert System and National Weather Radio.
- ✓ Action 2: Increase public awareness of the forecasting and warning system and educate citizens on what to do before, during, and after a severe weather event through GOV TV media.

V.B Increase participation in and number of storm watcher programs throughout County.

- ✓ Action 1: Enable preparedness for the impacts of severe weather through better planning, education, and awareness in the Village of Tijeras through the community's participation in *StormReady*.

V.C Identify critical facilities and structures that are vulnerable to high winds and hail.

- ✓ Action 1: Utilize County Assessor data to analyze vulnerability of critical facilities.
- ✓ Action 2: Conduct a survey of all manufactured homes in the county to gather data on location, age, and condition to determine appropriate mitigation action (anchoring structures, relocation, acquisition).

V.D Install severe weather warning systems and safe areas in large venues.

- ✓ Action 1: Install warning systems in large capacity facilities.
- ✓ Action 2: Install severe weather instruction signage at recreational fields.

V.E Increase protection of vulnerable buildings.

- ✓ Action 1: Enforce building codes and regulations through periodic inspections.
- ✓ Action 2: Retrofit existing structures and critical facilities to protect them from damage by wind and hail.

EARTHQUAKE MITIGATION ACTIONS

Based upon historical seismic data, the risk of damage from earthquakes in Bernalillo County is still possible. Any action should focus on assessing the potential vulnerabilities of critical facilities.

Goal VI: *Reduce possibility of damage and loss to existing community assets including structures, critical facilities, and infrastructure due to* ***earthquakes.***

Goal VI Objectives:

VI.A Assess vulnerability of critical facilities to earthquake hazards.

- ✓ Action 1: Increase awareness of potential of earthquakes in Bernalillo County.
- ✓ Action 2: Conduct non-technical assessment of critical facilities to determine relative vulnerability and risk.
- ✓ Action 3: Utilize Earthquake – Resistant Design and construction techniques.
- ✓ Action 4: Expand structural information requirements to analyze vulnerability of critical facilities, utilizing County Assessor data.
- ✓ Action 5: Conduct Technical Assistance Visits to help homeowners implement non-structural earthquake retrofits of their home.

OTHER HAZARDS MITIGATION ACTIONS

The risk of damage from Landslides/Land Subsidence, Dam Failure, and Volcanoes is relatively low in Bernalillo County, but based upon historical data, it is still possible. Any action should focus on assessing the potential vulnerabilities of critical facilities. The probability of a volcanic eruption is extremely low, and no mitigation actions have been proposed. ***The following objectives are actions to follow up on during the 5-year review.***

Goal VII: *Reduce possibility of damage and loss to existing community assets, including structures, critical facilities, and infrastructure due to* ***landslides/land subsidence dam failure, and volcanoes.***

Goal VII Objectives:

VII.A Assess vulnerability of critical facilities due to Dam Failure.

- ✓ Action 1: Increase awareness of potential of dam failures in Bernalillo County.
- ✓ Action 2: Conduct non-technical assessment of structures, infrastructure, and critical facilities to determine relative vulnerability and risk.

VII.B Assess vulnerability of assets due to Landslides/Land Subsidence.

- ✓ Action 1: Increase awareness of potential of landslides and land subsidence in Bernalillo County.
- ✓ Action 2: Conduct non-technical assessment of structures, infrastructure, and critical facilities to determine relative vulnerability and risk.
- ✓ Action 3: Map areas vulnerable to landslides and land subsidence.
- ✓ Action 4: Utilize Earthquake–Resistant Design and construction techniques in vulnerable areas.
- ✓ Action 5: Anchor slope mesh over areas prone to landslides that threaten infrastructure and critical facilities.

VII.C Assess vulnerability of assets due to Volcano eruption.

- ✓ Action 1: Increase awareness of potential of volcano eruptions in Bernalillo County.
- ✓ Action 2: Conduct non-technical assessment of structures, infrastructure, and critical facilities to determine relative vulnerability and risk.
- ✓ Action 3: Educate county, city, and local governments on volcano warning system and aviation color code warning system.

MITIGATION ACTIONS TO GUIDE FUTURE DEVELOPMENT AND PROMOTE PUBLIC AWARENESS

The two remaining goals address important aspects of the mitigation planning effort that go beyond addressing existing problem areas. These goals are based upon the concepts of preventing hazards through appropriate land use and development controls, as well as increasing public awareness on the potential effectiveness of mitigation actions at the individual, community, and County level.

Goal VIII: *Promote disaster-resistant future development.*

Goal VIII Objectives:

VIII.A Create zoning ordinances to restrict development in high-hazard areas.

- ✓ Action 1: Plan review and revisions at the City and County level to incorporate vulnerability analysis.

VIII.B Utilize revision of comprehensive plans and zoning ordinances to limit development in high-hazard areas and improve the ability to identify vulnerable structures.

- ✓ Action 1: Distribute and promote the inclusion of the vulnerability analysis information as part of periodic Plan review and revisions at the City and County level.

VIII.C Encourage and facilitate the adoption of building codes that provide protection for new construction and substantial renovations from the effects of identified hazards.

- ✓ Action 1: Strengthen City and County regulations on earthquake, wind, and flood related codes.

VIII.D Provide adequate and consistent enforcement of ordinances and codes within and between jurisdictions.

- ✓ Action 1: Work with the State, County, and City building inspectors to consistently enforce building codes from jurisdiction to jurisdiction.

VIII.E Address identified data limitations regarding development build-out potential in high-hazard areas.

- ✓ Action 1: Complete structure data records in the County GIS to allow future revisions of this plan, to more easily incorporate information about property values, construction types, etc.

Goal IX: *Promote hazard mitigation as a public value in recognition of its importance to the health, safety, and welfare of the population.*

Goal IX Objectives:

IX.A Provide public education to increase awareness of hazards and opportunities for mitigation.

- ✓ Action 1: Identify and publicize success stories as part of a consistent public relations program.
- ✓ Action 2: Promote Ditch & Water Safety Task Force programs in Bernalillo County.

IX.B Promote partnerships between the City and the County to continue to develop a County-wide approach to identifying and implementing mitigation actions.

- ✓ Action 1: Convene regular meetings with the Mitigation Planning Team to discuss issues and progress related to the implementation of the Plan.
- ✓ Action 2: Create and promote partnerships among the municipalities and the County to develop a County-wide approach to mitigation activities.
- ✓ Action 3: Incorporate hazard mitigation concepts into regular City and County operations.

A Hazard Mitigation Plan is a community's plan for evaluating hazards, identifying resources and capabilities, selecting appropriate actions, and developing and implementing the preferred mitigation actions to eliminate or reduce future damage from those hazards in order to protect the health, safety, and welfare of residents in that community. The implementation strategy outlines the key information about responsibilities and funding that are necessary to implement the mitigation actions.

There may be differences in the amount of information and analysis, or the number of proposed initiatives, for each separate jurisdiction. This may be a result of the different characteristics of each jurisdiction, the information and data available for the analysis, and the time available for the jurisdiction's representatives to conduct the planning process.

The Mitigation Plan and Implementation Strategy also identifies procedures for keeping the Plan current and for updating it at least once every five years, as prescribed by the DMA of 2000.

PRIORITIZATION

Bernalillo County (for the unincorporated areas) and each of the municipalities within the County identified and ranked hazard mitigation actions for their respective jurisdictions. Each committee member had previously met with his or her community to identify and determine their hazard priorities. The Mitigation Planning Team met on October 27, 2004, to prioritize these actions into a County-wide consensus.

All the proposed mitigation actions under consideration were listed on large poster sheets for the entire Mitigation Planning Team to review. Each team member was then given 5 voting dots to use as votes. Each of the team members then placed any number of voting dots next to any of the mitigation actions they felt were important and a priority to the County as a whole and to their community. Prior to making their decisions, team members reviewed maps, goals, and objectives, and the priority given to each hazard for which actions were devised. According to the rules of multi-voting, if someone felt especially strongly about one particular action, he or she could place all 5 dots next to it. The voting dots were tallied and the mitigation actions were then listed. Team members took into account the following considerations:

- ✓ *Hazard priority:* How does the action relate to the hazard order of priority?
- ✓ *Plan goals and objectives:* How does the mitigation action address the goals and objectives of the Plan?
- ✓ *Equity:* Does this action benefit most, if not all, the communities within the County? Is there an equitable distribution of actions by municipality?
- ✓ *Countywide impacts:* How does the action affect the County as a whole?
- ✓ *Ease of implementation:* Can this action be easily implemented first? Does the County or town have the capability (funding, regulatory authority, staff) in place now to implement the action?
- ✓ *Multi-objective actions:* Does this action achieve multiple community goals?
- ✓ *Time:* Can this action be quickly accomplished compared to those that would take a long time to obtain the necessary approvals or funding?
- ✓ *Post-disaster mitigation:* Is this action more feasible in a post-disaster setting? Would the extent of damages, political will, and access to State and Federal mitigation funds dramatically alter the feasibility of implementation?
- ✓ *Benefit-Cost Analysis:* Is this the project that produces the greatest net cost benefit?

FEMA defines Benefit-Cost Analysis (BCA) as the method by which the future benefits of a mitigation project are determined and compared to its cost. The end result is a Benefit-Cost Ratio (BCR), which is derived from a project's total net benefits divided by its total cost. The BCR is a numerical expression of the cost-effectiveness of a project. BCRs of 1.0 or greater have more benefits than costs, and are therefore cost-effective.

During the project discussions, a preliminary benefit-cost analysis was discussed by the Planning Team. Projects that were too costly to consider were not prioritized and are therefore not discussed in the text. The Planning Team used their working experience to focus on projects that were reasonably likely to be funded. Fundable projects were those that the benefit-cost analysis had determined to be cost effective. For these projects, the cost of implementing the mitigation technique is less than the cost of not providing any mitigation and continuing to pay for the consequences of not mitigating.

The Team used the STAPLE + E process, which is composed of the following evaluation categories: **S**ocial, **T**echnical, **A**dministrative, **P**olitical, **L**egal, **E**conomic, and **E**nvironmental. Each category has its own specific considerations that must be met when evaluating a mitigation method.

Table 36: The STAPLE + E Process

Evaluation Category	Considerations
Social	▪ Community Acceptance ▪ Adversely Affects Segment of Population
Technical	▪ Technical Feasibility ▪ Long-term Solution ▪ Secondary Impacts
Administrative	▪ Staffing Levels & Training ▪ Funding Allocated ▪ Maintenance/Operations
Political	▪ Political Support ▪ Local Champion or Proponent ▪ Public Support
Legal	▪ State Authority ▪ Existing Local Authority ▪ Action Potentially Subject to Legal Challenge by Opponents
Economic	▪ Benefit of Mitigation ▪ Cost of Mitigation Action ▪ Contributes to Economic Goals ▪ Outside Funding Requirement
Environmental	▪ Affects Land/Water Bodies ▪ Affects Endangered Species ▪ Affects Hazardous Materials and Waste Sites ▪ Consistent with Community's Environmental Goals ▪ Consistent with Federal Laws

Source: Table adapted from FEMA 386-3, Developing the Mitigation Plan: Identifying Mitigation Actions and Implementing Strategies

Each criterion in the STAPLE + E process was evaluated and rated according to: 0 = Poor, 1 = Fair, 2 = Good, 3 = Excellent. These rating were defined as:

Poor: The mitigation method does not meet basic criteria established under the evaluation category.

Fair: The mitigation method meets the basic criteria established under the evaluation category.

Good: The mitigation method exceeds the basic criteria established under the evaluation category.

Excellent: The mitigation method exceeds the basic established criteria in an innovative or new way.

The Planning Team members prioritized the hazards for each community. All of the jurisdictions identified wildfire as the number one hazard in their community. The unhealthy condition of the forests, the drought, and lack of access and water supply were identified as factors contributing to the hazard risk. The planning team members from the City and the County identified hazardous materials as the number two hazard on their list, due to the large quantities of hazardous materials traveling through the City and County via rail and highway. All of the team members agreed that drought was a potential hazard to the County, but it was listed further down the prioritization list since drought is a regional issue and mitigation measures are limited in individual communities. Table 37 below presents the complete prioritization of hazards that resulted from the meetings.

