

Hazard Mitigation Plan Sandoval County, New Mexico

Prepared for



Sandoval County Emergency Services
Sandoval County, New Mexico
314 Melissa Road
Bernalillo, NM 87004

Under contract with



Office of Emergency Management
4491 Cerrillos Road
Santa Fe, New Mexico 87507

Prepared by



One Park Square

6501 Americas Parkway, NE, Suite 900
Albuquerque, NM 87110-5311

and

200 Orchard Ridge Drive, Suite 101
Gaithersburg, MD 20878

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RESOLUTION NO. _____

WHEREAS Sandoval 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 Sandoval County, New Mexico (hereinafter referred to as the "Plan") has been developed by Sandoval County Emergency Services 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 Sandoval County Commissioners that:

The Hazard Mitigation Plan for Sandoval County, New Mexico, is hereby adopted as an official plan.

The Sandoval County 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 Sandoval County Commissioners, subject to the approval of the Sandoval County Commissioners.

The Sandoval County 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 Sandoval 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 Sandoval 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 Sandoval 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 SANDOVAL COUNTY**

Victoria S. Dunlap, County Clerk

Elizabeth C. Johnson, Chair

Jack E. Thomas, Vice Chair

Daymon Ely, Member

APPROVED AS TO FORM:

William Sapien, Member

David Mathews, County Attorney

David Bency, Member

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

RESOLUTION NO. _____

WHEREAS [insert community name], Sandoval 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 Sandoval County, New Mexico (hereinafter referred to as the "Plan") has been developed by Sandoval County Emergency Services 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 Sandoval County, New Mexico is hereby adopted as an official Plan of [insert community name].

The Sandoval County 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 _____, 2003

ATTESTED and FILED this the _____ day of _____, 2003

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

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

Sandoval County, New Mexico is 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 Sandoval County to undertake a hazard mitigation planning process. The resulting *Hazard Mitigation Plan for Sandoval County, New Mexico* (hereinafter referred to as the "Plan") identifies and profiles the hazards that can affect Sandoval 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.

Sandoval County Emergency Services provided the lead in soliciting the participation of both incorporated municipalities and unincorporated communities within the County to form the *Sandoval County Mitigation Planning Team* to undertake a comprehensive planning process that has culminated 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 Sandoval County as follows:

- Floods, including flash floods
- Wildfires
- Drought
- Severe weather including winter storms
- Human-caused hazards, including hazardous materials releases, nuclear facility accidents, and terrorism
- 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, flash floods, wildfire, and drought are considered to pose significantly higher risk to the residents of Sandoval 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.

- ✓ **Flash Floods** – Flash floods are aptly named: inundation can occur suddenly with high velocity stormwater flows. Although the duration of these events is usually brief, the damages can be quite severe. In the past, flash floods have affected many low-lying areas throughout Sandoval County, and this threat is expected to continue. However, specific impacts depend on the location, duration, and quantity of rainfall and are therefore difficult to predict. Flash floods are more likely to occur in drainageways that receive runoff from watersheds with steep slopes and narrow stream valleys. In urban areas, parking lots and other impervious surfaces that shed water rapidly can also contribute to flash floods. In

addition, the County experiences flash flooding from heavy rain on dense snow pack in winters and excessive rain in spring and summer.

- ✓ **Wildfire** – Forest land in Sandoval County is extremely susceptible to wildfires due to dense timber stands and recent drought conditions. The higher than normal tree densities and accumulation of fuels present a significant, continued threat of wildfire to structures located in the wildland-urban interface area. The Plan determines that more than 20,000 structures with an aggregate value of billions of dollars are located in areas identified as wildfire hazard areas.
- ✓ **Droughts** - New Mexico experiences drought approximately every ten years, so droughts have been a common occurrence in Sandoval County. Droughts in Sandoval County significantly affect human activities, wildfire suppression, natural resources, and water-dependent activities.

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 a series of alternative 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 following table includes a description of the mitigation actions that are recommended in this Plan, listed in the order of priority as determined by the Mitigation Planning Committee.

Mitigation Action	Priority
Develop a countywide wildland-urban interface project.	1
Develop a countywide stormwater management plan to include flooding and erosion in Sandoval County.	2
Develop a city stormwater management plan for Rio Rancho.	3
Develop a Barrancas Arroyo Reach plan for flood and erosion.	4
Provide flood protection while reducing sediment and erosion at Calabacillas Watershed.	5
Create a firebreak around the town of Cochiti Lake and surrounding areas.	6
Install an emergency communication system that is not dependent on local telephone and electrical services for Cochiti Lake.	7
Build levees, culverts, and dirt work to channel water away from roads and homes in Jemez Springs.	8
Install early warning devices for critical facilities in the village of San Ysidro.	9
Ensure that engineering services provide specifications for backup generators and fuel tanks to provide the town of Cochiti Lake with a continuous source of electrical power.	10
Thin trees and clean up defensible spaces around Jemez Springs.	11
In Jemez Springs, investigate and promote alternative economic resources to tourism that is based on the surrounding National Forests.	12

Develop a functioning Geographic Information System (GIS) within the City of Rio Rancho's Emergency Management Operations.	13
In Rio Rancho, increase the number of Code Enforcement Officers in the Department of Public Safety Code Enforcement Division from 5 to 8 within 2 years.	14
Utilize a GIS for identifying "sensitive area" properties in Rio Rancho.	15
Acquire citywide drainage ROW in Corrales.	16
Install an emergency call box at each San Ysidro Municipal Complex.	17
Extend water lines and install fire hydrants on the extended lines to areas currently not served.	18
Provide flood protection while reducing sediment and erosion at Black Watershed (SSCAFCA)	19
Provide flood protection while reducing sediment and erosion at Montoyas Watershed (SSCAFCA).	20
Provide flood protection while reducing sediment and erosion at Venada Watershed (SSCAFCA).	21

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

Sandoval County Mitigation Planning Team Members

Donna Atencio, Village of Cuba	Ethel Maharg, Mayor, Village of Cuba
Kris Axtell, Emergency Management Assistant, City of Rio Rancho	Diane Montoya, Administrative Assistant, Sandoval County Emergency Services
Rick Bassi, Emergency Management Coordinator, City of Rio Rancho	Dave Mottle, Village of Corrales Emergency Services
Jo Brand, Village of Corrales	James Service, Field Coordinator, Southern Sandoval County Arroyo Flood Control Authority
Liz Drummond, Village of Cochiti Lake	Robert Schulz, Floodplain Manager, City of Rio Rancho
Bob Foglesong, Southern Sandoval County Arroyo Flood Control Authority	Ronnie Sisneros, Town of Bernalillo
Evonne Gantz Mitigation Specialist, New Mexico Department of Public Safety, Office of Emergency Management (NMOEM)	David Stoliker, Southern Sandoval County Arroyo Flood Control Authority
Joe Grider, Trustee/Assistant Chief, Village of Jemez Springs	Steve Tollefson, Municipal Planning Manager, City of Rio Rancho
Tanya Latin, Village of Corrales	Debra Welsh, Town Administrator, Village of Cochiti Lake
Jess Lewis, Deputy Fire Marshall, Emergency Services Coordinator, Sandoval County	Daniel White, Marshal, Town of San Ysidro

Other Contributors

Frank Diluzio, Federal Emergency Management Agency, Office of Cerro Grande Fire Claims	Dave Bervin, N.M. State Forestry
Joseph Garcia, Chief, Jemez Springs Volunteer Fire Department	Pete Meskimen, Chief, Volunteer Fire Department
Mark Hatzenbahler, Fire Chief, Village of Cuba Fire Department	Chris Miller, Assistant Director of Operations, Sandoval County
Joseph Lalfin, Firefighter/EMT-I Corrales	Joe Minten, Jemez Springs Fire Department
Maureen Lincoln, Homeowner, La Cueva Volunteer Fire Department	Matt Morris, Placitas Volunteer Fire Department
Richard Lincoln, Homeowner, La Cueva Volunteer Fire Department	L. Ray Parsons, Sergeant, Marshal's Office, Jemez Springs
Gary Pals, Sandoval County	Kaye Sinclair, Sandoval County A.R.E.S.
Michael Scales, Sandoval County Planning and Zoning	Brad Stebleton, Senior Planner, Sandoval County Planning and Zoning

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

This section of the *Hazard Mitigation Plan for Sandoval County, New Mexico* 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 Profile* – identifying relevant characteristics of Sandoval County

OVERVIEW

Across the United States, natural and human-caused¹ disasters have led to increasing levels of death, injury, property damage, and interruption of business and government services. The toll on families and individuals can be immense, and damaged businesses cannot contribute to the economy. The time, money, and effort spent to respond to and recover from these disasters divert public resources and attention from other important programs and problems. With five presidential disaster declarations, three fire-suppression authorizations from the Federal Emergency Management Agency (FEMA) and one disaster-related Act of Congress since 1992, Sandoval County, New Mexico, recognizes the consequences of disasters and the need to reduce the impacts of natural and human-caused hazards. The elected and appointed officials of the County also know that with careful selection, mitigation actions in the form of projects and programs can become long-term, cost-effective means for reducing the impact of natural and human-caused hazards.

Therefore, the Sandoval County Mitigation Planning Team, composed of County residents and responsible officials, with the support of the State of New Mexico Office of Emergency Management (NMOEM) and FEMA, has prepared this *Hazard Mitigation Plan for Sandoval County, New Mexico*. The Plan is the result of nearly a year's 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.

MITIGATION PLANNING IN NEW MEXICO

The Cerro Grande Fire occurred on Thursday, May 4, 2000, when National Park Service personnel ignited a prescribed burn with the intent of reducing the future risk of fire by reducing the fuel load. Sporadic and changing winds carried embers across the fire line. Control was lost and the prescribed burn was declared a wildfire on May 5.

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 for property, business and financial losses, and other expenses directly related to the fire. The CGFAA also provides funding for mitigation efforts to reduce the risk of secondary hazards, such as the increased flooding that results when rainfall rushes down denuded hillsides.

Following the Cerro Grande Fire in 2000, concerned government officials and citizens, led by Sandoval County Emergency Services, requested funding through the Cerro Grande Fire Assistance Act to complete a countywide hazard mitigation plan.

¹ Human-caused hazards include technological (hazardous materials, nuclear, aviation accidents, etc.) and terrorism incidents.

PURPOSE OF THE PLAN

The *Hazard Mitigation Plan for Sandoval County, New Mexico* 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 Sandoval 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 Sandoval 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 NMOEM to assist Sandoval County in creating a hazard mitigation plan. URS worked with the County Mitigation Planning Team and NMOEM to solicit public input and draft this mitigation plan. Representatives of the NMOEM and FEMA conducted a kick-off meeting on June 14, 2002, to educate the public about pre-disaster mitigation, identify needs, and generate interest in the mitigation planning process. Then, Jess Lewis, the Sandoval County Emergency Services Coordinator, assembled the Sandoval County Mitigation Planning Team as an advisory body to undertake the planning process. Mr. Lewis contacted each municipality and invited them to join the Mitigation Planning Team. In addition, the Office of Cerro Grande Fire Claims contacted Native American tribes.
- ✓ *Hazard Identification and Risk Assessment* – The Mitigation 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 Mitigation 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 Mitigation 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 Mitigation 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 Mitigation 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 Mitigation 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 Mitigation Planning Team met in July, August, and December of 2002, and January and February 2003, to accomplish these tasks.
- ✓ *Mitigation Plan and Implementation Strategy* – Finally, the Mitigation Planning Team met in March and April of 2003 to determine the priorities for actions from among the alternatives and develop a specific implementation strategy including 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, all incorporated municipalities and sovereign governments 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 countywide efforts. Communities and governments that did not choose to participate in the development of the Plan were still provided the opportunity to adopt the Plan and provide any suggestions for additional mitigation actions that would meet their needs.
- ✓ *Public Involvement* – The Sandoval County Mitigation Planning Team hosted a series of public meetings to educate stakeholders about their risks, involve them in identifying issues, and educate them about mitigation options available to them. The meetings 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 the incorporated Village of Cuba on September 17, 2002; the unincorporated community of Canon on December 11, 2002; and the

incorporated Town of Bernalillo on December 12, 2002 (see Appendix C for copies of meeting agendas, attendance lists, and meeting minutes).

- Public Response Questionnaires to develop lists of potential mitigation actions by soliciting community input regarding vulnerabilities and potential solutions. Citizens participated 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 (see Appendix E for copies of press releases and public notices).
 - Presentations to the Sandoval County Commissioners for the Draft and Final versions of the Plan informing them of proposed mitigation actions and their implementation schedule, and seeking support for adopting the Plan.
 - Presentations to the individual jurisdictions to seek approval and adoption of the Plan.
- ✓ *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 local plans, including Sandoval County's, every five years. This means that the Hazard Mitigation Plan for Sandoval County 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 *Hazard Mitigation Plan for Sandoval County, New Mexico* 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.

COMMUNITY BACKGROUND

Sandoval County is a culturally, geographically, and economically diverse County located in north central New Mexico. Sandoval County includes developing suburban areas as part of the northern metropolitan area of Albuquerque, the State's largest city. The County also includes all or portions of eight Indian Pueblos, three Navajo Chapters, and a portion of the Jicarilla Apache Reservation, as well as six incorporated municipalities: the Towns of Bernalillo (the County seat) and Cochiti Lake; the Villages of Corrales, Cuba, Jemez Springs, and San Ysidro; and the City of Rio Rancho. Numerous unincorporated communities also lie within the County including Algodones, Canon, La Cueva, La Jara, La Madera, Placitas and Ponderosa.

The following briefly discusses relevant characteristics of Sandoval County under the categories of *Demographics*, *Physical Features*, and *Infrastructure*.

Figure 1: Location of Sandoval County



Source: www.sandovalcounty.com

Demographics

- ✓ *Population* – According to the 2000 U.S. Census, the population of Sandoval County is 89,908 residents, fifth among counties in the state. Rio Rancho, with 51,765 residents, is the largest city in Sandoval County and accounts for over 57% of the total County population. An additional 18,085 people reside in the neighboring incorporated municipalities of Bernalillo, Corrales, and Cochiti Lake and the unincorporated communities of Algodones and Placitas.
- ✓ *Growth Projections* – Sandoval County has shown a steady and remarkable growth in population over the last three decades, with increases in population of 50% from 1970 to 1980, 46% from 1980 to 1990, and 42% from 1990 to 2000 (U.S. Census). The University of

New Mexico's Bureau of Business and Economic Research (BBER) estimates population growth in Sandoval County from *90,775 in 2000 to 108,538 by 2005 (19.5% increase), 126,294 in 2010 (16.4% increase), 144,377 in 2015 (14.3% increase), and 162,409 (12.5% increase). The total anticipated increase in population within the next 20 years is therefore 55%. The majority of population growth has occurred, and is expected to occur in the future, in Rio Rancho and neighboring communities.

* Based on U.S. Census 2000 intercensal estimates. The U.S. Census has not yet revised all intercensal components, so the BBER still uses the **unrevised** series in its projections.

- ✓ *Employment* – The composition of employment in Sandoval County is 24% manufacturing, 19% retail and 24% services, with the majority of commercial/industrial development within the populated greater Rio Rancho area. Rio Rancho is home to several high-tech manufactures such as Intel, Xynatech, and Letrosomics. There are also five major call centers within the City. Intel is the largest employer with 5,400 jobs, followed by Sprint PCS with 1,200 employees (Rio Rancho Economic Development, 2003). Smaller communities, such as Jemez Springs, Cuba, and the Pueblos, near recreation areas are dependent on tourism (Focus 2050, 2000).
- ✓ *Housing* – The number of total housing units in the County is 34,866, with 27,528 of them located in the City of Rio Rancho and neighboring communities (2000 U.S. Census). Since housing is a function of population, the highest growth in housing units is anticipated within the Rio Rancho area. The Sandoval Planning and Zoning Department reports 40,000 platted lots in the Rio Rancho area, with only 1,000 of these lots currently developed.

Physical Features

- ✓ *Land Area* – Sandoval County covers approximately 3,710 square miles. Public and Native American tribal lands account for 73% of Sandoval County. The southeast portion of the County, home to the incorporated communities of Rio Rancho, Corrales, and Bernalillo and the unincorporated community of Placitas, is suburban. The remainder of the County is rural and includes open range federal and Native American tribal lands.
- ✓ *Topographic Features* – The resource land of Sandoval County includes forests, grassland, and dramatic canyons and volcanic plugs. The Jemez and Nacimiento Mountain ranges are located in northern Sandoval County. A small portion of the Sandia Mountain range extends into the southeastern corner of the County. The mountains range in elevation from over 11,000 feet at Redondo Peak in the Jemez Mountains to approximately 9,000 feet in the Nacimientos.
- ✓ *Hydrology* – The Rio Grande runs through the southeastern portion of the County between the Jemez and Sandia Mountains. The river is dammed at Cochiti Reservoir, one of four major flood and sediment control dams along the Rio Grande. The broad floodplain of the river contains flood-irrigated agricultural fields crisscrossed with acequias, or irrigation ditches. The Rio Puerco, an intermittent river, traverses the middle of the County.

Numerous smaller waterways have their headwaters located high in the surrounding mountains and are located entirely within the County. For example, the Jemez River watershed is a tributary to the Rio Grande watershed and includes the southern flank of the Valles Caldera. A dam at the Jemez River Reservoir controls the Jemez River.