Table 37: Prioritization of Hazards

Hazard	Bernalillo County	City of Albuquerque	Village of Los Ranchos de Albuquerque	Village of Tijeras
Wildfire	1	1	1	1
Human-Caused	2	2	3	5
Severe Weather	3	4	5	2
Flood	4	3	2	4
Drought	5	5	4	3
Earthquake/Other	6	6	6	6

Table 38: Ranking Results for Mitigation Projects			
All County Jurisdictions	**Hazard**	**Priority**	**Jurisdiction**
Wildland Urban Interface (WUI) Code for entire County.	Wildfire	1	All
Establish alternate hazardous materials routes away from sensitive receptors, critical facilities, schools and population centers.	Human-Caused	2	All
Continue training fire fighters in advanced Wildland fire fighting techniques to respond and control wildfires.	Wildfire	3	All
Establish an All Hazards Citizen's Emergency Response Team (CERT) program and develop county-wide HazMat support.	Human-Caused	4	All
Integrated Wildland Resource Group	Wildfire	5	All
Develop and support a County-wide response program to HazMat and WMD incidents.	Human-Caused	6	All
Increase number of sirens and radios/televisions with warning capabilities, in public buildings, parks, and recreational areas to announce alerts from the Emergency Alert System and National Weather Radio.	Severe Weather	7	All
Develop and implement a county-wide Winter StormReady Program.	Severe Weather	8	All
Create a State Drought Management Plan Work Group.	Drought	9	All
Create a Wellhead Protection Awareness Program.	Drought	10	All
Create and maintain defensible space around all critical facilities and structures, including housing, administrative, and other structures.	Wildfire	11	All
Further investigations to examine the vulnerability of structures to severe weather and hailstorms.	Severe Weather	12	All
Expand existing projects to use treated effluent for non-potable uses.	Drought	13	All
Create water conservation programs for residential, commercial and industrial users.	Drought	14	All
Increase awareness of potential for earthquakes in Bernalillo County.	Earthquake	15	All
Review and update existing building codes for earthquakes.	Earthquake	16	All
Conduct Technical Assistance Visits to help homeowners implement non-structural earthquake retrofits of their home.	Earthquake	17	All

Map areas vulnerable to landslides and land subsidence and input into GIS.	Landslides/ Land Subsidence	18	All
Anchor slope mesh over areas prone to landslides that threaten infrastructure and critical facilities.	Landslides/ Land Subsidence	19	All
Create a list of special populations (Elderly and Homebound) Welfare Check System.	Extreme Heat	20	All

Multiple Jurisdictions	**Primary Hazard (Secondary Hazard)**	**Priority**	**Jurisdiction**
Implement aggressive program to repair leaks in existing municipal water system, including lines to homes.	Drought	1	City/County/ Los Ranchos
Increase water storage capacity for fire suppression in the Bosque.	Wildfire	2	City/County
Improve access into the Bosque for emergency response.	Wildfire (Multi-Hazard)	3	City/County
Continue thinning and fuel reduction projects in Bosque.	Wildfire	4	City/County
Remove jetty jacks from along the Rio Grande in targeted high-risk areas to aid first responder access to the Bosque during wildfires.	Wildfire	5	City/County/ Los Ranchos
Improve access to identified East Mountain areas for emergency response.	Wildfire (Multi-Hazard)	6	County/Tijeras
Participate in State's program to use bio mass fuels as a way to dispose of tree thinning debris in the Bosque and East Mountain areas.	Wildfire	7	City/County
Study alternate chemical treatment methods at the waste water treatment plant.	Human-Caused	8	City/County
Develop mitigation strategies for known roads and buildings in flood areas in Bernalillo County.	Flood/ Flash Flood	9	City/County
Create a volcano awareness program to educate citizens on the potential dangers of the Albuquerque Volcanic Fields.	Volcano	10	City/County/Albuquerque

Map areas vulnerable to volcanic explosion and assign a high/medium/low risk value.	Volcano	11	City/County/Albuquerque
Create a list of special populations (Elderly and Homebound) Welfare Check System.	Extreme Heat	12	All

Bernalillo County	**Primary Hazard (Secondary Hazard)**	**Priority**	**Jurisdiction**
Wildland Urban Interface (WUI) Code for entire County.	Wildfire	1	City/County
Establish alternate hazardous materials routes away from sensitive receptors, critical facilities, schools, and population centers.	Human-Caused	2	City/County
Increase number of sirens and radios/televisions with warning capabilities, in public buildings, parks, and recreational areas to announce alerts from the Emergency Alert System and National Weather Radio.	Severe Weather	3	City/County

City of Albuquerque	**Primary Hazard (Secondary Hazard)**	**Priority**	**Jurisdiction**
Wildland Urban Interface (WUI) Code for entire County.	Wildfire	1	City of Albuquerque
Study alternate chemical treatment methods at the waste water treatment plant.	Human-Caused	2	City of Albuquerque
Establish alternate hazardous materials routes away from sensitive receptors, critical facilities, schools, and population centers.	Human-Caused	3	City of Albuquerque
Integrated Wildland Resource Group.	Wildfire	4	City of Albuquerque
Update first floor elevation certificates and incorporate them into City of Albuquerque GIS system.	Flood/ Flash Flood	5	City of Albuquerque
Create monitoring system to track land subsidence due to groundwater depletion in the northeast quadrant of the City of Albuquerque.	Landslides/ Land Subsidence	6	City of Albuquerque

Village of Los Ranchos de Albuquerque	Primary Hazard (Secondary Hazard)	Priority	Jurisdiction
Create Firewise Communities through the National Wildland-Urban Interface Fire Program in the Village of Los Ranchos de Albuquerque.	Wildfire	1	Village of Los Ranchos de Albuquerque
Select a village official to participate in the State Drought Management Plan Work Group.	Drought	2	Village of Los Ranchos de Albuquerque
Implement Los Ranchos de Albuquerque Incident Action Plan (IAP).	Wildfire	3	Village of Los Ranchos de Albuquerque

Village of Tijeras	Primary Hazard (Secondary Hazard)	Priority	Jurisdiction
Continue efforts as a Firewise Community through the National Wildland/Urban Interface Fire Program to educate the community in defensible space.	Wildfire	1	Village of Tijeras
Create a program for green waste disposal at transfer stations to encourage tree thinning by facilitating disposal of debris.	Wildfire	2	Village of Tijeras
Purchase 4-wheel drive emergency vehicle to improve access to difficult to reach areas.	Multi-Hazard (Severe Weather)	4	Village of Tijeras
Secure additional sources of water for emergency use.	Wildfire	5	Village of Tijeras
Flood Control Projects: Arroyo Crossing Points.	Flood/Flash Flood	6	Village of Tijeras
Flood Control Projects Stabilization of Arroyos.	Flood/Flash Flood	7	Village of Tijeras
Hire a Floodplain Manager for the Village.	Flood/Flash Flood	8	Village of Tijeras
Participate in State's program to use bio mass fuels as a way to dispose of tree thinning debris in the Village of Tijeras.	Wildfire	9	Village of Tijeras
Install Living Snow Fences along Critical Roadways in the Village of Tijeras.	Winter storm	10	Village of Tijeras

The Hazard Mitigation Plan contains the list of mitigation actions, including the rationale for inclusion, responsible organizations, estimated costs, possible funding sources, and timeline for implementation. Following is the list of mitigation actions, identified by the Mitigation Planning Team, for each municipality. The actions for each municipality are listed in order of priority, and the overall priority ranking, per the preceding discussion, is also indicated.

Bernalillo County

1. Wildland-Urban Interface Code for entire County.

Hazard:	Wildfire
Comments:	The WUI Code shall apply to the construction, alteration, movement, repair, maintenance, and use of any building, structure or premises within the WUI areas of the County. The objective of this code is to establish minimum regulations consistent with nationally recognized good practices for safeguarding of life and property. Regulations in this code are intended to mitigate the risk to life and structures from the intrusion of fire. The purpose of the rules is to prohibit wildland exposures from spreading to adjacent structures and vice versa. Certain requirements may not be applicable depending on the type of construction and the hazard rating. The Fire Chief or the code may allow alternative materials or methods as long as they meet the intent of the WUI Code.
Jurisdiction(s):	Bernalillo County, City of Albuquerque, Village of Los Ranchos de Albuquerque, and Village of Tijeras
Responsible Organization/Individual:	Bernalillo County and City of Albuquerque Fire Departments and Planning and Zoning Departments/BCFD Fire Marshall; City of Albuquerque Fire Marshall
Estimated Costs:	City / County administrative costs
Possible Funding Sources:	Self-funded
Timeline for Implementation:	3 – 6 Months
Cost-Benefit Analysis:	Regulations in this code are intended to mitigate the risk to life and structures from the intrusion of fire

2. Establish Alternative Hazardous Materials Routes away from Sensitive Receptors, critical facilities, schools, and population centers.

Hazard:	Human-Caused Hazards (Hazardous Materials Releases)
Comments:	Bernalillo County has no designated hazardous materials routes. Trucks containing hazardous materials should be routed away from sensitive areas such as schools, hospitals, and large population centers. Project would be a feasibility study resulting in the identification of alternate routes of travel for hazardous materials transport vehicles.
Jurisdiction(s):	Bernalillo County
Responsible Organization/Individual:	Local Emergency Planning Committee and City/County Emergency Managers
Estimated Costs:	$100,000
Possible Funding Sources:	City/County government budgets/EPA
Timeline for Implementation:	12 Months
Cost-Benefit Analysis:	Assets at-risk due to hazardous materials mobile sources total more than 412 million dollars. Response to a single major hazardous materials incident can cost more than $700,000. Study could identify means to re-direct HazMat traffic away from most critical areas.

3. Continue training fire fighters in advanced Wildland fire fighting techniques to respond and control wildfires.

Hazard:	Wildfire
Comments:	Bernalillo County has developed comprehensive fire fighting techniques to respond to wildfire type situations that requires on-going training of fire-fighting personnel.
Jurisdiction(s):	Bernalillo County
Responsible Organization/Individual:	Bernalillo County Fire Department/Training Commander
Estimated Costs:	On-going
Possible Funding Sources:	County General Fund
Timeline for Implementation:	12 Months, On-going
Cost-Benefit Analysis:	Comprehensive fire fighting techniques for wildfire will lead to increased safety of fire fighters and rapid response

4. Establish an All Hazards Citizen's Emergency Response Team (CERT) Program and develop county-wide HazMat support.

Hazard:	Human-Caused Hazards (Hazardous Materials Releases, Terrorism)
Comments:	Citizen's Emergency Response Teams (CERT) training volunteers to assist emergency response entities to assist with the community needs of disaster prevention, preparedness, and response. CERT will provide vital supplemental support to both local and national responders. This proposal is for a start-up program to train and to fund personal response equipment for CERT members.
Jurisdiction(s):	Bernalillo County
Responsible Organization/Individual:	Bernalillo County Fire and Rescue/Emergency Management Coordinator; Albuquerque Office of Emergency Management/Albuquerque Community Response Team Coordinator; Village of Tijeras Fire Department/Fire Chief; Village of Los Ranchos de Albuquerque Fire Department/Fire Chief; and Office of the Emergency Managers
Estimated Costs:	$165,000
Possible Funding Sources:	Office of Homeland Security
Timeline for Implementation:	12 Months
Cost-Benefit Analysis:	A well-trained CERT can support emergency response staff, and therefore save costs on overtime. Overtime currently averages $30-50 per hour: cost of project equals about 3300 hours in overtime.

5. Integrated Wildland Resource Group.

Hazard:	Wildfire
Comments:	Develop a program to integrate planning and training efforts for local emergency response for wildfire. The group will function as a platform for sharing lessons learned and strategies for an integrated city/county/volunteer response to wildfires.
Jurisdiction(s):	Bernalillo County, City of Albuquerque, Village of Los Ranchos de Albuquerque and Village of Tijeras Fire Departments
Responsible Organization/Individual:	Bernalillo County Fire Department/Training Commander and Office of Emergency Management ; City of Albuquerque Fire Department/Training Commander; City of Albuquerque Wildland Fire Task Force; Village of Tijeras Fire Department/Fire Chief; Village of Los Ranchos de Albuquerque Fire Department/Fire Chief
Estimated Costs:	$25,000
Possible Funding Sources:	General budget
Timeline for Implementation:	6 Months
Cost-Benefit Analysis:	Integrated planning will lead to faster and more efficient response to wildfire

6. Develop and support a county-wide response program to HazMat and WMD incidents.

Hazard:	Human-Caused Hazards (Hazardous Materials Releases, Terrorism)
Comments:	Develop a program to integrate planning and training efforts or local emergency response to HazMat and WMD incidents.
Jurisdiction(s):	Bernalillo County, City of Albuquerque, Village of Los Ranchos de Albuquerque and Village of Tijeras Fire Departments
Responsible Organization/Individual:	Bernalillo County Office of Emergency Management; City of Albuquerque Office of Emergency Management/EOC Manager; Bernalillo County Fire Dept/Training Commander; City of Albuquerque Fire Dept/Training Commander; Village of Los Ranchos de Albuquerque Fire Dept/Fire Chief; Village of Tijeras Fire Dept/Fire Chief
Estimated Costs:	$25,000
Possible Funding Sources:	General budget
Timeline for Implementation:	12 Months
Cost-Benefit Analysis:	Integrated planning will lead to faster and more efficient response to HazMat and WMD incidents

7. Increase the number of sirens and radios/televisions with warning capabilities, in public buildings, parks and recreational areas to announce alerts from the Emergency Alert System and National Weather Radio.