- ✓ *Natural Resources* – The northern and western portions of the County lie within the Great Basin area, which is a landscape of high desert vegetation, comprising species such as

sagebrush (*Artemisia tridentata*), chamisa (*Ericameria nauseosa*), four-wing saltbush (*Atriplex canescens*), and juniper scattered among grasses such as Indian rice grass (*Oryzopsis hymenoides*) and galleta grass (*Hilaria jamesii*). The vegetation of the Great Basin is well adapted to the cold winters, hot summers, and dry climate.

Typical vegetation of the mountain ranges consists of conifer forests with species of Douglas fir (*Pseudotsuga menziesii*), Englemann spruce (*Picea engelmannii*) and white fir (*Abies concolor*) at the highest elevations. As elevation decreases, mixed conifer forests, including aspen (*Populus tremuloides*) forests, become prominent. Ponderosa pine (*Pinus ponderosa*) and Gambel oak (*Quercus gambelii*) forests predominate at elevations of approximately 7,500 to 8,500 feet. At the lower elevations of 6,500 to 7,500 feet, piñon pine (*Pinus edulis*) and juniper (*Juniperus monosperma*) woodlands, and juniper grasslands blend into high elevation deserts.

- ✓ *Climate* – Sandoval County’s climate is arid; annual precipitation ranges from 8.86 inches at Bernalillo to 22.94 inches at Wolf Canyon (Western Regional Climate Center, 2003). Elevation is the greatest determining factor for temperature in Sandoval County. Mean average temperatures are from 64 F (approximately 5,000 feet) in the Rio Rancho area to 40 F (7,000 to 8,000 feet) in the higher mountain elevations. Temperatures can exceed 100 F at elevations below 5,000 feet. Average daytime January temperatures range from the mid-50s in the lower elevations to mid-30s in the higher elevations. There are more than 200 freeze-free days in the lower elevations of the County compared with fewer than 80 days in the higher elevations of the north.

Infrastructure

- ✓ *Vehicular Transportation Routes* - U.S. Highway 550 traverses Sandoval County and connects the northwestern and northeastern portions of the County to Interstate 25. U.S. Highway 550 intersects I-25 at Bernalillo. N.M. State Highway 4 at San Ysidro provides access for the Jemez area to U.S. 550 and I-25 as well as to N.M. State Highway 285 to the northeast. State Roads 16 and 22 provide access to I-25 for Cochiti Pueblo, Town of Cochiti Lake, Peña Blanca, and Santa Domingo Pueblo. Interstate 25 crosses the southeast corner of the County providing easy access to the metropolitan areas of Albuquerque and Santa Fe from the communities of Bernalillo, Placitas, and Algodones.
- ✓ *Rail Transportation Routes* – The Burlington Northern Santa Fe (BNSF) Railroad crosses Sandoval County for approximately 31 miles beginning at the southern County line just southeast of Corrales, and continuing north-northeast to Santo Domingo Pueblo. It then extends approximately 6 miles east to the County border. (See Figure 2.)
- ✓ *Utilities* – Utility providers for Sandoval County include the Public Service Company of New Mexico (PNM) and Jemez Mountain Electric Coop for electricity and gas, and Qwest Communications and Valor Communications for telephone service. Larger communities, including the incorporated communities of Bernalillo, Rio Rancho, Cuba, Jemez Springs, and the Town of Cochiti Lake; the unincorporated communities of Placitas and Peña Blanca; as well as the Pueblos of Cochiti, Jemez, Santa Ana, Zia, Sandia, San Felipe, and Santo Domingo have community water systems (New Mexico Environment Department [NMED], 2002), either publicly-owned water systems or water cooperatives. (State Engineer’s Office, 1966). They have public wastewater treatment and disposal facilities (NMED, 2002). Many other Sandoval County communities are predominantly rural, with major portions of the population obtaining water from on-site domestic wells and disposing of wastewater through individual septic systems.

Section One: Hazard Identification/Risk Assessment summarizes the results of the first fundamental task in the planning process wherein hazards that may affect Sandoval County are identified, profiled, and the 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 Sandoval County that may not have occurred in recent history.
- ✓ *Hazard Profiles* - determines the frequency or probability of future events, their severity, and factors that may exacerbate their severity. The Mitigation 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 not fine-grained. 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 in which Sandoval 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 Sandoval 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 average structure values of \$115,400. 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

Table 1 presents a description of the hazards that were identified, 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 Sandoval County. A questionnaire for residents was also developed using the hazards identified by the Planning Team. As noted, hazard identification involved a combination of input from concerned residents and preliminary research from several State and federal resources.

Table 1: Summary of Hazard Investigation

Hazard	How Identified	Why Identified
Floods, including Flash Floods	<ul style="list-style-type: none"> ▪ NMOEM 2000 All Hazard Plan List ▪ Identification of previous disaster declarations ▪ National Climatic Data Center (NCDC) 	<ul style="list-style-type: none"> ▪ There have been several previous flood disaster declarations. ▪ Several flash flood events have been recorded in Sandoval County
Wildfire	<ul style="list-style-type: none"> ▪ NMOEM 2000 All Hazard Plan List ▪ Residents ▪ Consultation with New Mexico Forestry Division 	<ul style="list-style-type: none"> ▪ Sandoval County has experienced many wildfires, including the Cerro Grande Fire. ▪ The New Mexico Forestry Division indicated that there are several yearly forest fires.
Drought	<ul style="list-style-type: none"> ▪ NMOEM 2000 All Hazard Plan List ▪ Residents ▪ New Mexico Department of Natural Resources 	<ul style="list-style-type: none"> ▪ The County has had droughts in the past. ▪ Residents indicated that droughts have been a recurring problem. ▪ New Mexico, including Sandoval County, is currently undergoing a dry weather phase.
Severe Weather, including Winter Storms	<ul style="list-style-type: none"> ▪ NMOEM 2000 All Hazard Plan List 	<ul style="list-style-type: none"> ▪ Sandoval County has experienced severe winters most years; some storm events have overwhelmed County operations and individual resources. ▪ Sandoval County has experienced destructive localized wind events in the recent past.
Human-Caused Hazards, including Hazardous Materials Releases, Nuclear Facility Accidents, and Terrorism	<ul style="list-style-type: none"> ▪ NMOEM 2000 All Hazard Plan List ▪ Review of U.S. Environmental Protection Agency (U.S. EPA) website 	<ul style="list-style-type: none"> ▪ Sandoval County has several facilities that handle or process hazardous materials. ▪ There have been previous transportation accidents and hazardous materials spills. ▪ Localized terrorist events, including school violence, have occurred in Sandoval County. ▪ The federal and state governments have advised every jurisdiction to consider the terrorism hazard.
Earthquake	<ul style="list-style-type: none"> ▪ NMOEM 2000 All Hazard Plan List ▪ USGS seismologic information 	<ul style="list-style-type: none"> ▪ Earthquakes have occurred in the State of New Mexico.
Other Hazards, including Landslides/Land Subsidence, Dam Failure, and Volcanoes)	<ul style="list-style-type: none"> ▪ NMOEM 2000 All Hazard Plan List 	<ul style="list-style-type: none"> ▪ NMOEM 2000 All Hazard Plan List

SECTION ONE: HAZARD IDENTIFICATION / RISK ASSESSMENT

Table 1A: Multi-Jurisdictional Risk Assessment for Sandoval County, NM

Jurisdiction	Floods	Wildfire	Drought	Severe Weather	Human Caused Hazards, incl. Hazardous Materials, Nuclear and Terrorism	Earthquakes, landslides, dam failure and volcanoes	Comments
Sandoval County	High	High	High	Moderate	Moderate	Low	See Table 1: Summary of Hazard Investigation; p. 9
Town of Bernalillo	High	High	High	Moderate	Moderate	Low	Risks same as County
Town of Cochiti Lake	High	High	High	High	Moderate	Low	For severe weather risk, see page 31
Village of Corrales	High	High	High	Moderate	Moderate	Low	Risks same as County
Village of Cuba	High	High	High	Moderate	Moderate	Low	Risks same as County
Village of Jemez Springs	High	High	High	Moderate	Moderate	Low	For wildfire, Jemez Springs community identified as one of 20 most vulnerable communities in NM
City of Rio Rancho	High	Low	High	Moderate	Moderate	Low	Lower wildfire risk shown on Plate 3
Village of San Ysidro	High	Low	High	Moderate	Moderate	Low	Lower wildfire risk shown on Plate 3

HAZARD PROFILES AND VULNERABILITY ASSESSMENT

The remainder of this section presents profiles and vulnerability assessment information for these hazards. The order that these hazards are discussed in the remainder of this report is the order of priority as determined by the Mitigation Planning Team.

FLASH FLOODS



OVERVIEW – FLASH FLOODS IN SANDOVAL COUNTY, NEW MEXICO

Nationwide, hundreds of floods occur each year, 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 (see Figure 2) associated with rivers and streams and shoreline inundation along lakes and coastlines.

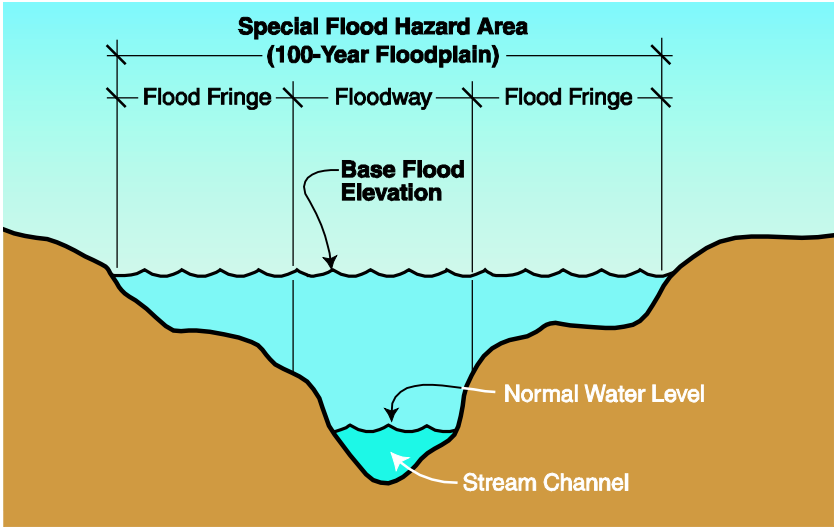


Figure 2: Definition Sketch for Floodplains

Source: *Understanding Your Risks* – FEMA Publication 386-2, page 2-12

SECTION ONE: HAZARD IDENTIFICATION / RISK ASSESSMENT

This type of flooding typically results from large-scale weather systems generating prolonged rainfall or from locally intense storms or from 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 Sandoval 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 fast and end quickly. 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 drainageways.

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, Sandoval County has suffered damage from numerous major floods and localized flash flooding almost every year since 1994. In addition, Rio Rancho is the municipality in Sandoval County that has been hit most frequently, with flash flooding recorded every other year starting in 1974, the most recent event occurring in 2001.

In 1999, a series of rainstorms in July and August caused extensive damage in Rio Rancho, Sandoval County, and elsewhere in New Mexico. Storms on July 29 and August 4 dumped more than 2 inches of rain each. Areas affected in Rio Rancho included Wastewater Treatment Plant #2. Damage estimates from these events amounted to \$470,000 for Rio Rancho and a total of \$1 million for the entire County. The flooding was a locally declared disaster in August, and State and federal disaster declarations followed in September. In all, one federal and five State declarations for flash flooding have been issued in 1975, 1976, 1988, 1990, and 1999.

Table 2 lists some of the significant flash flood events in Sandoval County in the last ten years.

Date	Estimated Damages (\$)	Damage Description/ Property or Infrastructure Damaged
July, 1994	Not available	Roads
August, 1995	n/a	Street closures
June, 1996	n/a	Street closures
August, 1996	n/a	Homes and roads
June, 1997	n/a	Ditches, homes, and roads
July, 1997	n/a	Culvert damage, vehicles
July, 1999	\$1,000,000	Roads, landfill, homes, wastewater treatment plant

In addition, large wildfires that hit the State during 2000, 2001, and 2002, created an especially dangerous risk of flash flooding from summer thunderstorms and heavy rains. Catastrophic wildfires like these events remove large amounts of vegetative cover, exposing hydrophobic soils that allow high runoff and increased flooding. These conditions will persist for several years until vegetation and soil are re-established to pre-fire conditions.

HAZARD PROFILE – FLASH FLOODS

Hazard Characteristics

In New Mexico generally and Sandoval County in particular, 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, although during most winters the snow pack is generally moderate. Winter floods also have resulted from runoff produced by intense rainfall events. Summer floods have occurred from intense rainfall on impervious desert soils or previously saturated soils. Summer thunderstorms that deposited large quantities of rainfall over a short period of time have also produced flash 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. In the flooding disaster of 1999, more that \$500,000 in damage was attributable to erosion as opposed to inundation. (Robert Schulz, Public Works, Rio Rancho, 2003). 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. Erosion damage from flash flooding includes access disruption, road closures, driving hazards, drainage facility damage and sedimentation. Erosion can occur rapidly during a storm event or can occur over time due to minor storms or breaks in water lines.

Severity and Probability of Occurrence

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

SECTION ONE: HAZARD IDENTIFICATION / RISK ASSESSMENT

- ✓ **Steep Slopes:** Sandoval County has a moderate to steeply sloping terrain that can contribute to flash flooding, since 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 Sandoval County are derived from underlying sandstones and shale. As a result, soils are typically fine-grained, and have low infiltration rates and high runoff potential. 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.

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

Table 3 shows a range of flood recurrence intervals and their probabilities of occurrence. Every year, a 10-year flood has a greater likelihood of occurring (10% chance) than a 100-year flood (1% chance). The extent of flooding associated with a 1% annual probability of occurrence—the base flood—is used as the regulatory boundary by a number of federal, state, and local agencies. Also referred to as the Special Flood Hazard Area (see Figure 2 on Page 10), this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities since many communities have maps that show the extent of the base flood and the likely depths that will be experienced. The base flood is often referred to as the 100-year flood. Since its 1% probability of occurring in any one year implies a recurrence interval of 100 years, this is often mistaken to have a literal meaning of “once every 100 years.” Experiencing a 100-year flood does not mean a similar flood cannot happen for the next 99 years; rather, it reflects the probability that over a long period of time, a flood of that magnitude should occur in only 1% of all years. Smaller floods occur more often than larger (deeper and more widespread) floods.

The determination of the extent of the base flood for Sandoval 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 location of the flood hazard areas with the greatest populations in the County are shown on the accompanying floodplain maps for the Village of Jemez Springs (Plate 1) and the City of Rio Rancho and Surrounding Area (Plate 2).

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 Sandoval County focused on the 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.

SECTION ONE: HAZARD IDENTIFICATION / RISK ASSESSMENT

Sandoval County Planning and Zoning Department estimated the population and number of homes and businesses in the County subject to

Table 4: Assets Vulnerable to Flash Flood			
Area	Population	Residential Structures	Small Business Structures
Unincorporated Areas	700	219	6
TOTALS	22,220	8,084	90

flash flooding from a 100-year event in 1998 as part of an application for the community to participate in the National Flood Insurance Program (NFIP). These estimates are provided in Table 4. According to this analysis, in Sandoval County a total of 22,220 people, 8,084 homes, and 90 businesses are vulnerable to flash flooding from a 100-year-flood event. Most of the vulnerable population, homes, and businesses are situated in the incorporated areas of the County. However, most of these structures are not in the City of Rio Rancho.

The figures in Table 5 are based on the U.S. 2000 Census Block that includes areas well outside the city limits of Rio Rancho. According to R. Schulz, Certified Floodplain Manager for Rio Rancho, there are less than 20 structures in flood hazard areas within the City of Rio Rancho. Therefore, the numbers vary from those in Table 4.

Table 5: Structures Identified in 100-year Floodplain, Sandoval County

**	Structures *	Estimated Value
Rio Rancho Census Block	551	\$494,698,171
Jemez Springs	64	\$11,148,800
Critical Facilities	4	Not Available
County Total	619	\$505,846,971

* Per 2000 Census housing information

** Based on 2000 Census Block that includes areas outside of the city limits

Critical Facilities

The two critical facilities located in the 100-year floodplain are the County Courthouse and a fire station in Corrales. The Sandoval County Courthouse, located in Bernalillo, is considered to have high flood vulnerability, compromising Courthouse operations during flood events and putting the citizens who depend upon its services at risk. Historical flooding has resulted in estimated flood depths at the building of less than 1 foot, but there have been repetitive damages and disruptions to the lower levels due to the flooding.

FUTURE DEVELOPMENT TREND

There are 2,947 acres within the floodplain areas of Sandoval County that do not belong to Indian reservations or State and federal agencies. The entire area could theoretically support 3,929 lots (at 0.75 acres each). However, much of the land is located in arroyos with steep banks and poor access and has little to no chance of being developed. The City of Rio Rancho Vision 2020 Comprehensive Plan prioritizes development in consolidated parcels of land and requires a master plan to accompany any proposed development. Part of the master plan is a comprehensive strategy for dealing with drainage issues and identifying “no-build” areas in or near floodplains. Additionally, under current Sandoval County zoning regulations, no new building permits are issued in identified flood-prone areas without mitigation measures such as elevating buildings above the floodplain or obtaining a Letter of Map Revision (LOMR) from FEMA.

CONCLUSIONS – FLASH FLOODING

The following summary identifies the salient points of the hazard identification, profiling, and vulnerability assessment portions of the work carried forward as part of the planning process (see *Section Two – Goals, Objectives, and Alternative Mitigation Actions*).