Hazard:	Multi-Hazard; Secondary Hazard: Severe Weather (Tornado/Windstorm; Thunderstorm/Lightning/Hail)
Comments:	Part 1 - Identify facilities with large venues and evaluate appropriate warning systems. Part 2 - Create building codes to increase number of warning sirens.
Jurisdiction(s):	Bernalillo County, City of Albuquerque, Village of Los Ranchos de Albuquerque and Village of Tijeras Offices
Responsible Organization/Individual:	Bernalillo County, City of Albuquerque, Village of Los Ranchos de Albuquerque and Village of Tijeras Fire Departments and Offices of the Emergency Managers/Bernalillo County EOC Manager; Albuquerque EOC Manager; Los Ranchos de Albuquerque Fire Chief; Tijeras Fire Chief
Estimated Costs:	$40,000
Possible Funding Sources:	General Budget
Timeline for Implementation:	12 months
Cost-Benefit Analysis	Hail damage from recent storm could total more than 40 million dollars. Early warning systems could have enabled people to get vehicles under protected areas.

8. Develop and implement a county-wide Winter StormReady Program

Hazard:	Winter Storm
Comments:	Develop a StormReady program to enable preparedness for the impacts of Winter Storms through better planning, education, and awareness. Program shall be county-wide and include participation at the local community level.
Jurisdiction(s):	Bernalillo County/Albuquerque
Responsible Organization/Individual:	Bernalillo County and City of Albuquerque Emergency Services/EOC Manager
Estimated Costs:	$50,000
Possible Funding Sources:	General budget
Timeline for Implementation:	12 Months
Cost-Benefit Analysis:	Cost is minimal compared to recent annual storm damage in Bernalillo County. December 2006 event cost $3.8 million dollars.

9. Create a State Drought Management Plan Work Group.

Hazard:	Drought
Comments	Convene a work group of city, county, and village officials to participate in the creation and implementation of the State Drought Management Plan by identifying staff to attend meetings.
Jurisdiction(s):	Bernalillo County
Responsible Organization/Individual:	Bernalillo County and City of Albuquerque; Village of Los Rancheros de Albuquerque; Village of Tijeras
Estimated Costs:	Salary and travel costs for meetings
Possible Funding Sources:	General budget
Timeline for Implementation:	12 Months; On-going
Cost-Benefit Analysis	Increased knowledge of staff in drought management will facilitate a comprehensive response to drought.

10. Create a Wellhead Protection Awareness Program.

Hazard:	Drought
Comments:	Create a program to be implemented through the neighborhood associations to educate communities about wellhead protection. Target communities with domestic wells.
Jurisdiction(s):	Bernalillo County
Responsible Organization/Individual:	Albuquerque Bernalillo County Water Authority/Water Resources Division Leader
Estimated Costs:	$25,000
Possible Funding Sources:	EPA
Timeline for Implementation:	12 Months
Cost-Benefit Analysis:	Small cost to help protect the area's major source of potable water. Cost is equal to purchasing eight acre-feet of water rights.

11. Create and maintain defensible space around all critical facilities and structures, including housing, administrative, and other structures.

Hazard:	Wildfire
Comments:	Bio park, and 1-40 over Bosque most at risk
Jurisdiction(s):	Bernalillo County and City of Albuquerque, and Office of Cultural Affairs (Hispanic Center), Village of Los Ranchos de Albuquerque, and Village of Tijeras.
Responsible Organization/Individual:	City of Albuquerque Open Space Division and Middle Rio Grande Conservancy District (MRGCD)
Estimated Costs:	✓ Hazardous fuels reduction $1500-3000 per acre ✓ Herbicide $500-800 per acre ✓ 5-year restoration $6000 per acre ✓ Continued monitoring $2200 year per acre
Possible Funding Sources:	United States Army Corps of Engineers
Timeline for Implementation:	12 Months; On-going
Cost-Benefit Analysis:	Value of assets at-risk total more than 250 million dollars

12. Further investigations to examine the vulnerability of structures to severe winds and hailstorms.

Hazard:	Severe Weather (Tornado/Windstorm; Thunderstorm/Lightning/Hail)
Comments:	County has high percentage of manufactured homes and a number of historic critical facilities. Identify specific vulnerabilities and distribute information about how to strengthen their ability to resist high wind events and hailstorms.
Jurisdiction(s):	Bernalillo County/City of Albuquerque/Los Ranchos de Albuquerque
Responsible Organization/Individual:	Bernalillo County Building Section; City of Albuquerque Building Inspection Section; Village of Los Ranchos de Albuquerque Planning Department
Estimated Costs:	$80,000
Possible Funding Sources:	Bernalillo County, Pre-Disaster Mitigation Assistance funds administered by NMOEM, Hazard Mitigation Grant Program Technical Assistance funds administered by NMOEM
Timeline for Implementation:	Within 24 months of adoption of Plan
Cost-Benefit Analysis:	Recent damage due to hailstorms estimated at 40 million dollars.

13. Expand existing pilot projects to use treated effluent for non-potable uses.

Hazard:	Drought
Comments:	City of Albuquerque and Bernalillo County already use treated effluent to irrigate golf course and limited number of city parks. Existing programs can be expanded and thereby reduce current use of potable water.
Jurisdiction(s):	City of Albuquerque and Bernalillo County
Responsible Organization/Individual:	City of Albuquerque and Bernalillo County Public Works departments
Estimated Costs:	$250,000
Possible Funding Sources:	Office of State Engineer, State legislative funds, Pre-Disaster Mitigation Assistance funds administered by NMOEM, Hazard Mitigation Grant Program Technical Assistance funds administered by NMOEM.
Timeline for Implementation:	12 Months
Cost-Benefit Analysis:	New water sources cost more than $6,000/acre-foot of water. Each acre-foot of water typically serves three households. Re-use of treated effluent equals cost of adding 125 new households.

14. Create water conservation programs for residential, commercial and industrial users.

Hazard:	Drought
Comments:	Expand City water conservation programs to encourage and provide incentives for residents to use water-saving landscaping techniques. Expand City Water Awareness Programs and Water Audits to all parts of County. Employ municipal and county, subdivision, and building regulations to promote water conservation. Implement aggressive program to repair leaks in existing municipal water system. Implement drought emergency plan to: implement residential, business and watering restrictions, water use violation fees, and a drought emergency surcharge for excessive water usage
Jurisdiction(s):	Bernalillo County / City of Albuquerque
Responsible Organization/Individual:	Albuquerque Bernalillo County Water Authority
Estimated Costs:	Part of City Water Conservation Program
Possible Funding Sources:	Self funding by the Albuquerque Bernalillo County Water Authority
Timeline for Implementation:	12 Months; On-going
Cost-Benefit Analysis:	Increased knowledge of staff in water conservation methods will facilitate a comprehensive response to drought

15. Increase awareness of potential for earthquakes in Bernalillo County.

Hazard:	Earthquakes
Comments:	Although earthquakes are rare in Bernalillo County, earthquakes should be included in other disaster information literature and programs already in place. Information should include what to do before, during, and after an earthquake.
Jurisdiction(s):	Bernalillo County
Responsible Organization/Individual:	Bernalillo County Office of Emergency Management
Estimated Costs:	Staff time and printing costs
Possible Funding Sources:	General fund
Timeline for Implementation:	12 Months
Cost-Benefit Analysis:	Increased awareness of potential earthquakes will protect lives and property

16. Review and update existing building codes for earthquakes.

Hazard:	Earthquakes
Comments:	Building codes are the first line of defense against earthquake damage. Adopt new building codes, as necessary, to ensure adequacy in respect to potential earthquake risk.
Jurisdiction(s):	Bernalillo County
Responsible Organization/Individual:	Bernalillo County Building, Planning, and Zoning Department/Building Official
Estimated Costs:	Minimal
Possible Funding Sources:	Self-funded by local planning departments
Timeline for Implementation:	12 Months
Cost-Benefit Analysis:	Updated building codes will minimize damage to structures and protect lives in the event of an earthquake

17. Conduct Technical Assistance Visits to help homeowners implement non-structural earthquake retrofits of their home.

Hazard:	Earthquakes
Comments:	Work with home owners to conduct inexpensive, non-structural retrofitting such: as securing appliances, bookcases, cabinet drawers and doors to prevent tipping/opening during an earthquake; securing pictures and framed art to walls; securing hanging fixtures to the ceiling, and applying safety film to glass windows and doors.
Jurisdiction(s):	Bernalillo County
Responsible Organization/Individual:	Bernalillo County Office of Emergency Management; Bernalillo County Zoning, Building & Planning/Building Inspector
Estimated Costs:	$500/per home or less
Possible Funding Sources:	Homeowner
Timeline for Implementation:	12 Months
Cost-Benefit Analysis:	Non-structural retrofits are an inexpensive means of mitigating property damage and personal damage due to the effects of earthquakes.

18. Map areas vulnerable to landslides and land subsidence in Bernalillo County and input into GIS.

Hazard:	Landslides/Land Subsidence
Comments:	Areas of eastern Bernalillo County are susceptible to landslides. The northeast quadrant of the City of Albuquerque is vulnerable to land subsidence due to ground water pumping. Mapping vulnerable areas will enable planners when developing land-use zoning maps and guide mitigation activities for landslide/land subsidence hazards.
Jurisdiction(s):	Bernalillo County and City of Albuquerque
Responsible Organization/Individual:	Bernalillo County and City of Albuquerque Planning, Zoning, and Mapping Departments
Estimated Costs:	City/County Administrative Costs
Possible Funding Sources:	City/County government budgets
Timeline for Implementation:	Within 12 months of adoption of plan
Cost-Benefit Analysis:	This project will identify the areas vulnerable to landslides and land subsidence and decrease, if not eliminate, this hazard as future development of the County and City of Albuquerque continues.

19. Anchor slope mesh over areas prone to landslides that threaten infrastructure and critical facilities.

Hazard:	Landslide/Land Subsidence
Comments:	Areas within Bernalillo County are vulnerable to landslides due to slope erosion. Anchor heavy-gauge metal slope mesh over areas prone to landslides along transportation routes and near critical facilities in areas of high vulnerability.
Jurisdiction(s):	Bernalillo County
Responsible Organization/Individual:	Bernalillo County Office of Emergency Management/Emergency Manager and Bernalillo County Public Works Department
Estimated Costs:	$100,000
Possible Funding Sources:	General fund
Timeline for Implementation:	12 Months
Cost-Benefit Analysis:	Protection of transportation routes and critical facilities will minimize damage and protect lives in the event of a landslide.

20. Create a list of special populations (Elderly and Homebound) Welfare Check System.

Hazard:	Extreme Heat
Comments:	Within the planning area there are many residents who are home bound or elderly and have difficulty seeking assistance. In the event of an extreme heat event, this system would provide welfare check visits to assure these residents are not in any heat related danger. Part of this program will be an effort to educate the prospective beneficiaries of the program and encouraging them to sign up.
Jurisdiction(s):	Bernalillo County and City of Albuquerque
Responsible Organization/Individual:	Bernalillo County and City of Albuquerque Office of Emergency Management/Emergency Manager, Fire Departments, Police Departments, and Emergency Medical Services.
Estimated Costs:	$25,000
Possible Funding Sources:	General fund
Timeline for Implementation:	12 Months
Cost-Benefit Analysis:	Protecting health and life is of more value than the costs associated with providing this service.

Multiple Jurisdictions

1. Implement aggressive program to repair leaks in existing municipal water system including lines to homes.

Hazard:	Drought
Comments:	Due to the on-going drought, value of water as an asset is rising. Water leakage not only wastes water, but can also contribute to subsidence and sinkholes.
Jurisdiction(s):	Bernalillo County
Responsible Organization/Individual:	Albuquerque Bernalillo County Water Utility Authority/Engineering & Planning Division Leader
Estimated Costs:	Costs will be on a project by project basis
Possible Funding Sources:	New Mexico Office of the State Engineer, Water Utility charges
Timeline for Implementation:	12 Months
Cost-Benefit Analysis:	An aggressive program to repair leaks in municipal water systems will increase water conservation and protect against infrastructure damage

2. Increase water storage capacity for fire suppression in the Bosque.

Hazard:	Wildfire
Comments:	Study needed on best way to increase water availability for fire suppression in the Bosque by increasing capability for water storage via new wells or dry hydrants.
Jurisdiction(s):	Bernalillo County
Responsible Organization/Individual:	Albuquerque Bernalillo County Water Utility Authority/ Water Resources Division Leader
Estimated Costs:	$40,000
Possible Funding Sources:	USFS, NM State Forestry, New Mexico State Fire Fund, Hazard Mitigation Grant Program Technical Assistance funds administered by NMOEM
Timeline for Implementation:	Within 18 months of adoption of plan
Cost-Benefit Analysis:	Increased water capacity in Bosque will increase fire fighting capabilities in a high-risk area

3. Improve access into the Bosque for emergency response.

Hazard:	Wildfire; Secondary = Multi-Hazard
Comments:	Several areas of limited access were identified in the Wildland-Urban Interface Assessment. Improved access can be completed by building bridges across conservancy ditches and roads.
Jurisdiction(s):	Various: all agencies participating in Bosque restoration. City of Albuquerque Open Space and New Mexico State Parks can coordinate.
Responsible Organization/Individual:	Middle Rio Grande Conservancy District (MRGCD)
Estimated Costs:	$150,000/ bridge
Possible Funding Sources:	NM State Fire Fund, Hazard Mitigation Grant Program Technical Assistance funds administered by NMOEM
Timeline for Implementation:	12 Months from adoption of plan
Cost-Benefit Analysis:	Value of residential assets at-risk in the Bosque area due to wildfire total more than 150 million dollars. Quicker response to fires can contain them before they become major wildfire events.

4. Continue thinning and fuel reduction projects in the Bosque.

Hazard:	Wildfire
Comments:	Continue Middle Rio Grande Bosque Initiative, Middle Rio Grande Bosque Restoration, and Bosque Ecosystem Revitalization Programs. Through these programs dead and downed trees and non-native plants are cleared out of areas within the Bosque. This keeps fire from spreading vertically to the upperstory; preserves native plants such as cottonwoods and willows and improves wildlife habitat.
Jurisdiction(s):	Bernalillo County, City of Albuquerque, Village of Los Ranchos de Albuquerque
Responsible Organization/Individual:	USACE, City of Albuquerque, Bernalillo County, Albuquerque Fire Department, Middle Rio Grande Conservancy District
Estimated Costs:	✓ $80M total, $3M City of Albuquerque, $8M USACE, $10M per year Federal funding per year for 10 years ✓ Hazardous fuels reduction $1500-3000 per acre ✓ Herbicide $500-800 per acre ✓ 5-year restoration $6000 per acre ✓ Continued monitoring $2200 year per acre
Possible Funding Sources:	Federal, City of Albuquerque, State
Timeline for Implementation:	12 Months; On-going
Cost-Benefit Analysis:	Value of residential assets at-risk in the Bosque area due to wildfire total more than 150 million dollars. Thinning will help reduce the threat of catastrophic fires.

5. Remove jetty jacks from along the Rio Grande in targeted high-risk areas to aid first responder access to the Bosque during wildfires.

Hazard:	Wildfire
Comments:	Continue Middle Rio Grande Bosque Initiative, Middle Rio Grande Bosque Restoration and Bosque Ecosystem Revitalization Programs are currently working to improve conditions in Middle Rio Grande Bosque. Non-functional jetty jack fields often have a build-up of vegetation and contribute to wildfire fuel loads. Removal of non-functional jacks improves access to the Bosque and reduces wildfire fuel loads.
Jurisdiction(s):	City of Albuquerque (in coordination with Bernalillo County)
Responsible Organization/Individual:	USACE, City of Albuquerque, Bernalillo County, Albuquerque Fire Department, Middle Rio Grande Conservancy District
Estimated Costs:	Total cost is 1.1 million dollars to remove
Possible Funding Sources:	United States Army Corps of Engineers
Timeline for Implementation:	12 Months
Cost-Benefit Analysis:	Value of residential assets at-risk in the Bosque area due to wildfire total more than 150 million dollars. Quicker response to fires can contain them before they become major wildfire events

6. Improve access to identified East Mountain areas for emergency response.

Hazard:	Wildfire; Secondary = Multi-Hazard
Comments:	Several areas of limited access were identified in the Wildland-Urban Interface Assessment. Access can be improved by upgrading bridges and roads
Jurisdiction(s):	Bernalillo County
Responsible Organization/Individual:	Bernalillo County Fire Department and Public Works
Estimated Costs:	Improving road access: average of $100,000/mile. New bridges: $200,000 each
Possible Funding Sources:	USFS, NM State Forestry, Hazard Mitigation Grant Program Technical Assistance funds administered by NMOEM
Timeline for Implementation:	12 Months
Cost-Benefit Analysis:	Improved access will save lives by providing evacuation routes and protect property by allowing access by emergency vehicles

7. Participate in State's program to use bio mass fuels as a way to dispose of tree thinning debris in the Bosque and East Mountain areas.

Hazard:	Wildfire
Comments:	Thinning projects create an over abundance of debris for disposal. Using the debris as a bio mass fuel source should be studied as an effective and cost effective solution for disposal.
Jurisdiction(s):	City of Albuquerque Open Space Division, New Mexico State Parks
Responsible Organization/Individual:	City of Albuquerque Open Space Division, New Mexico State Parks,
Estimated Costs:	$65,000
Possible Funding Sources:	USFS, NM State Forestry, New Mexico State Fire Fund, Hazard Mitigation Grant Program Technical Assistance funds administered by NMOEM
Timeline for Implementation:	24 months from adoption of plan
Cost-Benefit Analysis:	Disposal costs for slash average $8.00/cubic yard. Bio-fuel could be means to eliminate disposal costs and create additional fuel source.

8. Study alternate chemical treatment methods at the waste water treatment plant.

Hazard:	Human-Caused Hazards (Terrorism; Hazardous Materials Release)
Comments:	Due to the additional needs for security for liquid chlorine and transportation issues, the wastewater treatment facility should research alternatives to liquid chlorine disinfection. This will eliminate the need for stockpiles of the chemical at the facility and other locations. The wastewater treatment plant is also located in an area of limited access.
Jurisdiction(s):	Albuquerque Bernalillo County Water Utility Authority
Responsible Organization/Individual:	Albuquerque Bernalillo County Water Utility Authority/Water Quality Division Leader
Estimated Costs:	$50,000
Possible Funding Sources:	City/County government budgets/EPA
Timeline for Implementation:	12 months
Cost-Benefit Analysis:	Over 1,800 people live within one-mile of the wastewater treatment plant

9. Develop mitigation strategies for known roads and buildings in flood areas in Bernalillo County.

Hazard:	Flood, Flash Floods
Comments:	Fund and construct drainage improvements in areas of City of Albuquerque and unincorporated areas of Bernalillo County that are subject to chronic flooding including: ✓ Broadway Blvd. near Lomas Ave. ✓ Streets near City of Albuquerque Zoo ✓ Areas in South Valley
Jurisdiction(s):	Bernalillo County and City of Albuquerque
Responsible Organization/Individual:	City of Albuquerque and Bernalillo County Public Works/Technical Services Division
Estimated Costs:	Costs to be defined after further study and engineering
Possible Funding Sources:	Hazard Mitigation Grant Program Technical Assistance funds administered by NMOEM, AMAFCA
Timeline for Implementation:	Within 36 months of adoption of plan
Cost-Benefit Analysis:	Albuquerque Zoo has assets valued at more than 234 million dollars. Each identified area is in densely developed part of County. One hundred year flood could cause millions of dollars of damage.

10. Create a Volcano Awareness Program to educate citizens on the potential dangers of the Albuquerque Volcanic Fields.

Hazard:	Volcano
Comments:	The Albuquerque Volcanic Fields represent a potential danger to the City and to Bernalillo County residents. Create a program to enable preparedness for the impacts of a volcanic eruption through better planning, education, and awareness. Program shall be county-wide and include participation at the local community level.
Jurisdiction(s):	Bernalillo County and City of Albuquerque
Responsible Organization/Individual:	Bernalillo County and City of Albuquerque Emergency Services
Estimated Costs:	$50,000
Possible Funding Sources:	City/County general budgets
Timeline for Implementation:	Within 12 months of adoption of plan
Cost-Benefit Analysis:	Small cost aimed at enhancing the public awareness and education of a potential danger in the City of Albuquerque and Bernalillo County. Efforts will also aid in better planning at the city/county level.

11. Map areas vulnerable to volcanic activity and assign a high/medium/low risk value.

Hazard:	Volcano
Comments:	The Albuquerque Volcanic Fields represent a potential danger to the City and to Bernalillo County residents. Mapping vulnerable areas will enable planners when developing land-use zoning maps and guide mitigation activities for hazards associated with a volcanic eruption.
Jurisdiction(s):	Bernalillo County and City of Albuquerque
Responsible Organization/Individual:	Bernalillo County and City of Albuquerque Planning, Zoning, and Mapping Department
Estimated Costs:	City/County Administrative Costs
Possible Funding Sources:	City/County government budgets
Timeline for Implementation:	Within 12 months of adoption of plan
Cost-Benefit Analysis:	This project will identify areas vulnerable to this hazard and provide planners with the necessary information to better plan around the hazards associated with volcanic eruption. Effort will enhance planning and decrease, if not eliminate, this potential hazard as future development of the City of Albuquerque and Bernalillo County continues.

12. Providing portable Air Conditioners to Low Income residents.

Hazard:	Extreme Heat
Comments:	Due to the economic circumstances in the planning area, many residents are considered low income. This action would provide residents who meet certain financial thresholds with portable or window air conditioners during times of extreme heat. We would partner with social service agencies and local retailers
Jurisdiction(s):	Bernalillo County and City of Albuquerque; Village of Los Rancheros de Albuquerque; Village of Tijeras
Responsible Organization/Individual:	Bernalillo County and the City of Albuquerque Office of Emergency Management/Emergency Manager, Low Income Housing Authority.
Estimated Costs:	$100,000
Possible Funding Sources:	Donations, volunteers
Timeline for Implementation:	12 Months
Cost-Benefit Analysis:	Protecting the health of residents would far out weigh the costs of treating any emergencies that arise

City of Albuquerque

1. Update first floor elevation certificates, and incorporate in to City of Albuquerque GIS system.

Hazards:	Floods, Flash Floods
Comments:	City currently has parcel data but does not have accurate information concerning elevations within the floodplain. This project will help improve the city's rating in the National Flood Insurance Program's (NFIP) Community Rating System (CRS). The CRS is a voluntary incentive program that encourages communities to implement floodplain management activities that exceed the minimum NFIP requirement, and results in discounted flood insurance premium rates that reflect the reduction of flood risk.
Jurisdiction(s):	City of Albuquerque
Responsible Organization/Individual:	City of Albuquerque
Estimated Costs:	$50,000
Possible Funding Sources:	Pre-Disaster Mitigation Assistance funds administered by NMOEM
Timeline for Implementation:	12 Months; On-going
Cost-Benefit Analysis:	City has over one billion dollars worth of assets in defined 100 year flood zones.

2. Create monitoring system to track land subsidence due to groundwater depletion in the northeast quadrant of the City of Albuquerque.

Hazards:	Landslides/Land Subsidence
Comments:	The northeast quadrant of the City has experience subsidence due to groundwater pumping. Create a system to monitor groundwater levels and stop pumping when the water level drops low enough to increase the risk of land subsidence.
Jurisdiction(s):	City of Albuquerque
Responsible Organization/Individual:	Albuquerque Bernalillo County Water Utility Authority
Estimated Costs:	$150,000
Possible Funding Sources:	City of Albuquerque general budget
Timeline for Implementation:	24 months from adoption of plan
Cost-Benefit Analysis:	The northeast quadrant is the largest geographical and most populous area of the city. The effects of not having a system to monitor groundwater pumping could cause millions of dollars of damage.

Village of Los Ranchos de Albuquerque

1. Create Firewise Communities through the National Wildland/Urban Interface Fire Program in the Village of Los Ranchos de Albuquerque.

Hazard:	Wildfire
Comments:	Continue efforts to create Firewise Communities. Utilize the Village newsletter to educate the public on information pertaining to maintaining defensible space around their homes as well as clearing all debris from rooftops. Provide information to the public on evacuation routes and procedures. We will circulate wildfire safety and prevention materials.
Jurisdiction(s):	Village of Los Ranchos de Albuquerque
Responsible Organization/Individual:	Village of Los Ranchos de Albuquerque (District 12)
Estimated Costs:	$1,500
Possible Funding Sources:	General Fund
Timeline for Implementation:	12 Months; On-going
Cost-Benefit Analysis:	Firewise Communities are eligible for lower insurance rates

2. Select a village official to participate in the State Drought Management Plan Work Group.

Hazard:	Drought
Comments:	Currently no Village representatives are participating in the Plan. The Village should identify a staff member to participate. The Work Group shall be composed of city, county and village officials who will participate in the creation and implementation of the State Drought Management Plan through attendance at planning meetings.
Jurisdiction(s):	Village of Los Ranchos de Albuquerque
Responsible Organization/Individual:	Village of Los Ranchos de Albuquerque
Estimated Costs:	Salary and travel costs
Possible Funding Sources:	Village funds
Timeline for Implementation:	12 Months
Cost-Benefit Analysis:	Increased knowledge of village officials in State Drought Management Plan will facilitate a comprehensive response to drought

3. Implement Los Ranchos de Albuquerque Incident Action Plan (IAP).

Hazard:	Wildfire
Comments:	The purpose of the Los Ranchos de Albuquerque Incident Action Plan (IAP) is to provide a pre-planned coordinated mechanism to establish a safe, efficient, and organized inter- agency response and unified incident command system in the event of a large wildfire occurring within the Village of Los Ranchos de Albuquerque area. The six primary agencies responsible for the implementation plan include the Village of Los Ranchos de Albuquerque Fire Department, Village of Tijeras Fire Department, Bernalillo County Fire Department, City of Albuquerque Fire Department, New Mexico State Forestry, and the USDA Forest Service, Cibola National Forest. The IAP will include incident support locations and facilities, radio plan, contact phone list, dispatch, evacuation plan, jurisdiction, wildland command and will specify minimum training levels for responders and advanced training requirements as specified with the National Wildland Coordinating Group (NWCG).
Jurisdiction(s):	Village of Los Ranchos de Albuquerque
Responsible Organization/Individual:	Village of Los Ranchos de Albuquerque (District 12)
Estimated Costs:	Printing, less than $500
Possible Funding Sources:	Within current budget
Timeline for Implementation:	6 - 12 Months
Cost-Benefit Analysis:	The Los Ranchos de Albuquerque Incident Action Plan (IAP) will provide a pre-planned coordinated mechanism to establish a safe, efficient, and organized inter-agency response and unified incident command system in the event of a large wildfire occurring within the Village of Los Ranchos de Albuquerque area.