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. Municipalities, in particular Rio Rancho and Jemez Springs, have relatively more population and economic assets that are vulnerable to flood damages. Exacerbating the effects of flooding in the County are steep slopes, unstable desert soils, and obstructions in the floodplain.

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

What Can Be Mitigated?

Determining the aspects of Sandoval County flood vulnerability that can be mitigated requires a review of the causal factors for floods and the assets that can be affected. In Sandoval County, most flash flood events result in direct damage to structures and infrastructure, as well as erosion in developed areas. As a result, available alternatives for mitigation actions should focus on property protection, corrective measures for drainage and erosion in developed areas, and future development in the municipalities.

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 percent 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. Information such as the first-floor elevations, number of stories, the foundation type, and construction type of structures was not readily available in Sandoval County at the time this Plan was developed.
- ✓ Data for Structures – Coverage: The figures for homes and businesses vulnerable to flood in Table 4 are based on estimates provided by the Sandoval County Planning and Zoning Department. They are much larger than the figures in Table 5, which are derived from incomplete information in the Sandoval County GIS. The current coverage for the structure layers in the Sandoval County GIS is approximately 20% of the Census 2000 figures, which does not provide an adequate basis to perform detailed risk assessments. Despite the discrepancies, the County can conclude that based on the undercount for structures noted in Table 5, the cost of a 100-year flood would be quite high, and will only grow larger as the data improve.

WILDFIRES



OVERVIEW – WILDFIRES IN SANDOVAL 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.

PREVIOUS OCCURRENCES – WILDFIRES

The State of New Mexico Energy, Minerals and Natural Resources Department, Forestry Division lists over 350 reports of fires requiring emergency response from 1997 to 2003 in Sandoval County. Table 6, *Recent Wildfires in Sandoval County*, shows that approximately 53,000 acres were affected at a direct cost of over \$650,000 to the State for fire fighting efforts.

In May 2000, one of the worst wildfires in the State occurred when a prescribed burn went out of control in Sandoval County. The fire, which is now known as the Cerro Grande Fire of 2000, spread quickly to neighboring Los Alamos County. More than 48,000 acres were burned, with 350 families losing their homes. The fire was declared a presidential disaster, and a subsequent Act of Congress created the Cerro Grande Fire Assistance Program that has paid out more than \$243 million in fire-related claims as of November 13, 2001 (FEMA, 2001). The damage to the community continued after the fire was out as increased stormwater runoff from rainfall events rushed down fire-scoured mountains and hillsides, producing mudslides, erosion, and silting that wiped out roads and utilities.

Table 6: Recent Wildfires in Sandoval County (Cumulative totals for each year)

Year	Total Acres Burned	State Expenses
1997	100	\$3,682
1998	44	\$29,950
1999	307	\$74,515
2000	47,860	\$281,045
2001	35	\$18,750
2002	4,315	\$250,320
Total*	52,661	\$658,262

*Total does not include federal and local funds expended
 Source: State of New Mexico Energy, Minerals and Natural Resources Department, Forestry Division

HAZARD PROFILE – WILDFIRES

Hazard Characteristics

Wildfires can occur at any time of the year, but they mostly 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 burn types; surface, ground, and crown fires. A surface burn consumes the 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).

Wildfires in Sandoval County can occur in fields, grass, and brush as well as in the forest itself. Much of the western half of the County consists of forested areas surrounded by cropland and pastures. Potential aftermath of wildfires includes severe erosion and the silting of stream beds and reservoirs, resulting in damage to the watershed, and flooding due to a loss of ground cover.

Severity and Probability of Occurrence

Forestland in Sandoval County is extremely susceptible to wildfire due to the arid climate and recent drought coupled with dense, degraded timber stands with large accumulations of fuel from understory growth. In addition, many of the heavily forested areas in Sandoval County are located on steep slopes that aid in the spread of fires and add to the difficulty in fighting a wildfire.

The primary factor contributing to the degradation of forests in the Southwest is increased tree density and decreased grass and forb cover (broad-leaf herbs that grow in fields, prairies, or meadows). Past forest fire suppression practices and livestock overgrazing are the primary cause of degraded forests, with other factors creating added stress on an already burdened system (Dahms, 1997). Fire suppression and overgrazing resulted in the unnaturally heavy accumulation of live and dead vegetation and led to “doghair” thickets of ponderosa pine trees. Early logging activity in different regions is also a major factor of unhealthy forests, creating artificial fuel breaks, altering local micro-climate, and modifying forest composition and age structure (Gilmore, 1998).

In addition, aerial examination by the Southern Pueblo Agency of the Bureau of Indian Affairs (BIA) has determined that 75% of all piñon pines on the high mesa area are dead due to the bark beetle. A high mesa area consisting of piñon pines, junipers, and cedars surround the community of Cochiti Lake on three sides, with the lake bordering the community on the east. Further north, the forests on higher elevations include ponderosa pine and spruce. The ponderosa pine is also being damaged by the bark beetle. The dead and dying trees combined with more than three years of drought create an extreme fire hazard for the community. In Jemez Springs, beetles are killing large numbers of piñon and juniper trees in a small bosque area. When these dead and dying trees dry, fire danger is accelerated. Also, steep slopes and elevated areas like mesa tops can carry fire embers across great distances.

As a result, wildland-urban interface areas of Sandoval County contain tree densities 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. According to the Sandoval County Emergency Manager, there is a 100 percent probability of wildfire occurring in the County in any given year.

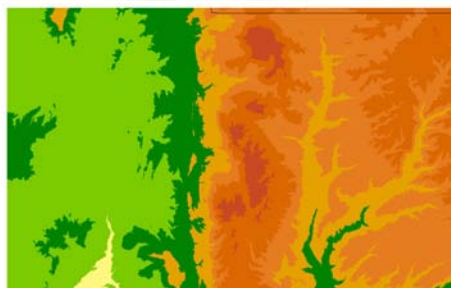
VULNERABILITY ASSESSMENT – WILDFIRES

Existing Community Assets

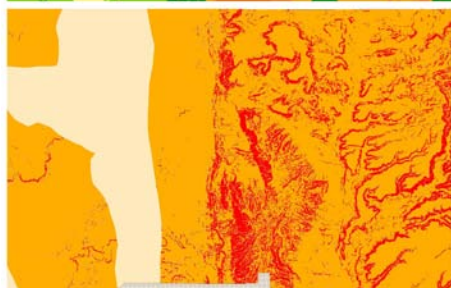
The results of an assessment of the vulnerability to wildfires are depicted in Plate 3—Sandoval County Wildfire Vulnerability—following this page. This exhibit was developed through a sequence of inventories and analyses as follows:



The National Fire Danger Rating System’s Fuel Model was used to identify areas of light, medium, and heavy fuel on the Sandoval County vegetative land cover map, as shown at left, an excerpt of the entire county mapping.



Next, digital elevation models (DEMs) were used to identify areas within Sandoval County with slopes less than 40%, between 41% and 60%, and greater than 61%, corresponding to low, moderate, and steep slopes, which in turn differentially influence the spread of wildfires.



Finally, to determine the fire hazard severity, fuel classification and the percent slope layers were overlaid in the GIS. Areas with medium or heavy fuel loads in steep slope areas were classified as *extreme* risk (shown in red). Areas with light fuel loads and over 61% slopes were classified as *high* risk (shown in orange), and areas with a light fuel load and less than 60% slope were classified as *moderate* risk (shown in pale yellow).

This analysis shows that future wildfires could cause substantial loss of property, along with direct and indirect economic effects for residents and community businesses. Table 7 shows that currently, over 2,200 square miles of Sandoval County forest lands were located in areas defined as high or extreme fire danger.

Table 7: Potential Fire Damage

Fire	Extreme Fire	High Fire
Population affected	5,394	52,147
Fire area square miles	228	1,998
% of County	6	58
# of housing units	2,092	20,222
Critical facilities	5	26
Assets at Risk¹	\$241.4M	\$2,333.6M

¹ Assumes average structure values per 2000 US Census @ \$115,400

The Greater Jemez area, located in the northeast portion of the County, is designated by the New Mexico State Forestry Division as one of the 20 most vulnerable urban interface communities in the State. The Greater Jemez Corridor was identified as a vulnerable area due to the proximity of excessive vegetation to homes, the ongoing drought, and its location in an area that has the largest number of fires caused by people and a large number of fires started by lightning (New Mexico Energy, Minerals and Natural Resources Department, Forestry Division, 2003).

Critical Facilities

Thirty-one critical facilities within Sandoval County have been identified as vulnerable to wildfire. Due to security issues, the names of specific facilities vulnerable to wildfire are not included in this document. However, Sandoval County maintains the list at its Emergency Operations Office. Six of the facilities are emergency response facilities, three are water wells, one is a communications facility and the rest are public/government structures.

Portions of the County's electrical system are susceptible to power outages, and in the case of fire or explosion, the remote and smaller communities could lose the ability to respond to a disaster, and secondary hazards could develop. In this situation, the fire hydrants could cease to function; the lift station and wastewater treatment plant could overflow. Furthermore, smaller communities have limited emergency communication ability, which could affect the ability to respond quickly, thereby potentially increasing the destructiveness of fires.

Future Development Trends

In recent years New Mexico, and Sandoval County in particular, have experienced an increase in population, especially in areas located in or near forest/range lands. This increase is likely to continue, particularly in areas near National Forests, such as the Jemez area of Sandoval County. Without wildland-urban interface regulations guiding growth, expanding residential development into wildland areas will likely increase the occurrence of human-caused fires and the number of people and property at risk due to wildfire.

There are currently 564,720 undeveloped acres in the County identified as high wildfire vulnerability, and 24,994 acres identified as extreme wildfire vulnerability. This translates into more than ½ million developable lots in the County (assuming 1 acre lot sizes), excluding Indian reservations and federal lands. In the absence of data regarding the amount of developable, vacant land, the aforementioned numbers are a rough estimate of the maximum potential for future development, although it is unlikely that the entire area is developable. It is clear that land supply will not be a deterrent to future population growth in the wildland interface areas.

CONCLUSIONS – WILDFIRES

Summary of Hazard Identification and Vulnerability Assessment

Past experience has proven that wildfires can be a significant threat to the citizens, structures, infrastructure, and natural resources within Sandoval County. Per Table 7, wildfires in Sandoval County can affect 22,314 housing units, with an aggregate value of over \$2 billion, scattered throughout areas identified as wildfire hazard areas. Other assets that fall in this hazard area are 31 critical facilities and electrical facilities located within the high or very high wildfire areas. As a result, the Mitigation Planning Team has identified the wildfire hazard as a priority in the Plan.

What Can Be Mitigated?

As picturesque forested lands become more and more popular as locations for homes, the size of the wildland-urban interface is increasing dramatically within Sandoval County. The increased development within the wildland-urban interface is creating more danger for both the forest and the population residing there. Homes bring in additional ignition sources, such as power lines and people. Mitigation options for wildland fire need to address not only the management of fuels, but also the potential for growing population in wildfire threat areas.

Traditional tactics for preventing wildfires have 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 2 and 3 of this document.

Data Limitations

As with several of the hazard analyses, better information about specific properties in or near wooded areas would help in the determination of relative vulnerability. The types of information that would be most useful include a more detailed assessment of the adjacent vegetation in terms of the proximity to the specific structures, the amount of fuel in the immediate vicinity, and details regarding the construction of the structures, including types of structures and building materials.

DROUGHT



OVERVIEW – DROUGHT IN SANDOVAL COUNTY, NEW MEXICO

A drought is a period of prolonged dryness that contributes to depletion of water supplies, both underground and on the surface. Droughts are common in New Mexico and Sandoval County. The climate in Sandoval County is arid with average annual precipitation ranges from about 9 inches in Bernalillo to 22 inches at Wolf Canyon. This normally meager annual precipitation causes extended periods of scant flow in the State’s rivers and streams and any measurable decrease in precipitation rates can create drought conditions in a relatively short time.

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). In the last 100 years, New Mexico has suffered from four devastating periods of drought; 1900-1910, 1931-1941, 1942-1956, and 1974-1979. The last short duration drought was in 1996 (New Mexico Drought Task Force, May 2002). As seen in Figure 4, as of February 2003, most of Sandoval County is currently designated as being in a severe drought (New Mexico Natural Resources, 2003).

The United States Geological Survey (USGS) has established gauging at many waterway locations to gather data on annual stream flows. Three locations in Sandoval County, the Rio Grande near San Felipe, the Rio Puerco at Guadalupe, and the Jemez River near Jemez Springs were examined for times of low stream flows, indicating a drought period. The gauging station data varies between the locations but consistently show extremely low annual stream flows during the approximate periods of 1930 – 1936, 1953 – 1956, and 1976 – 1977. See gauging station data in the USGS web site (<http://waterdata.usgs.gov/nm/nwis/annual>).

HAZARD PROFILE – DROUGHT

Hazard Characteristics

A drought is a period of prolonged dryness that contributes to depletion of groundwater and surface-water yields.

Severity and Probability of Occurrence

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. Dryland farming and ranching are most at risk from drought. Impact on these activities can be seen during a short-term drought. The drought during the 1950’s greatly affected non-irrigated agricultural areas in New Mexico. Up to that time, many farmers still practiced dryland

SECTION ONE: HAZARD IDENTIFICATION / RISK ASSESSMENT

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 2000 wells had been drilled to supplement surface-water irrigation allotments, which had been decreased in response to the drought (www.nm.water.usgs/drought). Since the 1950's, most agricultural production in New Mexico has been irrigated with surface water or groundwater, thus alleviating the severity of short-term drought conditions.

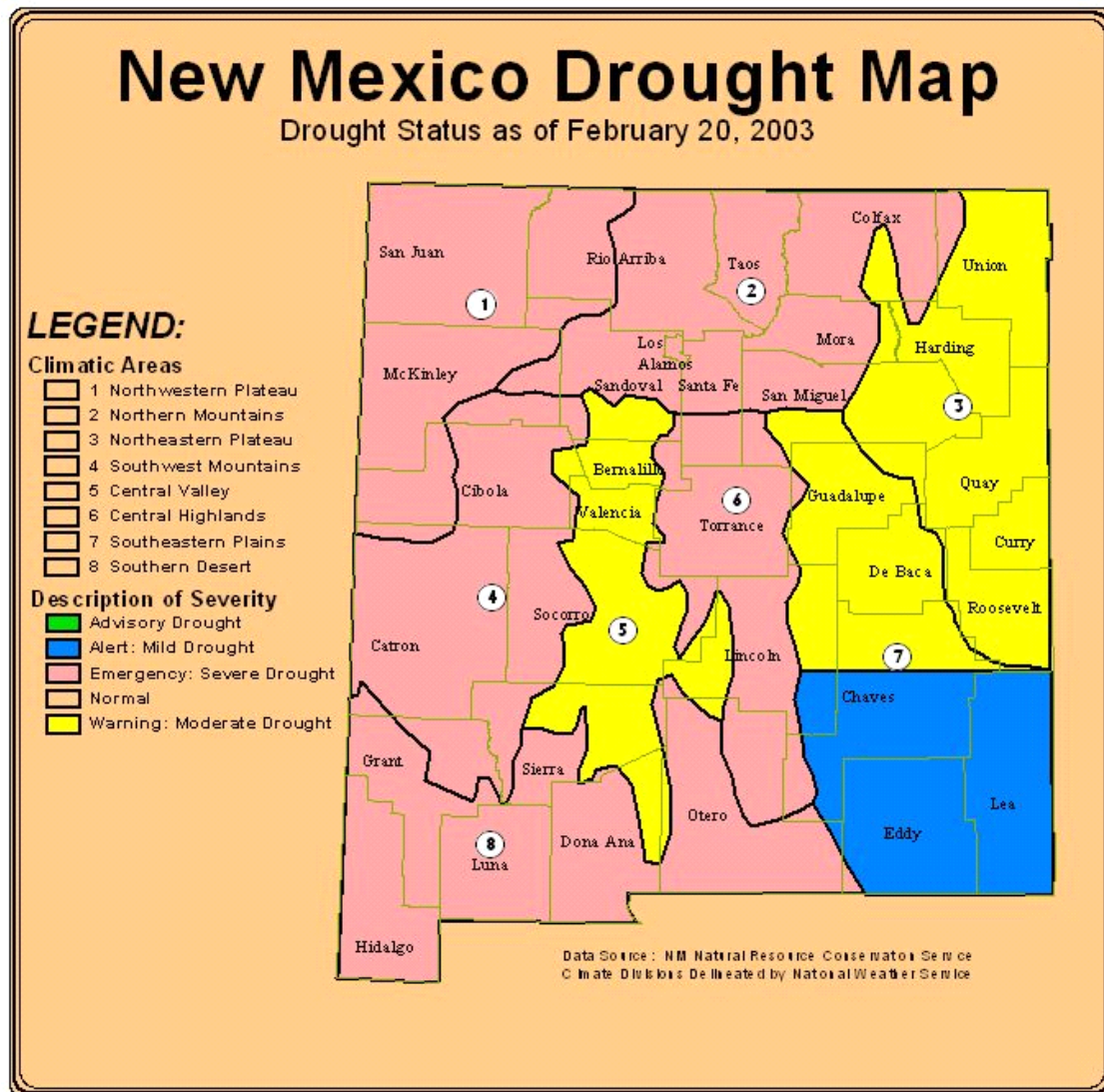
Water uses depending on in-stream flows, such as irrigated farms; aquatic, wetland, and riparian environmental communities; and recreational uses, are at high risk, but less exposed. Urban and agricultural water uses that rely on reservoirs and wells that are not dependent on high rates of aquifer recharge are the last to feel the effects (New Mexico Drought Task Force, 2002).