Village of Tijeras

1. Purchase 4-wheel drive emergency vehicle to improve access to difficult to reach areas.

Hazard:	Severe Weather (Winter Storm); Secondary Hazard = Wildfire
Comments:	Several areas in and near the Village are difficult to access during severe weather events
Jurisdiction(s):	Village of Tijeras
Responsible Organization/Individual:	Village of Tijeras
Estimated Costs:	$250,000
Possible Funding Sources:	State appropriations
Timeline for Implementation:	24 months after adoption of plan
Cost-Benefit Analysis:	Emergency response time critical; better access could reduce potential for catastrophic wildfire event

2. Secure additional sources of water for emergency use.

Hazard:	Wildfire
Comments:	Community water supply limited by present storage capacity; impacts ability to suppress wildland-urban fires
Jurisdiction(s):	Village of Tijeras
Responsible Organization/Individual:	Village of Tijeras
Estimated Costs:	$250,000
Possible Funding Sources:	New development impact fees, Office of State Engineer
Timeline for Implementation:	12 Months
Cost-Benefit Analysis:	Increased community water supply will increase ability to suppress wildfires

3a. Flood Control Project – Arroyo Crossing Points.

Hazard:	Flood, Flash Flood
Comments:	Create a structural arroyo crossing at Primera Agua Bridge
Jurisdiction(s):	Village of Tijeras
Responsible Organization/Individual:	New Mexico Department of Transportation (NMDOT) Municipal Arterial Project (MAP)
Estimated Costs:	$400,000
Possible Funding Sources:	NMDOT
Timeline for Implementation:	6 Months; On-going
Cost-Benefit Analysis:	Assets at risk for flooding in Tijeras total more than 2 million dollars

3b. Flood Control Project – Arroyo Crossing Points.

Hazard:	Flood, Flash Flood
Comments:	Create a structural arroyo crossing at Cresencino Project
Jurisdiction(s):	Village of Tijeras
Responsible Organization/Individual:	NMDOT MAP
Estimated Costs:	$400,000
Possible Funding Sources:	NMDOT
Timeline for Implementation:	6 Months; On-going
Cost-Benefit Analysis:	Assets at risk for flooding in Tijeras total more than 2 million dollars

3c. Flood Control Project – Arroyo Crossing Points

Hazard:	Flood, Flash Flood
Comments:	Create a structural arroyo crossing at Camino de Constancia
Jurisdiction(s):	Village of Tijeras
Responsible Organization/Individual:	NMDOT MAP
Estimated Costs:	$400,000
Possible Funding Sources:	NMDOT
Timeline for Implementation:	6 Months; On-Going
Cost-Benefit Analysis:	Assets at risk for flooding in Tijeras total more than 2 million dollars

4. Flood Control Project – Stabilization of Arroyos

Hazard:	Flood; Flash Flood
Comments:	Study of stabilizing arroyos within Village of Tijeras. Study to identify additional areas where low-water crossings should be engineered and mitigated. Install fabric baskets.
Jurisdiction(s):	Village of Tijeras
Responsible Organization/Individual:	NMDOT MAP
Estimated Costs:	$400,000
Possible Funding Sources:	NMDOT
Timeline for Implementation:	6 Months; On-going
Cost-Benefit Analysis:	Assets at risk for flooding in Tijeras total more than 2 million dollars

5. Hire a Floodplain Manager for Village of Tijeras.

Hazard:	Floods, Flash Floods
Comments:	Hire a Floodplain Manager (position can be part time) to enforce and manage existing floodplain ordinance. Floodplain Manager should have ASFPM certification.
Jurisdiction(s):	Village of Tijeras
Responsible Organization/Individual:	Village of Tijeras
Estimated Costs:	Part-time position $15,000
Possible Funding Sources:	General Fund
Timeline for Implementation:	12 Months; On-going
Cost-Benefit Analysis:	Assets at risk for flooding in Tijeras total more than 2 million dollars

6. Participate in State's program to use bio mass fuels as a way to dispose of tree thinning debris in the Village of Tijeras.

Hazard:	Wildfire
Comments:	Thinning projects create an over abundance of debris for disposal. Forest residues from fire mitigation activities can be turned into power instead of being burned in the woods. Using the debris as a bio mass fuel source should be studied.
Jurisdiction(s):	Village of Tijeras
Responsible Organization/Individual:	Village of Tijeras
Estimated Costs:	$65,000
Possible Funding Sources:	USFS, NM State Forestry, New Mexico State Fire Fund, Hazard Mitigation Grant Program Technical Assistance funds administered by NMOEM
Timeline for Implementation:	24 months after adoption of plan
Cost-Benefit Analysis:	Disposal costs for slash average $8.00/cubic yard. Bio-fuel could be means to eliminate disposal costs and create additional fuel source.

7. Install Living snow fences along critical roadways in the Village of Tijeras.

Hazard:	Winter Storms
Comments:	The village of Tijeras is in the Sandia Mountains, and can receive substantial snowfall. This action would establish a series of plantings that would serve as snow fences along critical road ways in the city limits. This would prevent dangerous and costly snow drifts from impeding traffic during snow events.
Jurisdiction(s):	Bernalillo County/Village of Tijeras
Responsible Organization/Individual:	Bernalillo County Office of Emergency Management/Emergency Manager and Village of Tijeras Public Works Department
Estimated Costs:	$125,000
Possible Funding Sources:	General fund
Timeline for Implementation:	18 Months
Cost-Benefit Analysis:	Protection of transportation routes will minimize damage and protect lives in the event of a winter storm.

MONITORING, EVALUATING, AND UPDATING THE PLAN

The Mitigation Planning Team developed an action plan that includes monitoring, evaluating, and updating the Plan. It recommends the establishment of a permanent Hazard Mitigation Team to lead the implementation of the plan and continue the hazard mitigation planning process beyond this Plan.

Monitoring, evaluating, and updating the Plan are critical to maintaining its relevance. Effective implementation of mitigation activities paves the way for continued momentum in the planning process and gives direction for the future. This section explains who will be responsible for monitoring, evaluating, and updating the Plan, and what those responsibilities entail. This section also lays out the method and schedule of these activities and describes how the public will be involved on a continuing basis.

EXISTING PLANNING MECHANISMS

After adoption, copies of the Plan will be given to the respective zoning and planning departments. During updates and revisions of community planning documents, the Mitigation Plan will be presented to the planning committee for consideration.

Where applicable, all mitigation actions will be incorporated into existing jurisdictions' planning documents via zoning, subdivision regulations and capital improvements program and other regulatory mechanisms. The following is a summary of what currently exists:

- ✓ *Albuquerque/Bernalillo County Comprehensive Plan.* The current Plan was approved in 2002 by the Mayor, City Council, Environmental Planning Commission, Planning Department Staff, Former Mayor, County Commission, County of Bernalillo, and County Planning Commission. The Plan's sections include: 1) Introduction and Context, 2) Goals and Policies, and 3) Monitoring and Implementation. Section 2 incorporates Land Use, Environmental Protection, Heritage Conservation, and Community Resource Management. Each sub-section includes Goals, Policies, and Possible Techniques. This Plan can incorporate many actions and strategies proposed within the plan to mitigate natural and human caused hazards.
- ✓ *Planned Growth Strategy (PGS) adopted in 2000.* This 750-page report discusses development trends and infrastructure costs for the City of Albuquerque and Bernalillo County. The major focus of the Planned Growth Strategy is effective implementation. Six chapters address an urban growth land use plan; zoning and design guidelines, financial requirements for infrastructure to address rehabilitation, deficiencies and growth needs; development impact fees; concurrency approaches to insure that adequate infrastructure and other facilities are available to support new development; development and transportation linkages; housing affordability; legally-defined Planned Communities in the Comprehensive Plan Reserve and Rural Areas; joint City–County–APS coordination; regionalism; and so on. Sections included to address implementation of this plan are: the process of developing and implementing the "preferred alternative" for Albuquerque's future. A critical finding of the study is that many of the "disconnects" between the public's preferences and what actually is taking place are caused by weak or non-existent implementation tools - rather than by inadequate policies, as contained in the City/County Comprehensive Plan and other already adopted legislation. PGS adopted bills include:

- O-04-9, Adopting Land Use Assumptions
- O-03-132, Adopting an Infrastructure and Growth Plan
- F/S O-02-39, Adopting Elements of a Planned Growth Strategy
- F/S R-02-111, Receiving the Planned Growth Strategy (PGS) Report

✓ *Village of Tijeras Comprehensive Master Plan,* approved in February of 2001. This plan discusses the communities' vision, goals, and objectives and implementation strategies.

✓ *Village of Los Ranchos de Albuquerque Master Plan, a*pproved in January of 2000. Includes proposed land use and zoning ordinances.

✓ *2003 New Mexico State Drought Plan*. Governor Richardson signed an executive order creating the 12-member Drought Task Force in May 2003. The New Mexico Drought Task Force recommends strategies for reducing the state's vulnerability to drought. The task force is chaired by State Engineer and includes experts in financing, water project construction, water rights, water conservation, and water quality, as well as officials who understand drought's impact on agriculture, wildlife, economic development, tourism, and wildfire.

✓ *2003 New Mexico State Water Plan*. Approved in 2003 by the Governor, this Plan contains detailed policy statements, implementation strategies, discussion, measurement, management, markets and public opinion on multiple subjects, including active management of the state's waters, river riparian and watershed restoration, relationship between water availability and land-use decisions, drought management planning and water conservation strategies and policies. It also outlines the integration of regional water plans into the state water plan.

HAZARD MITIGATION PLANNING TEAM

Ideally, a permanent entity is held responsible for maintaining the Plan and for monitoring, evaluating, and updating it. This Plan recommends creating a permanent planning group, the Bernalillo County/City of Albuquerque Mitigation Planning Team (the Team), with representation from all participating municipalities. The Team would represent citizen, municipal, business, educational, volunteer, and county interests through a balanced membership. A Mitigation Coordinator would lead the Team, in conjunction with oversight by the City of Albuquerque/Bernalillo County Coordinators of Emergency Management. Until the permanent Team is created and the Coordinator appointed, the Bernalillo County Emergency Manager will act as the interim Mitigation Coordinator.

The Hazard Mitigation Team will oversee the progress made on the implementation of the identified action items and update the plan, as needed, to reflect changing conditions. The Team will therefore serve as the focal point for coordinating county-wide mitigation efforts. The Team should meet quarterly to address all its responsibilities. It will serve in an advisory capacity to the Bernalillo County and City of Albuquerque Planning Commissions and Departments of Emergency Management.

The Team will monitor the mitigation activities by reviewing reports from the agencies identified for implementation of the different mitigation actions. The Team will request that the responsible agency or organization submit a semi-annual report, which should provide adequate information to assess the status of mitigation actions. The Team will then provide their feedback to the individual agencies. The Hazard Mitigation Team will meet quarterly: two (2) meetings a year to identify any new mitigation projects and two (2) meetings to review reports from other agencies.

Evaluation of the Plan should include not only checking on whether or not mitigation actions are implemented, but also assessing their degree of effectiveness. The Mitigation Team will review the qualitative and quantitative benefits (or avoided losses) of the mitigation activities and compare them to the goals and objectives that the Plan sets out to achieve. The Team will also evaluate mitigation actions to see if they need to be modified or discontinued in light of new developments. The Team will document progress annually.

The Plan will be updated every five years, as required by the DMA 2000, or following a disaster. The updated Plan will account for any new developments in the County or special circumstances (e.g., post-disaster). Issues that come up during monitoring and evaluation, which require changes in mitigation strategies and actions, will be incorporated in the Plan at this stage.

PUBLIC INVOLVEMENT

The Planning Team will involve the public during the evaluation and update of the Plan through annual public education activities, public workshops, and public hearings. The Team will also keep the public informed through newsletters, mailings, and the different agencies implementing the plan. The County's website (http://www.bernco.gov/live/) could serve as a means of two-way communication by providing information about mitigation initiatives and supplying feedback forms and other means for the public to express their views and comments. The Planning Team will incorporate the public comments in the next update of the Plan.

UPDATING THE PLAN

Throughout the hazard analysis and vulnerability assessment, descriptions of missing or inadequate data indicate some areas in which the County and municipalities can improve their ability to identify vulnerable structures. As the County and municipal governments work to increase their overall technical capacity and implement their comprehensive planning goals, they should also attempt to improve their ability to identify assets vulnerable to hazards. In short, the County and municipalities in subsequent versions of this Plan can improve the hazard identification and vulnerability assessment by:

- ✓ Revamping County and municipal building permit and data collection systems to require, and keep on file, elevation certificates for all new construction, elevated structures, and other substantial improvements within the 100- and 500-year floodplains.
- ✓ Updating the tax and GIS databases with information including addresses, foundation type, construction type, and first-floor elevations for each structure. The updated Plan will be better able to identify structures in need of mitigation based on first-floor elevations.
- ✓ Obtaining refined topographic contour information for the entire County, which will allow better identification of steep slopes.
- ✓ Incorporating existing and pending stormwater management plans and projects into the vulnerability assessment and mitigation strategy, which will provide a better connection between localized flooding issues and riverine flooding issues.

These recommendations are also noted in the mitigation actions. Several of these improvements are already underway and will produce an even more effective vulnerability assessment and mitigation plan upon revision.

APPENDIX A: DISASTER MITIGATION ACT OF 2000 INTERIM FINAL RULE REQUIREMENTS AND CORRESPONDING SECTIONS

Table A1: DMA 2000 Interim Final Rule Requirements and Corresponding Plan Sections

DMA 2000 Interim Final Rule Requirement	COA/Bernalillo County Hazard Mitigation Plan Section
Prerequisite	
Adoption by the Local Governing Body (§201.6(c)5))	Not Applicable (applies to single jurisdiction)
Multi-jurisdictional Plan Adoption (§201.6(c)(5))	Resolutions of Adoption
Multi-jurisdictional Participation (§201.6(a)(3))	Introduction
Planning Process	
Documentation of Planning Process (§201.6(c)(1))	Introduction: Planning Process and Community Background
Risk Assessment	
Identifying Hazards (§201.6(c)(2)(i))	Section One: Hazard Identification/Risk Assessment
Profiling Hazard Events (§201.6(c)(1))	Section One: Hazard Identification/Risk Assessment
Assessing Vulnerability: Overview	Section One: Hazard Identification/Risk Assessment
Assessing Vulnerability: Identifying Assets (§201.6(c)(2)(ii)(A))	Section One: Hazard Identification/Risk Assessment
Assessing Vulnerability: Estimating Potential Losses (§201.6(c)(2)(ii)(b))	Section One: Hazard Identification/Risk Assessment
Assessing Vulnerability: Analyzing Development Trends (§201.6(c)(2)(ii)(c))	Section One: Hazard Identification/Risk Assessment
Multi-jurisdictional Risk Assessment (§201.6(c)(2)(iii))	Introduction and Section One: Hazard Identification/Risk Assessment
Implementation Strategy	
Local Hazard Mitigation Goals (§201.6(c)(3)(i))	Section Two: Goals, Objectives, and Alternative Mitigation Actions
Identification and Analysis of Mitigation Actions (§201.6(c)(3)(ii))	Section Two: Goals, Objectives, and Alternative Mitigation Actions and Appendix F
Implementation of Mitigation Actions (§201.6(c)(3)(iii))	Section Three: Mitigation Plan and Implementation Strategy
Multi-jurisdictional Mitigation Strategy (§201.6(c)(3)(iv))	Section Three: Mitigation Plan and Implementation Strategy
Plan Maintenance Procedures	
Monitoring, Evaluating, and Updating the Plan (§201.6(c)(4)(i))	Section Three: Mitigation Plan and Implementation Strategy
Implementation Through Existing Programs (§201.6(c)(4)(ii))	Section Three: Mitigation Plan and Implementation Strategy
Continued Public Involvement (§201.6(c)(4)(iii))	Section Three: Mitigation Plan and Implementation Strategy

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COA/BernCo DISASTER MITIGATION
PLANNING TEAM

AGENDA
July 6, 2004
10:00 to 12:00
URS Corp, 6501 Americas Parkway Suite 900
Albuquerque, NM

Introductions

Presentation of the Project –

An explanation of the Disaster Mitigation Plan

Roles and Responsibilities

- Develop list of potential Planning committee members
- Discussion of dates and locations of public meetings
- Assignment of tasks to COA/BernCo, (in-kind) and URS staff
- **Next Steps**
- Schedule for first planning meeting

COA/BernCo DISASTER MITIGATION PLANNING TEAM

Meeting Notes
July 6, 2004 10:00 AM

DISASTER MITIGATION PLANNING TEAM

Attendees: Evonne Gantz, Jim Hunter, Patrice Clifford, Don Scott, Liz Saavedra, Lora Sedore, Will Gleason, Jill Williams, Julie Hamilton

Will Gleason opened the meeting with introductions. The team was presented with an overview of the draft COA/BernCo Hazard Mitigation Plan as follows:

- ✓ Draft plan is due Mid-November.
- ✓ Plan is divided into three sections. Section One – Hazard Identification and Risk Assessment, Section Two – Goals, Objectives and Actions, Section Three – Mitigation Plan and Implementation Strategy.
- ✓ Each jurisdiction will develop specific mitigation actions.
- ✓ Evonne will review the draft and complete the crosswalk. After that it will go to FEMA for approval. FEMA wants it approved and adopted by the local jurisdictions by June 2005.

Outreach and Public Input:

List of potential groups to contact includes:

- ❑ AMAFCA and MRGCD
- ❑ UNM and TVI, and SIPI
- ❑ APS and non-APS : **Note: APS may be recognized as a separate jurisdiction that needs to be on Planning Committee and to adopt Plan.**
- ❑ Fire Department Metropolitan Detention Center
- ❑ State Parks, State Forestry, State Land Office, and State Dept. of Public Health

- ✓ Invite key people from tribal seats of government. Distinguish between EOP and Mitigation Plan.
- ✓ Representatives from Kirtland Air Force Base should see draft mitigation plan.
- ✓ For all identified groups, URS will create an introductory package to send with invitation to participate in planning effort.
- ✓ Dates and locations of public meetings will be decided at a later date, but should be scheduled sometime from July thru late August/early September. Inform neighborhood associations by sending newsletter. Should have specific information on meeting dates. Can include information on EOP.

COA/BernCo DISASTER MITIGATION
PLANNING TEAM

✓

General Comments:

- ✓ Need input as soon as possible on costs to mitigate. Planning team will create separate groups for each major hazard (probably wildlfire, drought, flooding, and hazmat): these sub-groups will meet separately to discuss specific hazards and provide input on past events, costs associated with past events, and proposed mitigation actions.
- ✓ Start to discuss cost analysis with key officials from the State. (URS can provide a letter and a presentation).
- ✓ Bernalillo County to provide copy of their Threat Assessment, identifying critical facilities.
- ✓ Jim Hunter to call Neil Weinberg for City staffer to work w/ Jill on mapping and GIS analyses
- ✓ Jill to contact PNM for data on gas lines and Don Scott to contact Pipeline Group
- ✓ Public meetings should be held later, after hazards have been identified, so that there is something to present.
- ✓ Group meeting will be monthly, on every first Wednesday at URS offices at 10:00 AM.
- ✓ Next meeting scheduled for Wednesday, August 4, 2004, at 10:00AM at the URS office.

Action Items:

- ✓ Don & Liz to provide Vulnerability Assessment Plan.
- ✓ Jim Hunter to contact Neil Weinberg to work with URS on GIS/mapping
- ✓ Jim to contact Mary Lee Martin of APS
- ✓ Don Scott and Jim Hunter will identify key individuals to work on specific hazards.
- ✓ Lora will call the non-attendees.
- ✓ Will to contact AMAFCA, SLO, MRGCD, and MRCOG.
- ✓ Lora will contact TVI, Metropolitan Detention Center, & KAFB.
- ✓ Lora will create two lists: Team Members and People to keep Informed. Send to the County.
- ✓ Don Scott will contact the Fire / Hazmat Team / Fire Marshall.
- ✓ Jill will contact PNM Gas. Patrice will contact the pipeline group.
- ✓ Lora will put together a newsletter to send neighborhood associations and to key agencies/governmental entities. It will be sent to the group for review first.
- ✓ Don will identify specific places for neighborhood meetings.
- ✓ Lora will generate a list of everyone who should be contacted and send out a package.
- ✓ Lora will send Don a copy of the Sandoval Mitigation Plan.

COA/BernCo DISASTER MITIGATION
PLANNING TEAM

AGENDA
August 4, 2004
10:00 to 12:00
URS Corp, 6501 Americas Parkway Suite 900
Albuquerque, NM

- **Updates and New Introductions**
- Review list of action items from last meeting
- Review Introduction Section
  - Review section prior to meeting and have edits/comments
- Identify potential participants in specific hazard task forces
  - Bring contact information for these participants to the meeting!
- Finalize public meeting times and places
- Discuss history of declared disaster/emergencies within the last 20 years.
  - Bring data on specific incidents:
    - Dates, extent of incident (# of acres burned, # of structures, # of homes flooded, etc.) estimated losses from the event
- **Next Steps**
- Assignment of tasks to COA/BernCo, (in-kind) and URS staff

COA/BernCo DISASTER MITIGATION
PLANNING TEAM

Meeting Notes
August 4, 2004 10:00 AM

Attendees: Dave Bezy, Bill Ewing, Jim Hunter, Don Scott, Liz Saavedra, Lora Sedore, Will Gleason, Jill Williams, Jennifer Nelson

Will Gleason opened the meeting with introductions.

Reviewed Action Items from previous meeting:

✓ Vulnerability Assessment Plan not available

Outreach and Public Input:

✓ APS not participating actively in City/county plans.

✓ Updated list of sub-committees and contact information – (see Attachment)

✓ Schedule meetings for each group (fire, drought, floods, hazmat, earthquake etc.)

✓ Public Schools not participating actively in any City/county plan. Bill Ewing - State cannot force involvement. Invite to participate.

✓ UNM pursuing own Disaster Resistant University Plan. Invite to participate.

✓ Meetings will be open houses with URS, County and City representation. URS will produce base maps.

✓ Tentative dates and locations of public meetings:

1. Tuesday, August 31st in South Valley, Westside Community Center, 6-8pm
2. Wednesday, September 1th, East Mountains, Los Vecinos Community Center, 6-8pm. (note: date has been changed to Wednesday, September 8th)
3. Thursday, September 2nd, Central Albuquerque, Highlands Senior Center, 6-8pm.

✓ Press Release and Public Notice to be published in East Mountain Newspaper, Albuquerque Journal and forwarded to PIO for City and County.

✓ A 15-minute public announcement spot to be recorded and aired on Gov TV Cable channel.

✓ Invite City and County commissioners & councilors to Public Meetings.

✓ For all identified groups, URS to send introductory package and invitation to participate in planning effort, (see hand outs) also send newsletter.

General Comments:

✓ Dams on BIA and Tribal lands – not an issue for Corps or Bureau until reaches city/county boundaries.

✓ Concern APS is not participating in City/County plan.

✓ Next meeting: prioritize hazards.

COA/BernCo DISASTER MITIGATION PLANNING TEAM

- ✓ LEPC not planning for City or County, only Hazmat emergency mitigation.
- ✓ Contacts and resources added to list (see Attachment)
- ✓ Discussion of changes in how insurance agencies define fire hazard, ISO and Past Loss History. Jim informed group of possibility of dry hydrants for Bosque.
- ✓ Bill Ewing (DPS) wants to make sure earthquakes are included in plan.
- ✓ No meeting scheduled for core planning group in September

Action Items:

- o Each jurisdiction (Tijeras, Los Ranchos, City, County) to prepare Community Introductions for plan. To include general framework, specific information, distinguishing factors before next meeting. (E-mail is preferred).
- o Data needed from each jurisdiction:
- o Declared disasters or emergencies: type, amount damage or large $ damages
- o Wildfires: number of fires, acres, structures, deaths and $ amount property/crops lost.
- o Specific hazards and potential mitigation strategies. (Ex: Tijeras – Bark Beetle)
- o City information re: fires and photos on CD - Jim Hunter.
- o Powerpoint presentations on SNL-KAFB emergency planning zones
- o Lora will find Summary of Vulnerability Assessment (from Don Scott)
- o Need date for BIA/Tribal meeting. Jim will send to Lora.
- o Native American contact list from Patrice – Lora.
- o Contact Jay Hart for City Open Space for info on Bosque fire and cleanup, 5 agencies involved and cost per acre. - Jennifer
- o Corps 20 year plan for Bosque (Rio Grande State Park?) removal of jetty-jacks and salt-cedar. Site SW may have Plan. – Jennifer
- o Contact Dr. Love at NM Tech for Earthquake info. – Jennifer
- o Contact Kim McKibben re: East Mountain Solid waste - slash pile information.
- o Contact Keith Hayes, weather service for information.
- o Lora to contact Joanne Caffrey - reserve Westside Community Center.
- o Contact and invite City/County Commissioners to public meetings. - Jennifer
- o Record cable TV spot – Jennifer
- o Lora contact Kelly Clark, Los Ranchos rep.
- o Will to write letters to Council members & commissioners inviting to public meetings.
- o Rail study for hazmat through county – Lora.