As seen in Figure 3 on the following page, as of February 2003, the southern portion of Sandoval County was designated as moderate drought, while the northern portion of the County is designated an emergency, severe drought (New Mexico Natural Resources, 2003).

Table 8: 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.

Figure 3: New Mexico Drought Map (see Table 8 for description of Drought Severity Classifications)



Source: NM Natural Conservation & Resources (<http://www.nm.nrcs.usda.gov>) and U.S. Drought Monitor (<http://drought.unl.edu>) websites.

VULNERABILITY ASSESSMENT – DROUGHT

Existing Community Assets

When droughts occur, they can have significant consequences for 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 navigation and recreation. Those who rely on surface water (reservoirs and lakes) and subsurface water (ground water), for example, are usually the last to be affected. A short-term drought that persists for three to six months may have little impact on these sectors, depending on the characteristics of the hydrologic system and water use requirements. For droughts of longer duration, impacts may disappear quickly in the agricultural sector, because rain quickly

replenishes soil moisture, but lingers for months or even years in other sectors dependent on stored surface or subsurface supplies. Groundwater users, often the last to be affected by drought during its onset, may also be last to experience a return to normal water levels. The length of the recovery period is a function of the intensity of the drought, its length, and the quantity of precipitation received as the drought ends.

There are 353 farms in Sandoval County with a total of 779,766 acres in agricultural use. The top five farm commodities of the County are dairy products; cattle and calves; hay silage; nursery crops; and fruits, nuts, and berries. The market value of agricultural products sold in Sandoval County for 2000 was almost \$10 million (New Mexico Economic Development Department, 2003). Most of the agricultural commodities are produced on irrigated lands that rely on groundwater or surface water sources. The use of groundwater in particular moderates the impact of short-term droughts on agricultural production.

Critical Facilities

Critical facilities rely on water to provide services for fire fighting and human needs. In Sandoval County, virtually all critical facilities use groundwater as their primary sources of water. These sources provide a buffer from the impact of short-term droughts. In the City of Rio Rancho, all critical facilities are connected to the greater municipal water system. In the county, many rural fire stations rely on 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.

Future Development Trends

As business and population growth continues in Sandoval County, the potential impacts of prolonged drought grow significantly. Continued residential housing and commercial development and commercial development in Rio Rancho will require additional water rights and drilling new production wells. The City of Rio Rancho has used virtually all of its water rights and is in negotiations with the Office of the State Engineer to be able to drill new production wells. Since groundwater in Rio Rancho is typically recharged by surface water from the Rio Grande, 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. Deeper groundwater also requires more intensive treatment to filter out arsenic and minerals. The City of Rio Rancho is exploring means to maximize its current supply of water by recycling treated effluent for public irrigation and possibly leasing water from agricultural users.

With or without a prolonged drought, agricultural users of water in the County will come under increasing pressure to sell or lease water rights to developing urban areas. The County does not have any type of agricultural preservation ordinances in effect that might help mitigate this inherent conflict between urban and agricultural users of water.

CONCLUSIONS – DROUGHT

All of Sandoval County is currently in a moderate to 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 Sandoval County pose significant challenges. With a rapidly growing population, the demand for water is increasing; long term solutions for coping with a limited water supply will require increased

cooperation between urban users and agricultural users. Critical facilities in rural parts of Sandoval 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 Sandoval County.

What Can Be Mitigated?

The best practices include early assessment, public education, and water conservation programs. 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. In the future, there is also the potential for limiting population growth and development dependent on groundwater. Mitigation management for drought is a proactive process. However, most of the process has been at the State level since there is no federal water conservation or drought policy.

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.

SEVERE WEATHER



OVERVIEW – SEVERE WEATHER IN SANDOVAL COUNTY, NEW MEXICO

Sandoval 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 severe winter storms, high winds, substantial rainfall (that can cause localized flash flooding), thunderstorms and dangerous lightning, fog, dust storms, hail, drought, and periodic temperature extremes. All areas of Sandoval 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.

Winter storms are characterized by cold temperatures and heavy snow or ice. Winter storms, which are regularly experienced in New Mexico, are considered hazards when:

- ✓ local capabilities to handle disruptions to emergency services, traffic, communications, and electric power are overwhelmed;
- ✓ residents in isolated communities run out of basic supplies, including food and fuel;
- ✓ livestock suffer from severe cold and lack of feed; and
- ✓ building structural systems fail.

PREVIOUS OCCURRENCES – SEVERE WEATHER

Winters in New Mexico are generally mild, but occasionally winter storms produce large amounts of snow and below-freezing temperatures. For example, on April 1, 1988, a blizzard hit Sandoval County; the April Fool's Day Storm dropped 11 to 14 inches of snow throughout the area. Many trees were damaged by the heavy snow; the rapid melting also caused flooding problems in the days following. This storm still remains the largest single snowstorm in County history. Another winter storm, labeled The Arctic Express, tore through Sandoval County on December 21, 1990, blanketing the state with snow. Two more storms hit later in that same week; temperatures ranged from below zero to highs just in the 20's through the month of December. Frozen pipes plagued the area. January of 1995 and 1997 saw two more winter storms that dumped four to six inches of snow, causing schools to close and precipitating traffic jams and car accidents. During a winter storm on January 27, 2001, Rio Rancho received six inches of snow. Wind chill temperatures plunged below zero, and minor traffic accidents occurred due to the storm.

Sandoval County frequently experiences high wind events. Particularly during the months of March, April, and May, high wind events, sometimes exceeding 40 mph and, on occasion, reaching 80 mph, are not uncommon. Between 1990 and 2000, the National Climatic Data Center (NCDC) reported seven wind events in Sandoval County with an average speed of 47 mph. These events caused approximately \$100,000 in reported damage. Furthermore, four fatalities and over 100 injuries that occurred from 1958 to 1998 were attributed to high winds.

Other types of thunderstorm events—tornado, hail, and lightning—also affect Sandoval. Five weak tornadoes were reported in Sandoval County between 1966 and 2002, all at or below an F1 magnitude on the Fujita Scale. Over 100 people were injured or killed throughout New Mexico between 1989 and 1998 from lightning strikes. Hail is responsible for a considerable percentage of property and crop damage across New Mexico; however only one fatality and 20 injuries were reported due to hail from 1959 to 1998.

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 first in light snow or rain then suddenly in heavy snow as the highway climbs through a mountain pass. The weather may be relatively mild and sunny along the Rio Grande valley from Socorro to Albuquerque, with near blizzard conditions found across the high plains east of the central mountain chain. The following are some of the characteristics of the main types of severe weather:

- ✓ *Winter storms* 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. Major winter storms and occasional blizzard conditions bring bursts of heavy snow accumulating three to six inches in short periods or one to two feet in 12 to 24 hours. Blizzard conditions develop with winds over 35-mph. Freezing rain and drizzle will create a coating of ice that is hazardous to walk or drive on. Unusually heavy ice accumulations can damage trees, power lines and other utilities, and buildings.
- ✓ *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 report for more information about flooding in Sandoval County). The thunderstorm season in New Mexico is well defined, from early July to September. Thunderstorms are an almost daily occurrence during July and August, especially over the northwest and north central mountains of New Mexico, an area that includes Sandoval County.
- ✓ *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 also the leading cause of weather-related injuries and fatalities in New Mexico.
- ✓ *Hail* ranks as the most frequent type of severe weather in New Mexico and is responsible for a considerable percentage of property and crop damage. Damaging or severe hail (0.75 to

SECTION ONE: HAZARD IDENTIFICATION / RISK ASSESSMENT

two inches) is most common in May and June, as is very large hail (over two inches); although a significant number of hail reports also occur from July through September.

- ✓ *Tornadoes* are not a common occurrence in Sandoval. While the magnitude and location of tornadoes are unpredictable, all that have occurred in Sandoval in the past 30 years have been classified as low intensity (F0 and F1) and have done little damage.

The Fujita scale of tornado intensity (see Table 9) shows that tornadoes at the F0 classification cause light damage to chimneys, tree branches, and sign boards. Tornadoes of F1 magnitude can cause moderate damage to road surfaces, automobiles, and mobile homes.

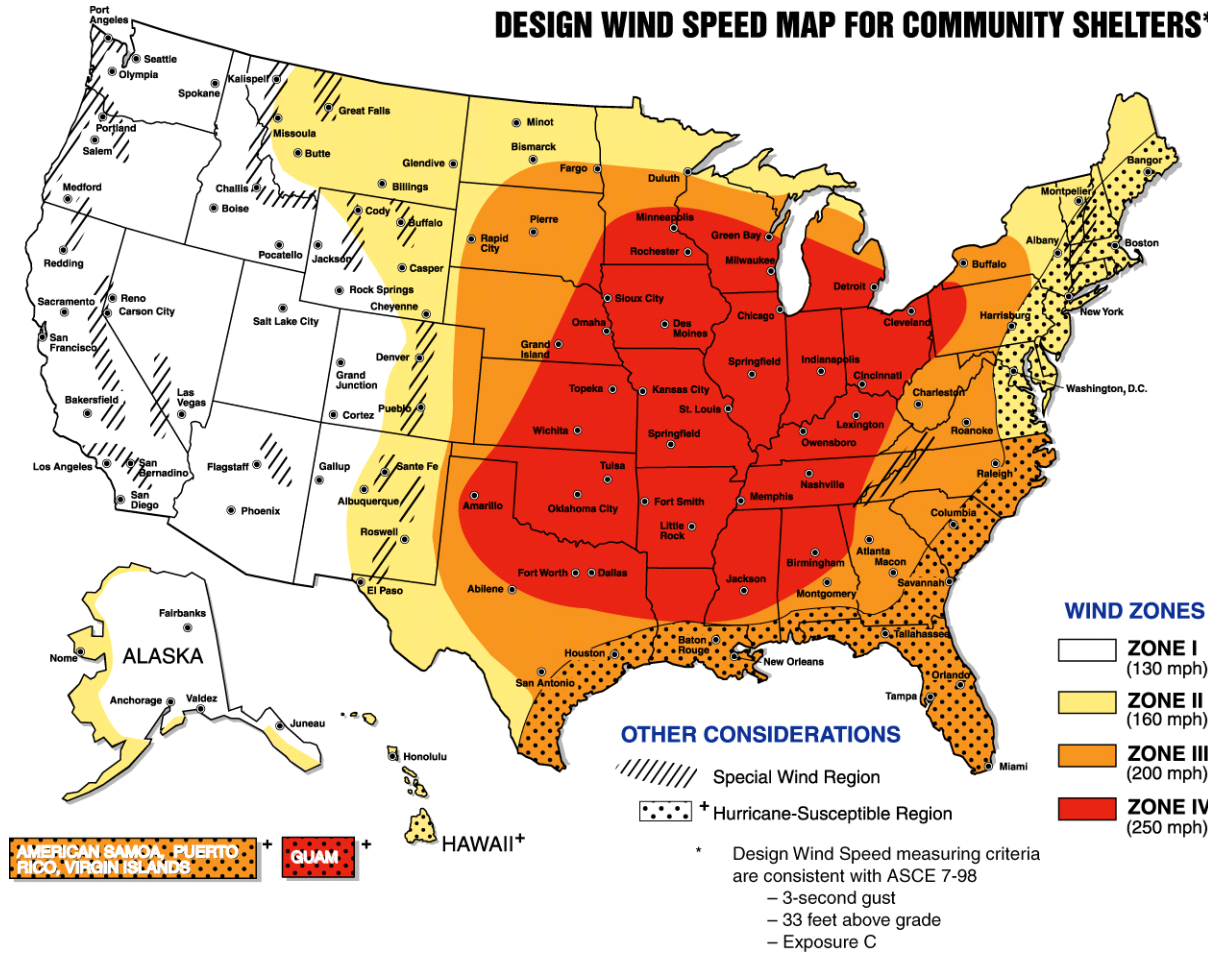
Table 9: Fujita Tornado Measurement Scale

Category	Wind Speed (Fastest ¼ mile wind speed (mph))	3-Sec Gust Wind Speed (mph)	Examples of Possible Damage	Number in Sandoval	% of Sandoval Tornadoes
F0	Gale 40-72	45-77	Light damage. Some damage to chimneys; branches broken off trees; shallow-rooted trees toppled; damage to sign boards.	2	40%
F1	Moderate 73-112	78-118	Moderate damage. Roof surfaces peeled off; mobile homes pushed off foundations or overturned; moving autos pushed off roads.	2	40%
F2	Significant 113-157	119-163	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.	0	0%
F3	Severe 158-206	164-210	Severe damage. Roofs and some walls torn off well constructed houses; trains overturned; most trees in forest uprooted; cars lifted off ground and thrown.	0	0%
F4	Devastating 207-260	211-262	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.	0	0%
F5	Incredible 261-318	263+	Incredible damage. Strong frame houses lifted off foundations and carried considerable distance to disintegrate; automobile-sized missiles fly through the air in excess of 100 yards; trees debarked; incredible phenomena occur.	0	0%
Tornado of undetermined intensity				1	20%
Total tornadoes in Sandoval, 1966-2002				5	

Severity and Probability of Occurrence

High winds occur frequently in Sandoval County. According to the Design Wind Speed Map for Community Shelters in Figure 4, Sandoval County lies within two different wind speed zones — Zones I and II — with possible extreme wind speeds of 130 mph and 160 mph, respectively, 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 4: Design Wind Speed Map for Community Shelters



Source: American Society of Civil Engineers, 7-98

Due to differences in altitude and terrain, the severity of winter storms varies in the different communities. The majority of the population and development in Sandoval County is in the southern portion of the County where the average annual precipitation is less than ten inches per year. Winter storm events in this area are usually short-lived and average just a few inches of snowfall. However, these events can cause disruption and damage to the community. School and business closures, as well as disruptions in transportation systems, electric power, telecommunications, and emergency services, are common occurrences with snow fall as little as two inches.

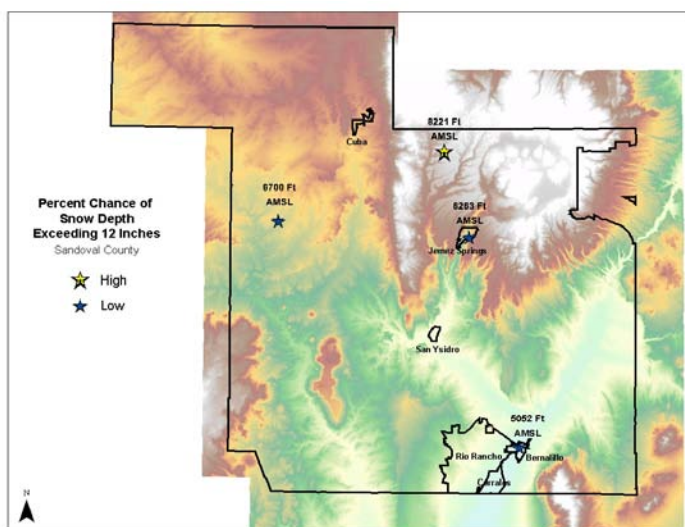
SECTION ONE: HAZARD IDENTIFICATION / RISK ASSESSMENT

Winter storms may contain one or more types of hazardous weather events. Table 10 provides definitions for these different types.

Storm Type	Description
Heavy Snowstorm	Accumulations of 4 inches or more in a 6-hour period, or 6 inches or more in a 12-hour period. The most common effects are traffic accidents; interruptions in power supply and communications; and the failure of inadequately designed and/or maintained roofing systems.
Sleet Storm	Significant accumulations of solid pellets that form from the freezing of raindrops or partially melted snowflakes. This condition causes slippery surfaces, posing hazards to pedestrians and motorists.
Ice Storm	Significant accumulations of rain or drizzle freezing on objects (trees, power lines, roadways), causing slippery surfaces and damage from the weight of ice accumulation.
Blizzard	Wind velocity of 35 mph or more, temperatures below freezing, considerable blowing snow with visibility frequently below one-quarter mile, prevailing over an extended period of time.
Severe Blizzard	Wind velocity of 45 mph or more, temperatures of 10 degrees Fahrenheit or lower, a high density of blowing snow with visibility frequently measured in inches, prevailing over an extended period of time.

Winter storms can and do occur frequently in Sandoval County, with the most severe weather occurring in the north-central and northeastern mountainous portions of the County. According to the NCDL and as shown on Figure 5, data collected from 4 computerized data collection weather stations scattered throughout the County indicate that the annual percent chance of snowfall exceeding 12 inches within a 24-hour period range from 0.03% at the Bernalillo metadata station (5052 feet above mean sea level (MSL)) to 22% at the Wolf Creek metadata station (8221 feet above MSL).

Figure 5: Percent Chance of Snow Depth Exceeding 12 Inches



Source: National Climatic Data Center

VULNERABILITY ASSESSMENT – SEVERE WEATHER

Existing Community Assets

- ✓ *High Winds* - A useful tool for determining vulnerability to high wind events like tornadoes (and tropical cyclones) is depicted in Figure 4. This map of design wind speeds was developed by the American Society of Civil Engineers (ASCE). It identifies wind speeds that occur frequently enough in different parts of the United States 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 generally and Sandoval County in particular 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 Sandoval County that have a heightened vulnerability to wind hazards. However, Sandoval County zoning has identified 3,630 structures (10 percent of housing) as mobile homes.

Although the distinctions between the two wind zones should not be overemphasized in the development of mitigation responses, the majority of the structures in the County are located in Wind Zone II with resulting design wind speeds of 160 mph.

- ✓ *Winter Storms* - Vulnerability to the effects of winter storms on buildings is dependent on the age of the building (and what building codes were in effect at the time it was built), type of construction, and condition of the structure (how well the structure has been maintained). Except for a few visual observations, data for individual structures were not available for this study, so it was difficult to determine the exact number and types of structures within Sandoval County that have heightened vulnerability to winter storm snow loading.

Critical Facilities

Critical facilities are typically vulnerable to wind damage due to age of construction and possible poor condition, especially in the more rural and isolated areas of the County. No specific critical facilities were identified as vulnerable to strong winds; however, the Town of Lake Cochiti's emergency communications capabilities, which use unreliable electric and telephone services, may be vulnerable to disruption.

Several critical facilities in the County are vulnerable to the effects of severe winter storms, such as potential disruption of services and transportation systems 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, Sandoval County maintains the list at its Emergency Operations Office.

Estimating Potential Losses

All municipalities and unincorporated areas of Sandoval County are vulnerable to severe weather, including lightening, hail, high winds, tornados, and winter storms. Although hail and lightening are common, there are virtually no historical records of losses from this type of storm event. The NCDC shows one hailstorm in the past fifteen years that resulted in damages and the total damage was only \$5,000. Winter storms also have no record of significant damage to property and structures.

High winds and tornados present the greatest vulnerability in terms of potential losses. All areas of the County have some vulnerability to high winds but, as indicated in the previous paragraph, the Town of Cochiti Lake's emergency communications infrastructure has a heightened vulnerability to disruptions due to high winds. Associated costs for disruption and repair of emergency communication services in the Town of Cochiti Lake were not available for this report.

With a lack of data about vulnerability for specific structures and critical facilities, the best indicator of potential losses due to a windstorm and/or tornado is the estimated losses from similar past storm events. Our methodology was to examine the total damages from similar events over a fifteen-year period and then calculate the average loss per year. In the fifteen year period from 1986 through 2001, NCDC records show a total of \$450,000 in damage from a tornados and windstorms. This translates to an average loss of \$30,000 per year in Sandoval County. All the damage reported is to property; no crop losses were reported. The data available does not give a breakdown of losses for residential versus critical facilities or commercial structures. Given the high percentage of manufactured homes in Sandoval County, it is likely that damage will be concentrated in residential structures as they are most vulnerable to high winds and tornados.

Future Development Trends

The majority of population growth and business development is anticipated in Rio Rancho and neighboring communities. Current Uniform Building Code (UBC) regulations have rigorous standards for roof loads and wind shear, so new structures do not measurably increase the risk associated with severe storms. However, the overall pattern of development in Rio Rancho makes the City's infrastructure vulnerable to severe storms. The City has a dispersed development pattern, with large, undeveloped platted areas punctuated by nodes of development. Current estimates are that the City has 40,000 platted, undeveloped lots that are difficult to develop because of terrain, lack of water, and unconsolidated ownership. With recent annexations, the City has increased the area for which it is responsible for maintaining. As the City's incorporated area grows, the potential impacts of severe storms on the City's infrastructure grow significantly.

CONCLUSIONS – SEVERE WEATHER

Summary of Hazard Identification and Vulnerability Assessment

Sandoval County experiences a wide range of severe weather but is most vulnerable to losses due to high winds and tornados. In the past fifteen years, the County has sustained about \$30,000 in property damage per year in annual losses from high winds and tornados. All municipalities and areas of the County can experience high winds. Severe winter storms have been and will continue to be a significant threat to the County but there are no reliable estimates

of damages from past winter storm events. Disruptions of emergency and other essential services are the main threats to the people and property. The Town of Cochiti Lake is vulnerable to disruption of emergency communications infrastructure due to high winds.

What Can Be Mitigated?

One important part of mitigating severe storms is forecasting and warning so people can prepare. Communities can prepare for winter storms by stocking sand and salt to improve road conditions, advising people to stay home or to use caution if they must go out, and recommending that people stock up on food, water, batteries, and other supplies.

Severe storm activity poses a significant threat to unprotected or exposed lifeline systems. Generally, commercial power networks are very susceptible to interruption from lightning strikes, high winds, ice conditions, and hail. Other utilities, including underground pipelines, may be impacted if not protected from exposure.

Upgrading and consistently enforcing building codes and addressing structural issues provide the greatest benefit for new construction. Inspections and retrofits for existing critical facilities provide effective mitigation in a developing area.

Data Limitations

The Sandoval County Tax Assessor's office has not developed a detailed property database, so the information necessary to determine the location and condition of manufactured homes and aged or dilapidated structures was not available. Consequently, the Mitigation Planning Team could not determine vulnerability to heavy snow accumulations or to high winds and tornados. Subsequent versions of this Plan will need to incorporate and respond to these data.

HUMAN-CAUSED HAZARDS

OVERVIEW – HUMAN-CAUSED HAZARDS IN SANDOVAL 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 manufacture, storage, transportation, and use of hazardous materials. Technological hazards are assumed to be accidental and their consequences unintended. The term *terrorism*, on the other hand, 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 targets.

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

HUMAN-CAUSED HAZARDS
HAZARDOUS MATERIAL RELEASES

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]. The community 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 U.S. Environmental Protection Agency's (U.S. 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

¹In 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).

SECTION ONE: HAZARD IDENTIFICATION / RISK ASSESSMENT

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

PREVIOUS OCCURRENCES – HAZARDOUS MATERIAL RELEASES

There are 100 hazardous materials facilities and 2 major transportation routes in Sandoval County. The County has experienced hazardous material release accidents both at facilities and along transportation corridors. Four SARA Title III facilities in Sandoval County filed TRI reports in the year 2000 (see Table 11).

Table 11: TRI Reported Releases for 2000, Sandoval County, New Mexico

Company Name	Chemicals Released
Form-Cove MFG 506 Industrial Park Rd., Rio Rancho	Styrene
Intel Corp MS F7T-109, 4100 Sara Rd., Rio Rancho	Ammonia (includes anhydrous forms and 10% of aqueous form since 1994), Boron trichloride (list 1995), Chlorine, Ethylene glycol, Hydrogen fluoride, Methanol, N-Methyl-2-pyrrolidone (list 1995), Nitrate compounds (list 1995), Nitric acid
Shollenbarger Wood Treating 318 N. Hill Rd., Bernalillo	Arsenic compounds, Chromium compounds, Copper compounds
Sparton Tech Incorporated 4901 Rockaway Boulevard Southeast, Rio Rancho, NM 87124	Information not available

Source: U.S. EPA Toxic Release Inventory Database

Note: Facilities were required to report information by July 1, 2001, for the Reporting Year 2000.

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 the release and the time elapsed. However, the consequences of releases of these materials can be very serious. 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.

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-place² that protects people and property from harmful effects; and
- ✓ non-compliance with applicable codes (e.g., fire and building codes) and maintenance failures (e.g., fire protection and containment features) that can substantially increase the damage to the facility itself and to surrounding buildings.

Table 12 indicates the number of people, as determined from the 2000 Census, that live within either a ½-mile or 1-mile radius of known SARA Title III facilities in the County.

Table 12: Population within ½ and 1 mile of SARA Title III Facilities in Sandoval County, New Mexico		
Company Name	Population within ½ mile of Facility	Population within 1 mile of Facility
Form-Cove MFG, 506 Industrial Park Rd., Rio Rancho	988	3,801
Intel Corp, MS F7T-109, 4100 Sara Rd., Rio Rancho	1,251	5,005
Shollenbarger Wood Treating, 318 N. Hill Rd., Bernalillo	1,043	4,010

The facility that shows the highest number of people within both a ½ mile and 1 mile radius is Intel Corporation.

While hazardous material releases in Sandoval County have occurred in the past, they are considered difficult to predict. An occurrence is largely dependent upon the accidental or intentional actions of a person or group. (Note: Intentional acts are addressed under the subsection concerned with *Terrorism*.)

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

VULNERABILITY ASSESSMENT – HAZARDOUS MATERIAL RELEASES

Existing Community Assets

Four facilities in Sandoval County 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 1 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. Ninety-six facilities in Sandoval 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. 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.

As shown on Plate 4, Sandoval County Hazardous Materials, following page 36, the municipalities of Bernalillo, Rio Rancho, and Corrales are some of the County's most populous municipalities and have the most residents at risk of exposure to hazardous material releases. Approximately 20% of the County's population (over 18,000 people) live within a ½-mile radius of the facilities noted above and thus are at a relatively higher risk of being affected by accidental or intentional releases of hazardous materials.

Critical Facilities

Seven critical facilities are listed within ½ mile of a hazardous materials facility, and an additional 12 critical facilities are located within 1 mile of a hazardous materials facility for a total of 19. Due to security issues, the list of critical facilities is not included in this document. However, Sandoval County maintains the list at its Emergency Operations Office.

Estimating Potential Losses

Unlike natural hazards such as fire and floods that tend to cause substantial damage to structures and infrastructure, hazardous material releases often result in little or no damage to structures. Hazardous material releases constitute a greater threat to living organisms, killing or injuring humans, animals, and disrupting the environment. Damages to structures are easier to predict and quantify than loss or injury of human life, which makes estimating potential losses from hazardous material releases more difficult than estimating losses from other hazards. One method of quantifying the potential losses from a hazardous material release is to estimate the cost of recovery, cleanup and economic loss due to businesses being shutdown. At this time, Sandoval County does not have reliable information about the costs associated with prior hazardous material incidents. As one of its mitigation objectives, Sandoval County will estimate the average cost of responding to a hazardous material release and also estimate the potential losses to local businesses and to the 19 critical facilities identified as being within ½ mile of hazardous material facilities.

Future Development Trends

Estimates of potential development identified 40,213 acres that could be developed within ½ mile of hazardous material facilities. In the absence of data regarding the amount of developable vacant land, the aforementioned numbers are a rough estimate of the maximum potential for future development, although it is unlikely that the entire area is developable. County regulations require hazardous materials facilities be separated from residential areas by zoning and site setbacks.

CONCLUSIONS – HAZARDOUS MATERIAL RELEASES

Summary of Hazard Identification and Vulnerability Assessment

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. Anticipated population growth and related residential and commercial development within the County will expose an increasing population to the possibility of hazardous material emergencies. Due to size of the County, emergency hazardous material response will continue to be difficult in isolated or remote areas of the County.

What Can Be Mitigated?

Individual facilities and transportation companies are responsible for maintaining facilities and operations in a safe manner, and the regulation of this activity is beyond the responsibility of County level government. However, local communities can become more involved and informed about specific aspects of these operations and in so doing, determine areas where mitigation actions may be possible, such as public education, evacuation drills and response exercises, and warning systems. In addition, future development can be guided in such a way that new facilities and anticipated development patterns have limited overlap.

Data Limitations

The Mitigation 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.

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 paid increased attention to 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 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).

PREVIOUS OCCURRENCES – TERRORISM

Sandoval County has had numerous incidents of bomb threats to critical facilities such as schools and government facilities, as well as to the Intel plant, which employs up to 5,000 workers. Sandoval County was also the victim of a bioterrorism threat in 2002.

HAZARD PROFILE – TERRORISM

Hazard Characteristics

The Federal Bureau of Investigation (FBI) further characterizes terrorism as either domestic or international, depending on the origin, base, and objectives of the terrorist organization. However, the origin of the terrorist or person causing the hazard 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:

- Agriterrorism
- 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, or 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 Sandoval County has many notable landmarks from a local historic perspective, it does not contain sites with national symbolism, or an extensive area of dense urban population; therefore, 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 Sandoval County have been identified as infrastructure, emergency response facilities, hospitals, government offices, and special events. The Sandoval County Emergency Manager has identified the most vulnerable locations within the County. Due to security issues, this list is maintained at the Sandoval County Emergency Services Office.

Critical Facilities

All individual critical facilities are listed as vulnerable to terrorism. However, government facilities, as well as other vulnerable privately owned facilities, such as the Intel plant, have constructed physical barriers and increased security measures. Due to security issues, the list of critical facilities is not included in this document. However, Sandoval County maintains the list at its Emergency Services Office.

Future Development Trends

Future development does not necessarily increase vulnerability beyond the basic issue identified under Hazardous Material Releases; more development near known sources of potential intentional releases increases the number of people and property subject to the existing level of vulnerability.

CONCLUSIONS – TERRORISM

Summary of Hazard Identification and Vulnerability Assessment

Human-caused hazards are difficult to predict. Technological accidents can occur at hazardous material facilities, at nuclear power plants, or along transportation corridors. Terrorists can target any of these facilities, critical facilities, or agricultural lands. Sandoval County has 100 Hazardous material facilities, many within relatively densely populated areas. Trucks transport hazardous materials along two major highways that intersect the County—I-25 and US 550. These roads run through the most populated areas of the County.

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 the event that an event occurs. The State of New Mexico is divided into 12 Homeland Security regions (based on existing State Police District Boundaries), and each region has completed a prioritized risk and vulnerability assessment as part of a Homeland Security Strategic Plan as of January 2003. Sandoval County is part of the District 5 Plan. A copy of the Plan is available in the Sandoval County Emergency Services Office.

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

SECTION ONE: HAZARD IDENTIFICATION / RISK ASSESSMENT

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 facilities* 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. The closest nuclear facility to Sandoval County is in neighboring Los Alamos County, at the Los Alamos National Laboratory (LANL). The University of California runs the laboratory for the National Nuclear Security Administration of the U.S. Department of Energy. The central mission of LANL is enhancing the security of nuclear weapons and nuclear materials worldwide through stewardship and management of the nation’s nuclear stockpile. The County lies outside the standard planning area (10-mile radius) designated for nuclear emergencies. However, the County does lie within the 50-mile radius for the Ingestion Exposure Pathway emergency planning zone. Also, it is likely that the County would receive evacuation traffic.

PREVIOUS OCCURRENCES – NUCLEAR/RADIOLOGICAL ACCIDENTS

Between 1945 and 1982, there were eight nuclear-related events in New Mexico.

Date	Table: Nuclear Related Events in New Mexico 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, and 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 effects to the environment and agriculture.

Although not detectable by the senses, radiation is easily detected by scientists with sophisticated instruments that can detect even the smallest levels.

Severity and Probability of Occurrence

State and local governments, with support from the federal government and utilities, develop emergency response plans that include a Plume Exposure Pathway emergency planning zone with a radius of 10 miles from the plant, and an Ingestion Exposure Pathway emergency planning zone within a radius of 50 miles from the plant.

Plume Exposure Pathway refers to whole-body external exposure to gamma radiation from the plume and from deposited materials, as well as inhalation exposure from the passing radioactive plume. The duration of primary exposure could range in length from hours to days.

The Ingestion Exposure Pathway refers to exposure primarily from ingestion of water or foods, such as milk and fresh vegetables that have been contaminated with radiation. Nuclear facilities must notify the appropriate authorities in the event of an accident. The federally recognized classification levels are: Unusual Event, Alert, Site Area Emergency, and General Emergency.

Plate 5, Sandoval County 10- and 50-Mile Buffer Los Alamos National Laboratory, following page 43, shows the 10-mile and 50-mile radii around the LANL facilities. Within the 10-mile Plume Exposure Pathway planning zone, the portion of Sandoval County closest to LANL is within largely uninhabited areas of San Ildefonso Pueblo. Much of the County falls well within the 50-mile radius, meaning that, in the case of a large-scale general emergency, the County may be affected.

Several factors affect the severity of radiation exposure:

- ✓ Time: Most radioactivity loses its strength fairly quickly. 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.
- ✓ Availability of potassium iodide: Potassium iodide saturates the thyroid gland and protects it from taking in radioactive iodine.

SECTION ONE: HAZARD IDENTIFICATION / RISK ASSESSMENT

Across the United States, a number of events that reach the level of Unusual Event or Alert (see Table 14 for definitions) occur each year at the 100+ nuclear facilities. These events warrant the notification of local emergency managers. Of these, Alert-level emergencies occur less frequently. For example, in 1997, there were 40 notifications of unusual events and 3 Alert-level emergencies nationwide. However, as with other human-caused hazards, the probability of accidents or deliberate incidents is difficult to determine.

Table 14: Nuclear Event Warning Classifications

Warning Classification	Description
Notification of Unusual Event	The least serious of the four levels. The event poses no threat to you or to plant employees, but emergency officials are notified. No action by the public is necessary.
Alert	Declared when an event has occurred that could reduce the plant's level of safety, but backup plant systems still work. Emergency agencies are notified and kept informed, but no action by the public is necessary.
Site Area Emergency	Declared when an event involving major problems with the plant's safety systems has progressed to the point that a release of some radioactivity into the air or water is possible, but is not expected to exceed EPA Protective Action Guidelines (PAGs) beyond the site boundary. Thus, no action by the public is necessary.
General Emergency	The most serious of the four classifications and is declared when an event at the plant has caused a loss of safety systems. If such an event occurs, radiation could be released that would travel beyond the site boundary. State and local authorities will take action to protect residents living near the plant. The alert and notification system will be sounded. People in the affected areas could be advised to evacuate promptly or, in some situations, to shelter in place. When the sirens are sounded, residents should listen to their radios, televisions, and tone alert radios for site-specific information and instructions.

Critical Facilities

Since LANL is located close to Sandoval 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 10-mile emergency planning zone.