COA/BernCo DISASTER MITIGATION
PLANNING TEAM

Fire Subcommittee Meeting

AGENDA
August 18, 2004
10:00 to 12:00
URS Corp, 6501 Americas Parkway Suite 900
Albuquerque, NM

Invitees:

Robert Ortega, COA Fire Chief
Bett Clark, Bernalillo County Fire Chief
Kelly Clark, Los Ranchos Fire Chief
Will Nuanez, Tijeras Fire Chief
Dave Bervin, NM State Forestry
Dana Anderson, US Forest Service
Jim Hunter, COA, Emergency Manager
Don Scott, Bernalillo County, Emergency Manager

Introductions

Presentation of the Project –

An explanation of the Disaster Mitigation Plan

Wildfire Sub-Committee

- Discussion of specific areas
- Discussion of overlapping jurisdiction
- Existing and Future Mitigation Strategies

COA/BernCo DISASTER MITIGATION PLANNING TEAM

Meeting Notes
August 18, 2004,10:00 AM

DISASTER MITIGATION PLANNING TEAM – WILDFIRE

Attendees Dana Anderson, Dave Bervin, Estephanie Muller, Dave Bezy, Gabriel Marquez , Jim Hunter, Bett Clark, Jessica Wilkins, Kelly Clarke, Terrell Treat, Liz Saavedra, Lora Sedore, Will Gleason, Jennifer Nelson

Will Gleason opened the meeting with introductions. The team was presented with an overview of the draft COA/BernCo Hazard Mitigation Plan.

- ✓ Draft plan is due in three months.
- ✓ Plan is divided into three sections. Section One – Hazard Identification and Risk Assessment, Section Two – Goals, Objectives and Actions, Section Three – Mitigation Plan and Implementation Strategy.
- ✓ Each jurisdiction will develop a specific profile and mitigation actions for wildfires and Wildland Urban Interface (WUI) areas.

General Comments:

- ✓ Bernalillo County (unincorporated areas) has all types of wildfire/WUI areas within its boundaries, ex. Grasslands, bosque, foothills, pinon/juniper, aspen groves and ponderosa pine forest.
- ✓ State threats include pinon/bark beetle infestation. New (aerial?) survey completed in 2004, includes map and data on numbers of acres affected.
- ✓ City threats include bosque (main concern), foothills and west mesa grasslands, especially agricultural land in North Valley.
- ✓ Los Ranchos 45-50 residential structures are adjacent to bosque.
- ✓ State statistics include all fires regardless of cause. Breakdown of statistical and non-statistical data include in-state jurisdiction and outside state jurisdiction, respectively.
- ✓ Multiple agencies have jurisdiction regarding bosque, include: MRGCD, AMAFCA, Cuidad, Corps, irrigation districts, etc… Jay Hart has this information.
- ✓ Need to know of any changes to WUI and current mitigation efforts not in WUI Assessment.
- ✓ Each jurisdiction must identify critical facilities in WUI. Include power, water, other utilities, infrastructure, special populations, schools, government and public buildings.
- ✓ City vulnerable facilities include Bio Park, Zoo, Hispanic Cultural Center, due to proximity to bosque.
- ✓ Need future development potential near WUI. Can utilize Census data at block level and estimates of future growth rates. City/County/MRCOG may have more current data than Census. Vacant lots also a possibility for estimating growth.

COA/BernCo DISASTER MITIGATION
PLANNING TEAM

Action Items:

- ✓ Obtain Vulnerability Assessment Plan – Lora from Bob Redden, NM OEM.
- ✓ Obtain data/map of current Bark Beetle infestation - Dave Bervin, new flyover in late September. Information will be in GIS format.
- ✓ Contact Jay Hart, City Open Space for data on bosque restoration and participating agencies.
- ✓ Need estimate of number of acres of
    - Pinon die off due to bark beetle,
    - Cottonwood die off due to age and no regeneration due to lack of flooding,
    - Cottonwood forest cleared and stacks of logs/slash remaining.
- ✓ Lora will create criteria for jurisdictions to evaluate critical facilities, and email to task force.
- ✓ Contact East Mountain Fire Task Force.
- ✓ Look on State Forest website for information on coalitions and technology.
- ✓ "Firewise Community"
- ✓ Get other studies & consortium, ex. Bosque Initiative.
- ✓ County has evacuation Plans on website.
- ✓ Lora to contact Cal Tino, BIA forestryrep.
- ✓ Need projects description, put actions in project name. Include current projects new funding for old projects.
- ✓ Include pros feasibility of projects.
- ✓ Fire ACT
- ✓ Get East Mountain and Los Ranchos Area plans.

COA/BernCo DISASTER MITIGATION
PLANNING TEAM

Summary of Comments from Hazard Mitigation Open House Meetings

Westside Community Center, Albuquerque, September 1, 2004
(Number of attendees 6 not including URS staff)
- ✓ Severe storms: post lightning instructions at public parks and ball fields.
- ✓ Distribute lightening awareness to AYSO, Little League, etc.

Los Ranchos de Albuquerque Village Hall, September 2, 2004
(Number of attendees 5 not including URS staff)
- ✓ Sewer upgrades are in progress, some residents not yet hooked up, some still on wells. Priority- bring into compliance.
- ✓ Septic contamination when flooding, make this a funding priority.
- ✓ Sewer backs up during flooding
- ✓ Ponding on 4th street
- ✓ Many million-dollar homes along bosque
- ✓ Broken fire hydrants a problem
- ✓ WUI is a priority
- ✓ Hazmat issues –10,000 and 30,000 gallon propane tanks on 4th
- ✓ Fireworks facility – potential fire hazard from large amount of cardboard storage.
- ✓ Plating business – hazardous chemicals
- ✓ Gunshop – ammunition
- ✓ Gas stations – propane and gasoline.
- ✓ Little egress for fire trucks and evacuation routes
- ✓ Need north – south evacuation routes. East/west streets have little or no egress
- ✓ Evacuation is an issue with increasing population and no widening of roads planned. Issue with historic road, 4th/ Camino Real.
- ✓ Public right of way as a tool to implement evacuation routes

Los Vecinos Community Center, Tijeras, September 8, 2004
(Number of attendees 9 not including URS staff)
- ✓ Increase rights-of-way through acquisition of land or condemnation if necessary to improve access for emergency vehicles.
- ✓ Sprinkler systems mandatory for new homes in areas with difficult access
- ✓ Stand Alone sprinkler systems
- ✓ Jurisdictions: initial attack must be improved
- ✓ EMIFPA political problems must be worked out. Organization is15 years old and not yet a household work, and should be. End result is communities are hurt. Needs more clout, heads of organizations must have buy-in
- ✓ Evacuation – plan/strategy is it sufficient? Sheriff has limited resources, must work on and identify as a potential hazard
- ✓ Pre plan for animal evacuation.

- ✓ Access
- ✓ Promote self-sufficiency in case of fire, severe storms – loss of power, water, phone
- ✓ Implementation
- ✓ Flash floods- road wash outs, bridges a problem
- ✓ Many new fire resistant building products available for decking and roofing

COA/BernCo DISASTER MITIGATION
PLANNING TEAM

AGENDA
Thursday, September 16, 2004
10:00 – 12:00
URS Corp, 6501 Americas Parkway Suite 900
Albuquerque, NM

- **Updates**
- Review list of action items from last meeting
- Review and prioritize hazards
- Wildfire: proposed mitigation actions
- Floods/Flash Floods: Proposed mitigation actions
- Drought: Proposed mitigation actions
- Review schedule and deadlines
- **Next Steps**
- Assignment of tasks to COA/BernCo, (in-kind) and URS staff

COA/BernCo DISASTER MITIGATION
PLANNING TEAM

AGENDA
October 6, 2004
8:30 – 1:00
URS Corp, 6501 Americas Parkway Suite 900
Albuquerque, NM

- **Updates**
- Review list of action items from last meeting
- Review Section One
  - Review section prior to meeting and have edits/comments
- Prioritize Hazards for Bernalillo County, City of Albuquerque, Tijeras, and Los Ranchos
- Establish mitigation goals
- Identify mitigation actions
  - Bring outlines for specific projects for fire, flood, drought, haz mat: bring information on project costs, timeframe, potential funding sources (**see example below**) We need specific projects for each jurisdiction: especially Tijeras and Los Ranchos

1. Expand projects to use Southside Reclamation Plant treated effluent for non-potable uses	
Comments:	City of Albuquerque and Bernalillo County already use treated effluent to irrigate golf course and limited number of city parks. City and County could expand existing programs and thereby reduce current use of potable water.
Responsible Organization:	City/County Water Utility Authority
Estimated Costs:	$1,250,000
Possible Funding Sources:	Office of State Engineer, State legislative funds, Pre-Disaster Mitigation Assistance funds administered by NMOEM, Hazard Mitigation Grant Program Technical Assistance funds administered by NMOEM.
Timeline for Implementation:	RFP for study out in 2005, complete study by end of 2006
Cost-Benefit Analysis	New water sources cost more than $6,000/acre-foot of water. Each acre-foot of water typically serves three households. Re-use of treated effluent equals cost of adding 125 new households.
Priority	5

Remember, projects can be capital –intensive like the one above or public awareness programs or proposed changes to existing ordinances and regulations.

- **Next Steps**
- Assignment of tasks to COA/BernCo, (in-kind) and URS staff

COA/BernCo DISASTER MITIGATION PLANNING TEAM

Meeting Notes
October 6, 2004 8:30 AM

DISASTER MITIGATION PLANNING TEAM

Attendees: Dave Bezy, Jim Hunter, Don Scott, Liz Saavedra, Lora Sedore, Will Gleason, Jessica Wilkins, Kelly Clarke, Patrice Clifford, Evonne Gantz, Jennifer Nelson

Group reviewed Section One and prioritized hazards. Began to identify goals, mitigation strategies and actions.

Action Items:

- ✓ **Don Scott**:
  - Obtain number of structures and population in East Mountain
  - Obtain value of critical facilities within County from Assessor
  - Future development trends in county (esp. East Mtn) based on past growth
  - New estimates on hailstorm damages, if available.
- ✓ **Jim Hunter:** Obtain value of critical facilities within city; Zoo, Bio Park, SIPI.
- ✓ **Jennifer Nelson**:
  - Contact Karen Takai, USFS and/or Karen Lightfoot, NM Forestry, for East Mountain wildfire initiatives, state and federal efforts.
  - Contact Fire Marshal for water cooperatives names/locations.
  - Acequia information
  - Drinking water: how affected by drought and flood
- ✓ **Jessica Wilkins**
  - Future development trends in LR based on past growth
  - FEMA/insurance report
- ✓ **Evonne Gantz**: Presidential flood declaration information: dates and cost
- ✓ **Dave Bezy:** Flood damage reports, value and dates from bridge washout
- ✓ **Lora Sedore**: Historical hazmat and Cochiti Dam Plan

Please return information to us no later than close of business Wednesday, October 15, 2004.

COA/BernCo DISASTER MITIGATION
PLANNING TEAM

Participant notes from 10-6-2004

Weather/Severe Storm
EAS Boxes in every Community. Center
Increase Public Awareness
Lightning Procedures and severe weather at every major ballpark

Entertainment

- Lightning alert system
- EAS
- Plan/procedures/best practices

Public School Fields

- Increase yearly code inspections on public facilities for weather related damages.
- Inspections that target wind shear & snow loads
- Coordinate AIL jurisdictions IBC
- Mobile homes- come use target

HAZMAT

- Limit Hazmat cargo to specific routes
- Specify areas for secured. Parking, safe parking areas.
- RR Limit # of tankers form 5 to 2-3 for chlorine, propane

Suggest

- Limit hours that trucks can travel through Big-I
- Alternative methods for wastewater treatment
- Promote safer handling of Hazmat; e.g.- Allow tank yanks that enable under ground tank upgrades.
- Lake of HAZMAT Inspect. Fire marshal- Add resources.

Flood Goal: Every Comm. Flood plain MGR.
Tijeras- Identify a FPM Bridge over Tijeras Arroyo if not in, join NFIP/CRS

Los Ranchos

- Village- Wide drainage study
- Garduño St.
- Awareness/PR to curtail excess pumping/ditch water
- CRS Program-apply

Bern. Co.

Well head protection program

- Identify private wells prone to flooding & protect

Earthquakes

- Retrofit public Bldg.
- Raise public awareness Bldg. Codes: C.S. Require water heaters strapped
- Non-Structural Retrofits 04 public Bldg: Filing cab, book shelves

Subsidence/Landslides

- Bldg. codes

COA/BernCo DISASTER MITIGATION
PLANNING TEAM

AGENDA
October 27, 2004
10:00 to 1:00
URS Corp, 6501 Americas Parkway Suite 900
Albuquerque, NM

- **Updates**

- Review list of action items from last meeting
- Review Sections 2 and 3
- Review sections prior to meeting and have edits/comments
- Prioritize Mitigation Actions
- Discuss projects and implementation strategy
- Bring current project details and project proposal details including:
  - Responsible Organization
  - Estimated Costs
  - Possible Funding Sources:
  - Timeline for Implementation
  - Cost-Benefit Analysis
- **Next Steps**
- Assignment of tasks to COA/BernCo, (in-kind) and URS staff

City of Albuquerque / Bernalillo County Hazard Mitigation Plan

Please take a few minutes and complete this questionnaire this evening, or forward it to Will Gleason, Project Manager, URS Corporation, 6501 Americas Parkway NE, Ste. 900, Albuquerque, NM 87110. The completed questionnaire will be reviewed for inclusion into the City of Albuquerque / Bernalillo County Hazard Mitigation Plan.