Future Development Trends

Rio Rancho and its developing urban area are outside the 10-mile emergency planning zone, but fall within the 50-mile planning zone (see Plate 5 following page 43). The impacts of a nuclear accident are best addressed in an emergency operations plan. Sandoval County will be updating its emergency operations plan in 2003.

CONCLUSION – NUCLEAR/RADIOLOGICAL ACCIDENTS

Summary of Hazard Identification, and Vulnerability Assessment

The nearby location of LANL poses potential risks to populated areas. However, most of the County is located outside the 10-mile emergency planning zone.

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 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.

EARTHQUAKE

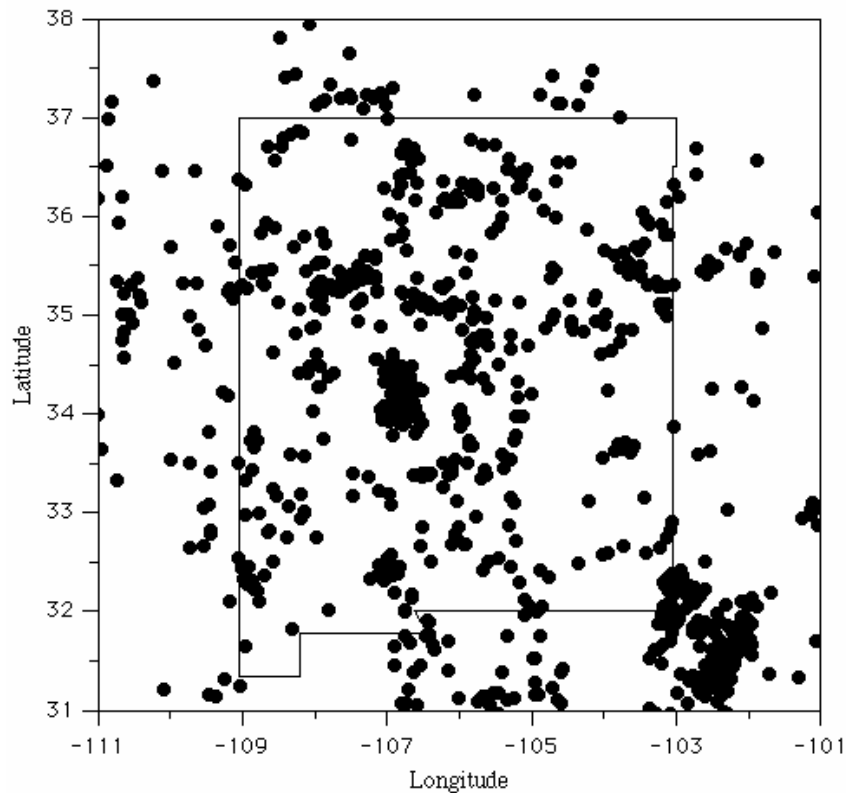
OVERVIEW – EARTHQUAKES IN SANDOVAL COUNTY

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. Earthquakes can even trigger volcanic eruptions or cause tsunamis in coastal areas.

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 6 depicts the approximate epicenters for past earthquakes in New Mexico and surrounding areas between 1962 and 1995. The map was prepared by seismologists of the Geophysics Program at the New Mexico Institute of Mining and Technology.

Figure 6: Past Earthquake Epicenters In New Mexico



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

An earthquake in 1906, with an estimated magnitude of 6.5; in 1935; and in 1966 with a magnitude of 5.5, caused damage to houses, schools, and other facilities in the State.

An earthquake near Sandoval County in January 1971 caused about \$40,000 of damage to the University of Albuquerque, West Mesa High School, and several shops in the Old Town area. And in early 1989, a swarm of 34 earthquakes with magnitudes between 2.0 and 4.7 occurred near the town of Bernardo, located approximately 90 miles south of Sandoval County.

HAZARD PROFILE – EARTHQUAKES

Hazard Characteristics

The dense cluster of earthquakes in the very center of the state (Figure 6) 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.

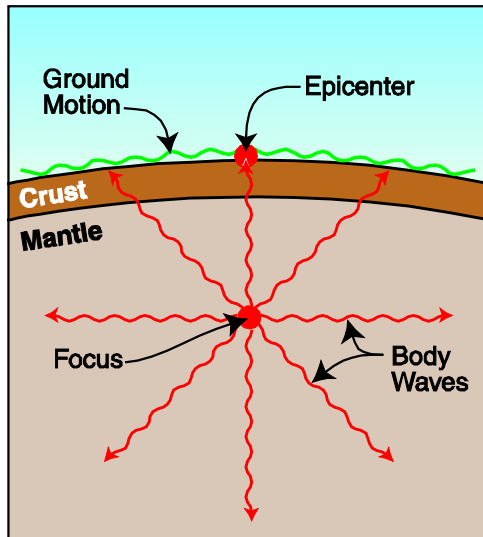
Some small earthquakes in New Mexico have been triggered by human activity. Three of the earthquakes were caused by atomic bomb testing, including the explosion of the first atomic bomb at the Trinity Site in 1945 and subsequent underground explosions near Carlsbad in 1961 and east of Farmington in 1967. Some earthquakes in southeastern New Mexico may be related to oil and gas production, and a series of earthquakes recorded near Heron and El Vado reservoirs in northern New Mexico were apparently caused by the weight of the water in the reservoirs.

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 characterizes 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 7: 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 $g = 980 \text{ cm/sec}^2$ or 32 ft/sec^2). Although the specific damages caused by different magnitudes of earthquakes are listed in Table 15, as a rule of thumb ground acceleration must exceed 15 PGA (or 15% of the gravitational acceleration rate) for significant damage to occur. Table 15 shows the relationship between 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 6 shows that an earthquake can cause 4.0 to 10.0 %g PGA with a 10% probability of exceedance in 50 years. These levels of ground motion are roughly approximate to those from an earthquake of magnitude 4 to 5 on the Richter scale and to an intensity of IV to VII on the MMI scale. This means that an earthquake within this range would at most cause negligible damages in buildings of good design and construction, slight to moderate damage in well-built ordinary structures, and considerable damage in poorly built or badly designed structures.

SECTION ONE: HAZARD IDENTIFICATION / RISK ASSESSMENT

Table 15: 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 motor cars 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 motor cars 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	VII - 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	VIII 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-social.wr.usgs.gov/ciim/pubs/ciim/node5.html> Visited July 27, 2002.

VULNERABILITY ASSESSMENT – EARTHQUAKES

Existing Community Assets

Table 16 displays data for the different zones, as depicted following page 48 as Plate 6—Sandoval County Earthquake Zones—(referred to as EQ Zones) within Sandoval County corresponding to the different PGA values that are associated with a 10% exceedance in 50 years. The data include the potentially affected population, housing units, and critical facilities. The largest population and number of housing units affected are in the 10 PGA zone, which includes the City of Rio Rancho. The Mitigation Planning Team needs more information on these 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.

Table 16: Assets Vulnerable to Earthquakes

Assets Affected	EQ Zone 5	EQ Zone 6	EQ Zone 7	EQ Zone 8	EQ Zone 9	EQ Zone 10	TOTAL
Population Affected	1,266	3,351	1,051	2,660	7,983	73,593	89,904
Housing Units Affected	523	1,519	647	1,284	2,358	28,534	34,865
Critical Facilities	0	16	2	8	13	38	77
Loss	\$6.9 million	\$87.2 million	\$90.6 million	\$182.9 million	\$202.2 million	\$3,923.1 million	\$4,492.9 million

Critical Facilities

Seventy-seven 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

There are 190,028 acres within the 10%g PGA earthquake zone in Sandoval County. Theoretically there could be 253,371 residential lots in this area. In reality, however, it is unlikely that the entire area will be developed, even given Sandoval County’s robust rate of growth over the last two decades. Within the most severe earthquake zone (Zone 10), there are currently 28,534 structures. At the current rate of growth, that number would increase by 11,413 structures by the year 2010. New buildings constructed in the County must conform to the 1997 UBC (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, although they have been observed in the nearby areas of Bernalillo and Rio Arriba Counties. The potential for such a disaster is low to moderate, as illustrated on the accompanying Plate 6: Sandoval County Earthquake Zones. As explained in the Severity and Vulnerability sections, even the worst earthquake the County might expect would not inflict significant damage if buildings are built to a code that incorporates seismic resistance. More detailed information on other structures in the County 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 vulnerable to earthquake damage. More detailed information on other structures in 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 on such specifics as the distance from the epicenter and depth of the epicenter. More information regarding the existing buildings, such as unreinforced masonry buildings and critical facilities, would help the Mitigation Planning Team assess specific vulnerability and risk issues more accurately.

OTHER HAZARDS

Three other hazards, reviewed by the Mitigation Planning Team, present relatively less immediate risk to Sandoval 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 SANDOVAL 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.

No records of past landslides or subsidence have been found for Sandoval County. However, some areas of the County are considered susceptible to landslides (see Figure 8 on the following page); several natural and human factors may contribute to them. 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.

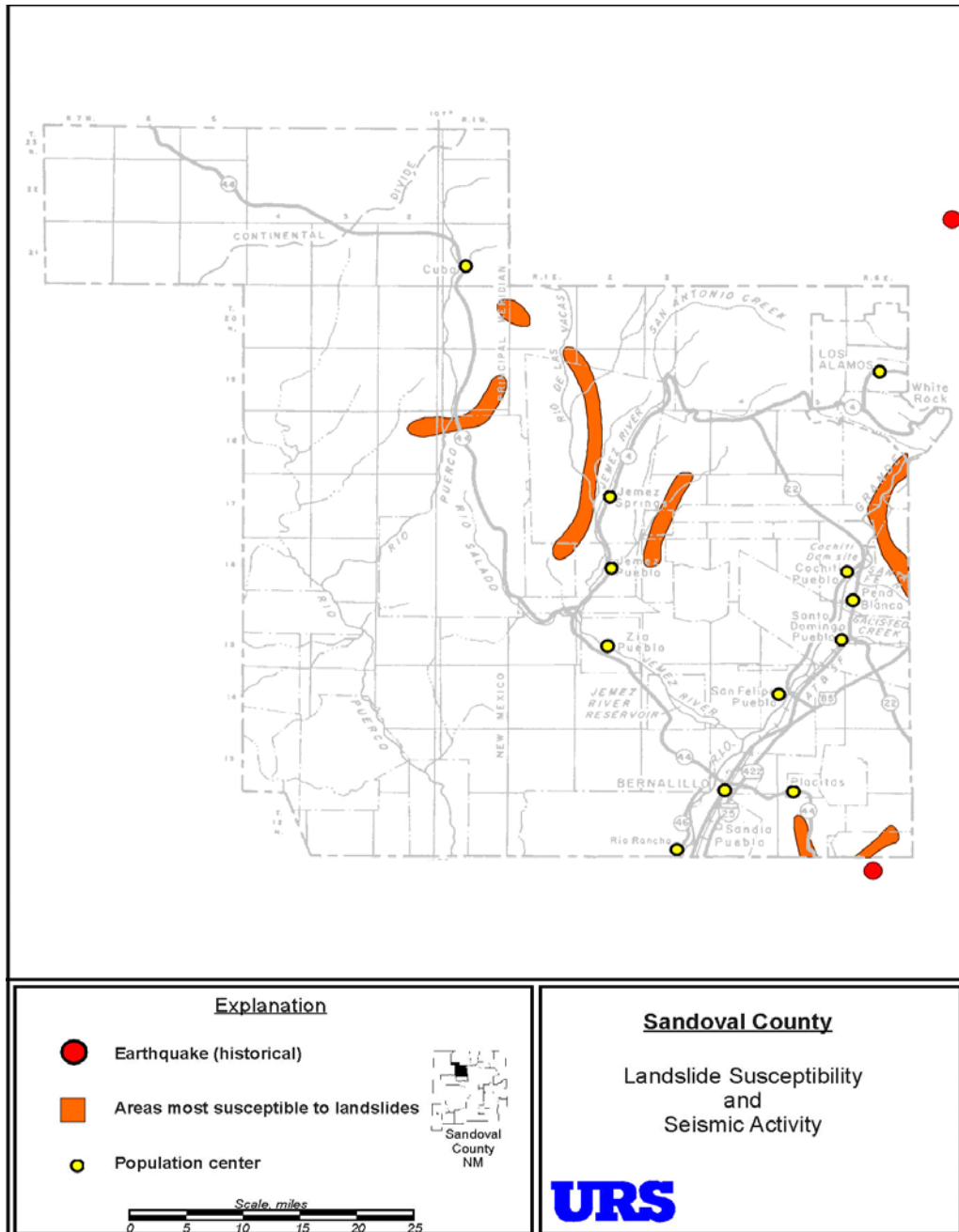
Subsidence is caused by a diverse set of human activities and natural processes that include the mining of coal, metallic ores, limestone, salt, and sulfur; the withdrawal of groundwater, petroleum, and geothermal fluids; the dewatering of organic soils; the wetting of dry, low-density deposits known as hydrocompaction; the dissolution of underground strata; natural sediment compaction; liquefaction; and crustal deformation.

Significant landslide susceptibility exists on the margins of major uplift areas and near deeply incised river channels where slopes are steep and unconsolidated materials or incompetent shale beds are present. However, these areas are largely uninhabited and extensive development in the near future is not anticipated.

CONCLUSIONS – LANDSLIDES AND LAND SUBSIDENCE

Landslides and sinkholes are possible in Sandoval County but pose a generally low risk to life and property because the landslide susceptibility areas lie far from population centers.

Figure 8: Landslide Susceptibility and Seismic Activity Map of Sandoval County



Source: USGS, 1997, 2001.

OTHER HAZARDS – DAM FAILURE

OVERVIEW – DAM FAILURE IN SANDOVAL COUNTY, NEW MEXICO

Dam failure can occur when a dam is overtopped (overflows). Overtopping is especially dangerous for an earthen dam because the downrush of water will erode the dam face and could breach the dam. Sandoval County has two large dams, Cochiti Dam and the Jemez Canyon Dam, as well as several smaller earthen dams. The two large dams are owned and managed by USACE.

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. 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.

The Jemez Canyon Dam, completed in 1953 at a cost of \$10.5 million, is located within the Santa Ana Pueblo Indian Reservation, at the confluence of the Jemez River and the Rio Grande. The dam was built to serve as flood and sediment control and now includes a conservation pool for the Silvery Minnow, an endangered species, but no recreational use is allowed. The dam can impound as much as 102,700 acre-feet of water and has a crest elevation of 5,233 feet. Native water inflow is bypassed up to a channel capacity of 7,000 cubic feet per second (cfs). Due to the recent drought conditions, the Jemez Canyon Dam is well below capacity.

No known dam incidents and/or failures involving notable property damage have occurred in Sandoval County. Two tailings dams failed in the late 1970s and three earthen dams failed prior to 1992 in other parts of the state. No failures have occurred since 1992 because of dry weather conditions as well as dam safety compliance (D. Lopez, former State Engineer, 2003).

Hydrologic or structural deficiencies are the primary cause of dam failure floods. However, the safety of the structure can be influenced by reservoir operations. Hydrologic deficiencies result from the following:

- Inadequate spillway capacity
- Excessive runoff after heavy precipitation
- Large waves generated from landslides into the reservoir
- Sudden inflow from upstream dam failures

Structural deficiencies may be a result of the following:

- Seepage through the embankment
- Piping along internal conduits
- Erosion

- Cracking
- Sliding
- Overturning
- Rodent tunneling
- Landslides hitting the dam
- Other weaknesses in the structure

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.

There are three classification definitions for dam hazard potential:

- ✓ Low Hazard Classification is for dams where failure or misoperation results in no probable loss of life and minor economic and environmental losses. Losses are principally limited to the owner's property.
- ✓ Significant Hazard Potential is for dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifelines facilities, or can impact other concerns. These dams are often located in predominantly rural or agricultural areas, but could be located in areas with population and significant infrastructure.
- ✓ High Hazard Potential is for dams where failure or misoperation will probably cause loss of human life.

The two large dams owned by USACE, as federally owned dams, are required to complete Emergency Action Plans (EAP). These Plans include inundation maps as well as lists of critical facilities that may be threatened by the dams. Copies of the EAPs are located at the Sandoval County Emergency Manager's Office.

The Cochiti Dam is rated as a high hazard dam. As noted above, dams assigned the high hazard classification are those where failure or misoperation would probably cause a loss of life. On the positive side, 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.

CONCLUSIONS – DAM FAILURE

Dam failure in times of heavy rains and high water levels would inundate the developed communities located downstream. Cochiti is the only dam 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 Sandoval due to dam failures is considered to be very low. In addition, dams were not on the priority list because the County is currently in a state of drought and the large dams in the state are below 60% capacity. Due to the severe drought conditions, it will be several years before the dams in Sandoval County could pose a risk to the community.

OTHER HAZARDS – VOLCANOES

OVERVIEW – VOLCANOES IN SANDOVAL 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. 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.

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.

In Sandoval County, the Jemez Mountains are a volcanic field in north central New Mexico that overlies the west edge of the Rio Grande rift. Volcanism that created the Jemez Mountains began 13 million years ago. The most recent activity was 130,000 years ago. The volcanic field is best known for the Valles Caldera, which formed 1.12 million years ago and produced the Bandelier Tuff. The Valles Caldera is the most studied caldera in the United States (and probably the world). The geothermal and hot springs systems are caused by the flow of groundwater through the caldera. The water flows near the top of a subsurface body of igneous rock that still may be partially molten and is certainly still hot. Some of the water rises to the surface to produce fumaroles and hot springs. Geothermal activity continues.

CONCLUSION – VOLCANOES

Despite the fact that much of northern and western Sandoval County is dominated by volcanic terrain and features, the risk of volcanic eruption is considered low (Kues & Callender, 1986). Most volcanism that occurred in Sandoval County took place more than 1 million years ago; the youngest Sandoval County volcanic deposits are tens of thousands of years old (Kues & Callender, 1986). Volcanic activity is preceded and accompanied by significant seismic signatures; evaluation of historical seismic records indicates that no seismic activity with an epicenter in Sandoval County has ever been recorded

Due to the antiquity of known volcanism and the absence of historical seismic activity in Sandoval County, the Mitigation Planning Team concludes that the near-term risk of volcanic eruption in the County is low. (Reference: 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.)

CAPABILITIES AND RESOURCES

CAPABILITIES

Sandoval 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. However, the diversity of Sandoval County's landscape, culture, and residents is reflected in the varying level of community services found in different parts of the County. For example, the Rio Rancho area benefits from its proximity to Albuquerque and the readily available public services, such as police and fire protection, hospitals, and clinics. Services in rural parts of the County are scarcer. These are summarized in Table 17.

Table 17: Sandoval County/Incorporated Municipalities Capability Assessment Matrix

Name of Jurisdiction	Comprehensive Plan	Capital Improvements Plan	Zoning	Emergency Response 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
Sandoval County	•	•	•	•	•		•				•	•	•
Bernalillo			•		•		•				•	•	•
Cochiti Lake					•		•						•
Corrales			•	•	•		•				•	•	•
Cuba					•		•					•	•
Jemez Springs							•				•	•	•
Rio Rancho	•	•	•	•	•	•	•	•	•		•	•	•
San Ysidro			•		•		•					•	

¹ The State of New Mexico has adopted the UBC as the minimum standard for all communities in the State.

The Uniform Building Code (UBC), implemented statewide, and the floodplain ordinance, implemented locally, are two of the most important capabilities that the County utilizes to mitigate potential damage from floods, wind, and other hazards.

- ✓ *UBC* – Building codes are important mitigation tools because they are tailored to fit specific hazards present in each region. Consequently, structures that are built to applicable codes are resistant to hazards, such as strong winds, floods, and wildfires, and can help mitigate the effects of these hazards. New Mexico has adopted the 1997 UBC code as a minimum standard for all communities and provides inspection services through the Construction Industry Division of the New Mexico Department of Regulations and Licensing. Individual counties and municipalities are at liberty to adopt the most current UBC but have not yet chosen to do so.

SECTION ONE: HAZARD IDENTIFICATION / RISK ASSESSMENT

- ✓ *Floodplain Ordinance* – 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 also undertook several important planning initiatives prior to this hazard mitigation plan:

- ✓ Sandoval County developed and began implementation of a comprehensive plan document in March of 1987. The Comprehensive Plan for Sandoval County is divided into four sections: land use and natural, historic, and cultural resources; County infrastructure; services to the public; and economic development. All of these policies and strategies promote sound land use and regional cooperation among local governments to address planning issues. The Comprehensive Plan was updated in 2002 and does not contradict the goals and objectives of the Plan.
- ✓ Subdivision regulations (adopted 1973) and comprehensive zoning ordinances (adopted 2001) have been implemented at the County level and are designed to promote the health and general welfare of the County. The regulations and ordinances are also designed to accommodate the growth of Sandoval County while promoting development that is beneficial to its citizens. The most important aspect of land use regulations promulgated by Sandoval County is the requirement that mitigation measures be implemented as part of any development within the 100-year floodplain.
- ✓ Sandoval County has participated in the NFIP since June 1998. Sandoval County has had flood damage prevention ordinances since 1996. These ordinances were designed to minimize flood losses within the County. To date, 31 properties (out of a total of approximately 700 properties in the floodplain) have obtained flood insurance with total policy amounts of \$8,200,000.
- ✓ Sandoval County has completed a capital improvement plan aimed at enhancing the economic viability of its communities.

RESOURCES

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

Community-based Organizations

Firewise Communities/USA: a project of the National Wildfire Coordinating Group's Wildland-Urban Interface Working Team. It provides information and guidance for communities in the wildland-urban interface area. The Greater Eastern Jemez Wildland-Urban Interface Corridor is represented by a Firewise Board that contains a representative from each of the member communities. The Board has developed a plan identifying the following opportunities for public education including: local newspaper articles, participation at the Jemez Springs Art in the Park, held during Memorial Day Weekend; organization of a Chipper Day for each community to reduce fuel loads; and utilization of resources, including the Student Conservation Association Team for firewise educational opportunities within the community (www.firewise.org).

Technical Resources – to help in future decision making:

- ✓ *FEMA elevation certificates*: kept on file at Sandoval County Planning and Zoning. Certificates are in paper format only but provide detailed information that can be used to determine risk on a building-by-building basis.
- ✓ *GIS capabilities* at the County level.

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*.
- ✓ *Taxes*: The County and municipalities have the authority to levy sales taxes.
- ✓ *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. Sandoval County is in the process of completing the application to become a CRS community.
- ✓ *Emergency Management Response Plan*: Adopted in 1999.

SUMMARY OF CAPABILITIES AND RESOURCES

The Capabilities and Resources of Sandoval 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

- ✓ Proposed updates to the Comprehensive Plan for Sandoval County provide opportunities to integrate information about hazard vulnerability into the process of determining development suitability and long-range strategies in the County that will lead to sustainable growth.
- ✓ CRS planning is consistent with and complementary to the mitigation planning process undertaken for the Disaster Mitigation Act of 2000 and can help in developing more detailed mitigation activities for flood-related disasters in Sandoval County.

Deficiencies

- ✓ Local communities facing development pressures may need to develop local code enforcement capacity.
- ✓ Communities in Sandoval County do not have wildfire prevention ordinances.
- ✓ There is a relatively low subscription rate to the flood insurance program.
- ✓ Development is still allowed in the floodplain, although there are provisions to provide some measure of mitigation, and despite the fact that there is ample developable land outside the floodplain.

SECTION TWO: GOALS, OBJECTIVES, AND MITIGATION ACTIONS

This section presents a series of goals, objectives, and mitigation actions to help guide the County in addressing its hazard vulnerabilities. The identified mitigation actions reflect the vulnerabilities discussed in Section One by identifying measures that may help the County 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, goals directly respond 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 will they proceed, when should the action 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, the desires of Sandoval County citizens, and guidance provided by NMOESS.

Current criteria under DMA 2000 recommend 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 18.

In public meetings held in September and December 2002, citizens and local government representatives identified goals and objectives based on the findings of the risk assessment. They expressed the chief desire that mitigation objectives should maintain the rich historic, recreational, and agricultural fabric of the community. Furthermore, objectives should recognize the necessity of commercial interests. First and foremost, however, mitigation objectives should protect people, property, local governments, and the local economy from the effects of hazards.

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

Table 18: State of New Mexico Hazard Mitigation Goals	
State and Local Governments	
<ul style="list-style-type: none"> ▪ 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	
<ul style="list-style-type: none"> ▪ 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	
<ul style="list-style-type: none"> ▪ Become aware of 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. 	

SECTION TWO: GOALS, OBJECTIVES AND MITIGATION ACTIONS

FLOOD MITIGATION ACTIONS

As detailed in Section One, Sandoval County is highly susceptible to flash floods with occurrences nearly every year. Heavy thunderstorms in the summer, steep slopes, sparse vegetative cover, and fine-grained soils lead to rapid runoff of large volumes of water. The situation is exacerbated by wildfire and drought, which reduce vegetative cover and expose the soil to even greater runoff. Appendix F describes a variety of property protection actions that can be taken to mitigate hazards and evaluates their feasibility. However, data limitations in many cases restrict the ability to determine the most appropriate mitigation actions for specific affected properties at this time.

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

Goal I Objectives:

I.A Reduce exposure of structures to flooding with property protection measures while keeping historic/traditional character intact.

- ✓ *Action 1: Develop a Sandoval County Stormwater Management Plan.*
- ✓ *Action 2: Provide flood protection while reducing sediment and erosion at Calabacillas Watershed.*
- ✓ *Action 3: Provide flood protection while reducing sediment and erosion at Black Watershed.*
- ✓ *Action 4: Provide flood protection while reducing sediment and erosion at Montoyas Watershed.*
- ✓ *Action 5: Provide flood protection while reducing sediment and erosion at Venada Watershed.*
- ✓ *Action 6: Build levees, culverts, and earthwork to channel water away from roads and homes in the Village of Jemez Springs.*
- ✓ *Action 7: Develop a City-wide Stormwater Management Plan for the City of Rio Rancho.*
- ✓ *Action 8: Develop a plan to correct flood and erosion problems for Barrancas Arroyo Reach in the City of Rio Rancho.*
- ✓ *Action 9: Undertake a citywide drainage right-of-way acquisition program in the City of Rio Rancho.*
- ✓ *Action 10: Install early warning devices for critical facilities in the Village of San Ysidro.*

I.B Promote the purchase of flood insurance by property owners in flood hazard areas.

- ✓ *Action 1: Work with municipal officials to increase awareness among property owners, including information mailings to property owners in the 100-year floodplain;*

SECTION TWO: GOALS, OBJECTIVES AND MITIGATION ACTIONS

and sponsoring a series of workshops about costs and benefits of acquiring and maintaining flood insurance coverage for property owners in the 100-year floodplain

I.C Address identified data limitations regarding lack of detailed information about:

- **individual structures located in the 100-year floodplain**
- **first floor elevations for priority areas**

- ✓ *Action 1: Complete structure data records in the Sandoval County GIS to allow future revisions of this Plan to incorporate information about property values, construction types, etc. more easily.*
- ✓ *Action 2: Obtain information for all remaining structures in the 100-year floodplain to determine the best property protection methods to promote with individual property owners, including first floor elevations for properties within the 100-year floodplain, market and/or replacement value, and construction type. Techniques for gathering information over time should include developing and implementing a program for integrated information “capture” at key points in normal municipal administrative procedures including applications for building permits at municipal and County offices.*

WILDFIRE MITIGATION ACTIONS

Wildfires pose a significant threat to Sandoval County. From 1997 to 2003, 350 fires in the County required an emergency response, including the Cerro Grande Fire of 2000. The arid climate, dense timber stands, large accumulation of fuel from understory growth, and steep slopes make the County highly susceptible to wildfire. Tree densities in the wildland-urban interface areas of the County are several times greater than what is considered normal in a healthy forest. The threat has worsened in recent years due to drought and to insect infestation that has killed large numbers of piñon pines, ponderosa pines, and juniper trees. About 2,220 square miles and over 22,000 structures are in wildfire hazard areas. The greater Jemez area is one of the 20 most vulnerable wildland-urban interface areas in the State. Appendix F includes typical mitigation actions that can be taken to address wildfires, but there are limitations to the data available to make detailed determinations for risks. Therefore, the following recommendations for actions include a number of follow-on efforts to better assess relative vulnerability and risk.

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

Goal II Objectives:

II.A Reduce the exposure of residential structures to wildfires.

- ✓ *Action 1: Reduce fuel loads and create defensible space in the wildland-urban interface in Sandoval County.*
- ✓ *Action 2: Add fuel reduction and no native species removal to the Bosque Fire Plan in Corrales.*
- ✓ *Action 3: Submit plans for a water tank that can supply fire hydrants in the future in Corrales.*
- ✓ *Action 4: Create a firebreak around the Town of Cochiti Lake and surrounding inhabited areas.*
- ✓ *Action 5: Thin trees and clean up defensible spaces around Jemez Springs.*
- ✓ *Action 6: Extend water lines and install fire hydrants on the extended lines to areas currently not served in the Village of San Ysidro.*

II.B Develop a comprehensive approach to reducing the possibility of injury and loss of life due to the exposure of SARA Title III facilities to wildfires in forested areas.

- ✓ *Action 1: Perform detailed assessments of individual SARA Title III facilities within wildfire hazard areas, including presence or absence of vegetation in close proximity to the buildings, power supply lines and communication lines. In the cases where vegetation is present, follow-on efforts would include an assessment of the available fuel within the forested areas and type of construction materials on the facility (in particular, the roof, siding, and window coverings), to determine more detailed assessments of vulnerability and risk. In cases where vulnerability and risk are considered to be relatively high (high fuel levels, close proximity of vegetation, combustible materials), follow-on efforts should include investigating the extent to*

SECTION TWO: GOALS, OBJECTIVES AND MITIGATION ACTIONS

which defensible space practices (see Appendix F) would alleviate the problems in a cost-effective manner.

II.C Reduce exposure to critical facilities in high or extreme wildfire hazard areas.

- ✓ *Action 1: Perform assessments for critical facilities located in high or extreme wildfire hazard areas similar to the process described in II.B.1.*

II.D Encourage residents to practice defensible space techniques.

- ✓ *Action 1: Hold public meetings for and send flyers to residents to educate them on defensible space and construction in Corrales and other fire-prone communities in the County.*

II.E Reduce economic dependence on forest-related tourism.

- ✓ *Action 1: In Jemez Springs, investigate and promote alternative economic resources to tourism based on the surrounding National Forests.*

DROUGHT MITIGATION ACTIONS

Droughts in Sandoval 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 navigation and recreation. The following actions are designed to reduce the effects of droughts on Sandoval County.

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

Goal III Objectives:

III.A Continue efforts to promote water conservation.

- ✓ *Action 1: Continue efforts to encourage residents to use water-saving landscaping techniques.*
- ✓ *Action 2: Employ zoning, subdivision, and building regulations at the municipal level to promote water conservation. For example, simple provisions in local subdivision ordinances, such as directing stormwater runoff to open land as opposed to paved area, can dramatically increase the amount of stormwater that infiltrates the ground surface. This water in turn increases groundwater levels that mitigate for loss of function in wells and lessens the impact of low-water periods on base flow in receiving waterways.*
- ✓ *Action 3: Develop a countywide Drought Management Plan. The plan should focus on assessing the County's vulnerability to drought in detail, including impacts to specific agricultural users, municipal and community water utilities, and environmental resources, and explore detailed mitigation actions to minimize impacts during and after a drought.*
- ✓ *Action 4: Develop a pilot project to use treated effluent for irrigating landscape.*

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 by improving County implementation capabilities and strengthening regulations. Appendix F includes a list of wind hazard mitigation actions with information about their suitability for use in Sandoval County.

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

Goal IV Objectives:

IV.A **Develop a comprehensive approach to reducing the possibility of damage and loss of function to identified vulnerable buildings and critical facilities, due to the effects of severe weather hazards.**

- ✓ *Action 1: Conduct a non-technical evaluation process for remaining critical facilities to determine relative vulnerability and gather information for subsequent refinements of this Plan.*

IV.B **Address identified data limitations regarding lack of detailed information about characteristics of individual structures, such as construction type, age, condition, and compliance with current building codes.**

- ✓ *Actions 1 and 2: (Similar actions as I.D.1 and I.D.2).*

HUMAN-CAUSED HAZARDS MITIGATION ACTIONS

Human-caused hazards are difficult to mitigate since 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. In some cases, as detailed in Section One, the locations where accidental or intentional releases of hazardous materials can be identified, and established programs for protecting lives and property can be put in place. For example, hazardous material handling sites and nuclear power generating facilities must comply with State and federal regulations, including meeting design standards, notifying the appropriate authorities in the case of an accident, and having emergency response plans.

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

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

Goal V Objectives:

V.A **Develop a comprehensive approach to reducing the possibility of injury and loss of life for residents and occupants of existing structures and critical facilities with the highest relative vulnerability to the effects of hazardous material releases from discrete locations.**

- ✓ *Action 1: The Mitigation Planning Team should work with facility owners and operators identified in Section One as having the greatest potential impact (based on population in the immediate vicinity) to ensure:*
 - *Facilities are in compliance with all relevant local, State and federal requirements;*
 - *Neighboring property owners understand the potential extent of the risk; and*
 - *Alert and warning systems are appropriate to the situation.*

Pursue the installation of warning systems around hazardous material facilities when and if it is determined that existing warning systems are inadequate for the purposes of alerting neighboring property owners.

V.B **Protect the public water system and other critical facilities from contamination from hazardous materials incidents.**

- ✓ *Action #1: Assess need to and ways to harden critical facilities against the effects of human-made hazards, such as the accidental or intentional release of chemical, biological, or radioactive material; the accidental or intentional detonation of explosives; or acts of random violence or terrorism.*

V.C **Protect the general population and special populations from hazardous materials incidents.**

- ✓ *Action 1: Develop a functioning GIS within the City of Rio Rancho's Emergency Management Operations.*

SECTION TWO: GOALS, OBJECTIVES AND MITIGATION ACTIONS

- ✓ *Action 2: Update Emergency Operations Plan to include adherence to Homeland Security rules and regulations.*

V.D Enhance the response capability of County and municipal fire, police, and emergency medical personnel to facilities for special populations, such as nursing homes, senior centers, and daycare centers.

- ✓ *Action 1: Ensure that engineering services provide specifications for backup generators and fuel tanks to provide the town of Cochiti Lake with a continuous source of electrical power.*
- ✓ *Action 2: Install an emergency communication system that is not dependent on local telephone and electrical services for Cochiti Lake.*
- ✓ *Action 3: Install early warning devices for critical facilities in the Village of San Ysidro.*
- ✓ *Action 4: Install an emergency call box at each San Ysidro Municipal Complex*

V.E Increase awareness of hazards and actions to take during an emergency.