1. **Please rank the following hazards in order of concern. Designate #1 for the hazard of most concern.**

   ___Flash flood
   ___Hazardous Materials spills
   ___Wildfire
   ___Power failure
   ___Drought
   ___Dam failure
   ___Other_____

2. **What do you think should be done to reduce the future losses from these hazards?**

   _____

   _____

   _____

3. **What other recommendations would you like to make for the authors of the Hazard Mitigation Plan?**

   _____

   _____

4. Name and Address-OPTIONAL_____

COA/BernCo

Hazard Mitigation Capabilities Assessment Questionnaire

The **Hazard Mitigation Capabilities Assessment Questionnaire** is designed to assess the community's ability to reduce future losses from hazards like floods, hazard materials spills, or landslides through its various policies and programs. A capability assessment provides an inventory of existing policies, programs, practices and operational responsibilities that have or may have a major role in helping the community in its overall efforts to mitigate hazards. The results of the questionnaire are integral to the development of a mitigation strategy, the backbone of a local hazard mitigation plan currently in development by Bernalillo County and the City of Albuquerque.

- ***Responding to the Questionnaire:*** The questions presented in this questionnaire may cover several different agencies within your jurisdiction. Such agencies or positions within your jurisdiction may include
- Planning Department
- Floodplain Management
- Grants Administration
- Department of Public Works
- Tax Assessor's Office
- Municipal Executive Administrator
  - (Mayor, City Manager, Chairperson)

While you may make copies of this questionnaire to distribute to each agency, **please return all questionnaires for your jurisdiction under one cover**. If necessary, feel free to attach additional pages.

Please respond to each of the following questions and return by July 30,2004.

If you have any questions about this questionnaire, please contact Will Gleason or Lora Sedore, URS Albuquerque, 505-855-7500

Jurisdiction: _____

Department/Agency: _____

In Which Council of Government District? _____

Point of Contact:

Name: _____

Title: _____

Work Phone: _____ Email: _____

Is the Point of Contact the same person answering the survey? If not, please provide the name and title of the person filling out the assessment.

Name: _____ Title: _____

Section 1: Hazard Events

1. What hazards has your jurisdiction experienced in the past? (Check all that apply) Has your jurisdiction experienced any damage from these events? Please describe.

Hazard	✓	Date(s)	Description of Damage	# Deaths	# Injuries	$ Losses
Avalanche						
Aviation Accidents						
Dam Failure						
Earthquake						
Flooding						
Hazardous Materials Accidents						
Land Subsidence (i.e., sinkholes or mining?)						
Landslide						
Radiological (Nuclear) Incident						
Terrorist Incidents (not including false alarms)						
Tornado						
Tropical Cyclone (tropical storms, hurricanes, etc.)						
Wildfire						
Winter Storms						
Other: _____						

2. Within your jurisdiction, are there hospitals, schools, police stations, fire stations, or ambulance services that have experienced past damage from hazards? If yes, please describe the hazard event and the damages from it.

Facility	Address	Hazard Event	Description of Damage

3. Has your jurisdiction identified hospitals, schools, police stations, fire stations, or ambulance services that fall within hazard areas (even if there have been no previous events or damage)? If yes, please explain which hazards it faces and likely damage from the hazard. If the facility faces more than one hazard, please write separate entries for each hazard. Attach additional sheets if necessary.

Facility	Address	Type of Hazard	Likely Damage

Section 2: Existing Regulations, Policies, and Plans

The following section asks about the regulations within your jurisdiction that help prevent future damage from hazards, the name of the regulation, and the agency that administers it.

4. Check all of the following regulations, policies, or plans adopted, maintained, or administered by your jurisdiction.

Type of Regulation, Plan, or Policy	✓	Name of Regulation	Year Adopted	Administered by (including agency, position title, and name of jurisdiction if different)
a. A floodplain development or floodplain management ordinance?				
b. A building code?				
c. A disclosure requirement for residential home sales within hazard areas?				
d. A stormwater management plan?				
e. A comprehensive plan?				
f. A hazard mitigation plan?				
g. A risk assessment for any of the hazards mentioned in this survey?				
h. A subdivision ordinance?				
i. A capital improvements plan?				
j. An economic development plan?				
k. An emergency management response plan?				

Type of Regulation, Plan, or Policy	✓	Name of Regulation	Year Adopted	Administered by (including agency, position title, and name of jurisdiction if different)
l. A post-disaster recovery plan?				
m. A post-disaster recovery ordinance?				
n. A requirement for building permits for new construction or substantial improvements ()?				
o. A stream maintenance program?				
p. Other regulatory instrument regarding hazards not mentioned above?				

5. Do any of the above plans, ordinances, or reports contain :

	✓	In which ordinance or plan? (Indicate by the letter in Question 4 or write out the name of the document)
a. A freeboard (number of feet above the base flood elevation) requirement? If yes, how many feet? _____'		
b. A policy preventing new development or substantial improvements (over 50% of structural value) to structures in the floodplain?		
c. A regulation prohibiting enclosure of structure elements below base flood elevation?		
d. A regulation prohibiting fill in the floodplain?		
e. A regulation requiring fill and building foundations be designed to protect them from damage due to erosion, scour and settling?		
f. A requirement that critical facilities, such as hospitals and hazardous materials storage sites, be protected from higher flood levels?		
g. A prohibition of developments that can have adverse impact on public health or water quality, including alterations to shoreline, channels, and banks?		
h. A policy encouraging cluster development near sensitive areas like floodplains or wetlands?		
q. A steep slope or landslide ordinance?		
r. An ordinance regulating wildfire prevention?		
s. A regulation regarding mudflow or erosion-prone areas?		
t. A prohibition against dumping or placing debris in stream channels?		

	✓	In which ordinance or plan? (Indicate by the letter in Question 4 or write out the name of the document)
u. A regulation against siting new developments downstream of dams to protect them from dam breaks?		
v. A regulation requiring erosion and sedimentation control during construction projects to reduce siltation and the resulting loss of channel carrying capacity?		
w. A regulation authorizing a moratorium on building permits after a disaster event?		
x. A requirement that new structures in the regulated floodplain area submit first-floor elevations?		

6. Do any elements of your building code regarding structural elements that resist natural hazards (wind speeds, flooding, etc.) exceed the minimum requirements of State adopted building code? If yes, explain which elements and which hazards.

Building Code Element	Hazard Mitigated

7. Has your jurisdiction already identified necessary hazard mitigation projects? Please describe the project, the type of hazard it mitigates, the likely cost of the project, and the location of the project (by address, closest intersection, or other specific descriptor).

Project Description	Cost	Location

8. Does your jurisdiction have any means (regulatory, incentives, etc.) to encourage developers to implement appropriate "best management practices" to protect the environment or reduce exposure to natural or technological risks? Please explain.

_____

_____

Section 3: Technical Resources

The following section addresses the technical resources your jurisdiction has that might be available in mitigation planning efforts or implementation of mitigation projects.

9. Please identify the personnel resources that are responsible for activities related to hazard mitigation/prevention within your jurisdiction. Does your jurisdiction have:

	✓	Department/Agency and Position
a. A planner or engineer to review site plans for new developments?		
b. An engineer or professional trained in construction practices to inspect new buildings during construction?		
c. An engineer or other professional trained in construction practices to inspect new infrastructure during construction?		
d. A floodplain manager?		
e. Surveyors?		
f. Personnel with responsibility for determining vulnerability to hazards?		
g. Personnel skilled in using GIS		

10. Please identify whether your jurisdiction has access to or is eligible to use the following technical and funding resources. Then indicate whether these resources are currently in effect in your jurisdiction.

	Accessible /Eligible	Currently in Effect
a. A database or other recording instrument that includes first-floor elevations?		
b. GIS capability?		
c. Community Development Block Grants (CDBG)?		
d. Authority to incur debt through general obligation bonds?		
e. Authority to incur debt through special tax and revenue bonds?		
f. Authority to incur debt through private activity bonds?		
g. Capital improvements project funding?		
h. Authority to levy sales taxes?		
i. Fees for water, sewer, gas, or electric service?		
j. Fees for trash collection?		
k. Impact fees for homebuyers or developers for new developments/homes?		

11. Please identify any hazard mitigation-related training (or re-training) the government staff in your jurisdiction has had to enhance their performance of their existing job functions:

Type of Training	Staff Position
Floodplain Administration/Management and the National Flood Insurance Program	
Building Code Administration	
Building Inspection Training/Certification	
Retrofits for residential structures	
Retrofits for non-residential structures	
Community Rating System	
HazWoper	
[other]	
[other]	
[other]	

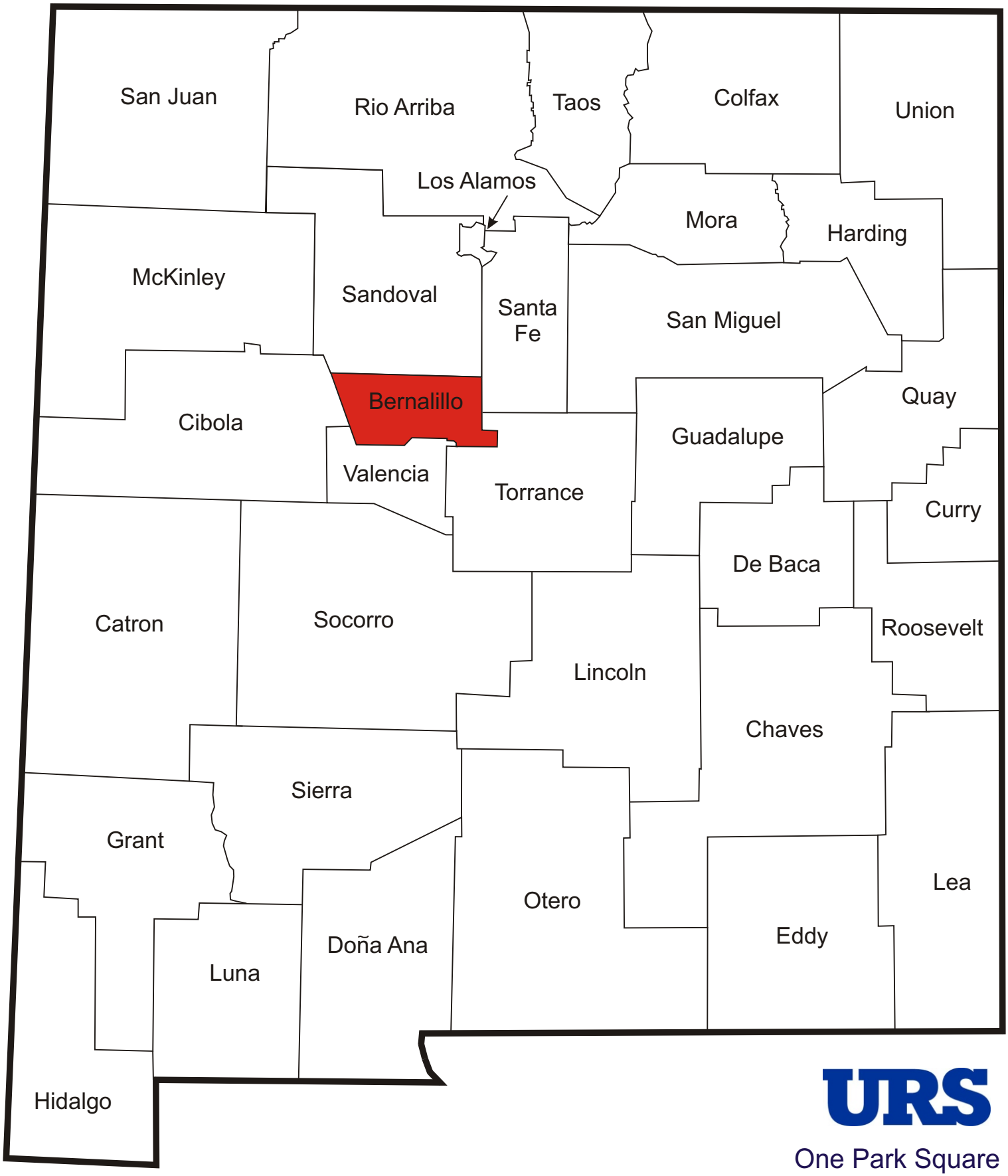
Section 4: Improving Capabilities

12. Are there any hazard-related or mitigation-related capabilities that you feel should be improved in your jurisdiction? Are there any capabilities that the jurisdiction doesn't have that you feel are needed? Please explain.

Needed Improvements	Explanation

Letters to individuals are not attached; sample letters with the list of recipients follows.

Note –No public comments were received from individuals during this review period.



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