- ✓ *Action 1: The Mitigation Planning Team will work with the County and municipalities to seek ways (newspaper articles, websites, etc.) to inform individuals and business owners about how to prepare for hazardous material releases. Preparations include some of the basic actions taken to prepare for earthquakes, floods, and fires: store a three-day supply of food and water; make sure flashlights, portable radios, and spare batteries are on hand; and identify an out-of-town contact and a place to reunite if separated from family members. All residents can be better prepared by becoming more aware of surroundings and reporting suspicious activity to local officials.*

EARTHQUAKE MITIGATION ACTIONS

Damage from earthquakes can be mitigated by retrofitting existing buildings and by building new buildings stronger, according to the most recent seismic design specifications required by building codes. Appendix F includes more specific information about techniques to use as part of a coherent mitigation process. However, the risk from earthquakes is relatively low in Sandoval County and pursuit of retrofits should be taken only for critical facilities or areas with special needs populations.

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: Conduct non-technical assessment to determine relative vulnerability and risk.*

MITIGATION ACTIONS TO GUIDE FUTURE DEVELOPMENT AND PROMOTE PUBLIC AWARENESS

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

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

Goal VII Objectives:

VII.A Encourage and facilitate the development or 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 municipal and County level.*
- ✓ *Action 2: Utilize a GIS for identifying sensitive-area properties in the City of Rio Rancho.*
- ✓ *Action 3: Create a GIS mapping system in the Village of Corrales.*

VII.B 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: Promote adoption of the Wildland-Urban Interface Code by all municipalities and the County.*

VII.C Provide adequate and consistent enforcement of ordinances and codes within and between jurisdictions.

- ✓ *Action 1: Work with the State, County, and municipal building inspectors to consistently enforce building codes from jurisdiction to jurisdiction.*
- ✓ *Action 2: Increase the number of Code Enforcement Officers in the City of Rio Rancho Department of Public Safety Code Enforcement Division from five to eight within two years.*

VII.D Address identified data limitations regarding lack of detailed information about development build-out potential in high hazard areas.

- ✓ *Action 1: (Similar/related action to Action I.D.1)*

SECTION TWO: GOALS, OBJECTIVES AND MITIGATION ACTIONS

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

Goal VIII: Objectives:

VIII.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.*

VIII.B Promote partnerships between the municipalities and the County to continue to develop a countywide 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.*
- ✓ *Promote partnerships among the municipalities and the County to develop a countywide approach to mitigation activities.*
- ✓ *Incorporate hazard mitigation concepts into regular County and municipal operations.*

VIII.C Continue the promotion of disaster resistance in the business community via the Project Impact initiative.

- ✓ *Action 1: Renew and expand commitments to business partner organizations.*

SECTION THREE: MITIGATION PLAN AND IMPLEMENTATION STRATEGY

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

Sandoval 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 Sandoval County Planning Team met on March 19, 2003, to prioritize these actions into a countywide consensus.

All 21 mitigation actions under consideration were listed on large poster sheets for the entire planning team to review. Each team member was then given 10 voting dots, half the total number of potential actions, to use as votes. Each of the seven team members then placed any number of voting dots next to any of the 21 mitigation actions they felt were important and a priority to the County as a whole. According to the rules of multi-voting, if someone felt especially strongly about one particular action, he or she could place all 10 dots next to it. The voting dots were tallied and the 21 mitigation actions were then listed in order of priority, according to the number of voting dots each received.

Prior to casting their votes, team members reviewed maps, goals, and objectives, and the priority given to each hazard for which actions were devised. 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?

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- ✓ **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?

The following table presents the results of the vote and the priorities set by the team.

Table 19: Multi-voting ranking results

Mitigation Action	Number of Votes	Priority
Countywide wildland-urban interface project	10	1
Develop a Countywide stormwater management plan to include flooding and erosion in Sandoval County.	9	2
Develop a city stormwater management plan for Rio Rancho.	8	3
Barrancas Arroyo Reach plan for flood and erosion.	7	4
Provide flood protection while reducing sediment and erosion at Calabacillas Watershed.	6	5
Create a firebreak around the town of Cochiti Lake and surrounding areas.	5	6
Install an emergency communication system that is not dependent on local telephone and electrical services for Cochiti Lake.	5	7
Build levees, culverts, and dirt work to channel water away from roads and homes in Jemez Springs.	5	8
Install early warning devices for critical facilities in the village of San Ysidro.	3	9
Engineering services to provide specifications for backup generators and fuel tanks to provide the town of Cochiti Lake with a continuous source of electrical power.	3	10
Thin trees and clean up defensible spaces around Jemez Springs.	3	11
In Jemez Springs, investigate and promote alternative economic resources to tourism that is based on the surrounding National Forests.	2	12
Develop a functioning GIS within the City of Rio Rancho's Emergency Management Operations.	2	13
In Rio Rancho, increase the number of Code Enforcement Officers in the Department of Public Safety Code Enforcement Division from 5 to 8 within two years.	1	14
Utilize a GIS for identifying "sensitive area" properties in Rio Rancho.	1	15
NO VOTES:		
Citywide drainage ROW acquisition.	0	16
Install an Emergency call box at each San Ysidro Municipal Complex.	0	17
Extend water lines and install fire hydrants on the extended lines to areas currently not served.	0	18
Provide flood protection while reducing sediment and erosion at Black Watershed.	0	19
Provide flood protection while reducing sediment and erosion at Montoyas Watershed.	0	20
Provide flood protection while reducing sediment and erosion at Venada Watershed.	0	21
TOTAL NUMBER OF VOTES		
	70	

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In addition, the following actions were submitted by the Village of Corrales after the committee meeting and were prioritized for the Village but not incorporated into the County-wide rankings. The Village of Corrales will be responsible for implementing these actions and coordinating with the County for participation in county-wide projects.

Mitigation Actions for the Village of Corrales	
Submit plans for a water tank.	1
Create a building code inspector position to work under the Fire Department and department of Planning and Zoning.	2
Create GIS mapping system.	3
Add fuel reduction and non-native species removal to the Bosque Fire Plan.	4
Hold public meetings for and send flyers to residents of Corrales to educate them on defensible space and construction.	5
Update Emergency Operations Plan to include adherence to Homeland Security rules and regulations.	6

The Villages of Cuba and Bernalillo will need to do additional work prior to adopting the Plan. Each Village will have to generate a list of mitigation actions and strategies for implementing projects. Prior to adopting the Plan, each Village will submit their respective mitigation projects to NMOEM for FEMA review and approval.

The hazard mitigation action 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.

Cochiti Lake (Town of)

1. Create a firebreak around the Town of Cochiti Lake and surrounding inhabited areas.

Comments:	Aerial examination by the Southern Pueblo Agency of the BIA has determined that 75% of all piñon pines on the high mesa area are dead due to the bark beetle. A high mesa area consisting of piñon, junipers, and cedars surround the community on three sides, with Cochiti Lake bordering the community on the east. Further north, the forests on higher elevations include ponderosa pine and spruce trees. The ponderosa also is being damaged by the bark beetle. The dead and dying trees, combined with more than three years of drought, create an extreme fire hazard for the community. The action would be to survey the area surrounding the Town, pursue a Joint Powers Agreement (JPA) with the Pueblo of Cochiti to allow the firebreak on land surrounding the Town, plan the firebreak, and implement.
Responsible Organization:	Town of Cochiti Lake, Pueblo of Cochiti, USFS, Southern Pueblo Agency (BIA)
Estimated Costs:	\$100,000
Possible Funding Sources:	Pre-Disaster Mitigation Assistance funds administered by NMOEM, Hazard Mitigation Grant Program Technical Assistance funds administered by NMOEM.
Timeline for Implementation:	After funding is received and the JPA is signed, project completion within two months.
Cost-Benefit Analysis	Value of structures at risk a minimum of \$15 million; more detailed cost-benefit analysis will be provided at time of request for funding.

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Priority 6

2. Install an emergency communication system that is not dependent on local telephone and electrical services.

Comments: The Town's Fire Department and Emergency Medical Services (EMS) staff are volunteers who respond to any emergency. This is a volunteer organization without any field communication equipment. The Town does not have reliable electric or telephone service and in an emergency would not be able to communicate with the Fire Department or other State or federal entities. Currently the Town is limited to receiving and transmitting capabilities with Sandoval County dispatch and law enforcement. Implementation would require approval by the Federal Communications Commission (FCC) for various frequency accesses via radio, transmitters, and receivers.

Responsible Organization: Town of Cochiti Lake

Estimated Costs: \$10,000

Possible Funding Sources: Pre-Disaster Mitigation Assistance funds administered by NMOEM, Hazard Mitigation Grant Program Technical Assistance funds administered by NMOEM.

Timeline for Implementation: After funding and FCC permission, the project can be completed within five months (depending on manufacturing and shipping).

Cost-Benefit Analysis Not applicable

Priority 7

3. Ensure engineering services provide specifications for backup generators and fuel tanks to provide the Town with continuous source of electrical power.

Comments: The Town's electrical system is susceptible to power outages. In the case of fire or explosion, the Town would lose the ability to respond to the disaster, or additional hazards could be created. In this situation, the fire hydrants would cease to function and the lift station and wastewater treatment plant would overflow. Installation of backup generators for the wells and wastewater treatment plant is necessary.

Responsible Organization: Town of Cochiti Lake

Estimated Costs: \$45,000

Possible Funding Sources: Pre-Disaster Mitigation Assistance funds administered by NMOEM, Hazard Mitigation Grant Program Technical Assistance funds administered by NMOEM.

Timeline for Implementation: After funding and engineering specifications received, project completion within four months.

Cost-Benefit Analysis Estimated cost of \$45,000 less than the value of one structure that could be saved during an emergency. Inadequate water pressure could severely hamper Town's ability to suppress structural fires, resulting in increased damage to property. If the wastewater treatment plant failed, cost to clean up raw sewage contamination could be much greater than estimated cost of mitigation action. More thorough cost-benefit analysis will be provided with request for funding.

Priority 10

Jemez Springs (Village of)

1. Build levees, culverts, and dirt work to channel water away from roads and homes.

Comments: Construct levees, culverts, and dirt work to channel water under, around, or away from State Road 4, Mooney Boulevard, and homes. Jemez Springs is nestled in a long, narrow valley along State Road 4, with the Jemez River running parallel to the road. Heavy Spring rains wash out several portions of the State Road 4, and some houses stand in the path of the water as it continues its run toward the river. These washouts block the road in and out of the village and at times totally isolate emergency traffic and some homeowners. In addition to State Road 4, Mooney Boulevard is subject to washouts that cause flooding to homes in the area.

Responsible Organization: New Mexico State Highway Transportation Department (NMSHTD), Village of Jemez Springs, USFS (runoff begins on Forest Service land), and Sandoval County.

Estimated Costs: \$1,000,000

Possible Funding Sources: NMSHTD, State of New Mexico, Sandoval County, and the FEMA Hazard Mitigation Grant Program.

Timeline for Implementation: Upon funding approval and procurement of contractors.

Cost-Benefit Analysis: Structures at risk for flooding valued at over \$11 million. Mitigation action would also reduce road closures that negatively impact local tourist economy, a major mainstay of the local economy.

Priority 8

2. Thin trees and clean-up defensible spaces around Jemez Springs.

Comments: Jemez Springs is susceptible to wildland fires. There is a small bosque area where beetles are killing large numbers of piñon pines and juniper trees. When the trees die and dry up, the fire danger is accelerated. Also, the threat of fire exists from the mesa tops as embers (fire brands) can ignite from great distances, as seen in other recent fires.

Responsible Organization: USFS and/or Village of Jemez Springs.

Estimated Costs: \$500,000

Possible Funding Sources: USFS, State Forestry, FEMA Hazard Mitigation Grant Program.

Timeline for Implementation: When funding becomes available and contractor is in place.

Cost-Benefit Analysis: 149 homes @ average cost of \$115,000 approximate value \$17,000,000

Priority 11

3. Investigate and promote economic resources that provide alternatives to tourism based on the surrounding National Forests.

Comments: The Jemez Springs economy is heavily dependent on tourism.

Responsible Organization: Village of Jemez Springs

Estimated Costs: \$500,000

Possible Funding Sources: FEMA Hazard Mitigation Grant Program, NM Economic Development Department,

Timeline for Implementation: Immediately upon receipt of funds.

Cost-Benefit Analysis: Closure of the National Forest surrounding Jemez Springs would cause a major economic hardship to the community. The loss of tourism, the major industry in Jemez Springs, will cause losses to businesses and local government. (Several closures occurred during the summer of 2002.)

Priority 12

Rio Rancho (City of)

1. Develop a City Stormwater Management Plan.

Comments: As a sub-plan of the City's Vision 2020 Comprehensive Plan, develop a master plan for the City's natural and artificial drainage system that identifies general hazards, deficiencies, and other problems and presents a strategy for addressing them over the long term.

Responsible Organization: Rio Rancho City Development, Rio Rancho Public Works & Southern Sandoval County Arroyo Flood Control Authority (SSCAFCA)

Estimated Costs: \$40,000

Possible Funding Sources: City of Rio Rancho

Timeline for Implementation: Two years to final draft.

Cost-Benefit Analysis: Not applicable

Priority 3

2. Barrancas Arroyo Reach Plan.

Comments: Develop a plan for the long-term mitigation and improvement of a reach of the Barrancas Arroyo that is subject to frequent flooding and erosion problems, compounded by threats to utilities, gas lines, and drainage infrastructure.

Responsible Organization: Rio Rancho Public Works, SSCAFCA, affected utility companies.

Estimated Costs: \$40,000 for study
\$250,000 for implementation

Possible Funding Sources: City of Rio Rancho, SSCAFCA, grants

Timeline for Implementation: Study and Plan - 2003
Implementation - 2008, depending on financing.

Cost-Benefit Analysis: Cost for implementation less than average value of two homes in area. Damage from previous storm estimated at \$500,000 for Rio Rancho area. Infrastructure at risk include water supply lines susceptible to damage from erosion and roads that experience chronic damage from flooding.

Priority 4

3. Develop a Functioning GIS within the City of Rio Rancho's Emergency Management Operations.

Comments: Initiate the development and use of a GIS to support mitigation strategies and increase information accessibility and effective decision-making during an emergency.

Responsible Organization: City of Rio Rancho Department of Public Safety and City Development Department.

Estimated Costs: TBD

Possible Funding Sources: City budget, U.S. Department of Housing and Urban Development (HUD), and law enforcement grant programs.

Timeline for Implementation: TBD by budgeting constraints.

Cost-Benefit Analysis: Not applicable

Priority 13

**SECTION THREE: MITIGATION PLAN
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4. In Rio Rancho, Increase the Number of Code Enforcement Officers in the Department of Public Safety Code Enforcement Division from five to eight within two years.

Comments: Increase the number of Code Enforcement Officers in the Department of Public Safety Code Enforcement Division from five to eight within two years. Ensure that all Code Enforcement Officers obtain certification within four years.

Responsible Organization: Rio Rancho Department of Public Safety

Estimated Costs: \$52,000 average cost for each new Code Enforcement Officer (includes salary, benefits, assigned work vehicle, and required training). \$52,000 X 3 = \$156,000.

Possible Funding Sources: City budget, HUD, and law enforcement grant programs.

Timeline for Implementation: Add one Code Enforcement Officer each budget year FY04 through FY06; each to complete certification within two years of hire (i.e., FY06 through FY08).

Cost-Benefit Analysis: Enforcement of building codes could reduce damage from severe weather, fires, and flooding. Damage from prior severe weather events, particularly high winds, can be mitigated with closer enforcement of existing building codes. Cost of three new officers would be offset by reduction in damage from storms.

Priority 14

5. Utilize a GIS for Identifying Sensitive-Area Properties in Rio Rancho.

Comments: Prioritize and implement a GIS sensitive-areas analysis to identify properties within severe slope areas, such as Mariposa (City of Rio Rancho) and Rio Puerco Escarpment (Rio Rancho Estates, Sandoval County), and flood hazard areas for property acquisition purposes.

Responsible Organization: Rio Rancho City Development Department, Rio Rancho Public Works Department, Sandoval County and SSCAFCA.

Estimated Costs: TBD

Possible Funding Sources: City, County and SSCAFCA budget; HUD, and FEMA grant programs.

Timeline for Implementation: Prioritize efforts within the next fiscal year (FY04).

Cost- Benefit Analysis: Not applicable

Priority 15

NO VOTES: Citywide Drainage Right-of-Way Acquisition

Comments: Acquire the City drainage system in its entirety for comprehensive management and to prevent faulty construction.

Responsible Organization: Rio Rancho Public Works, SSCAFCA

Estimated Costs: \$150,000 annually (see "Timeline" below)

Possible Funding Sources: City, SSCAFCA, grants, developer dedications.

Timeline for Implementation: The project is anticipated to take more than 10 years to complete.

Cost-Benefit Analysis: Average annual damage to roads and infrastructure greater than annual cost for ROW acquisition. Comprehensive drainage strategy would also reduce annual cost of operations and maintenance of existing system.

Priority n/a

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San Ysidro (Village of)

1. Install Early Warning Devices for Critical Facilities in Village of San Ysidro.

Comments:	Currently the Village of San Ysidro has an early warning system that is not operational. The system was installed in the 1970s, and the lack of an operational early warning system is a threat to public safety. A new system installed at the San Ysidro Marshal's Department Building would provide an early warning system that can be activated upon receipt of a notice of an emergency.
Responsible Organization:	San Ysidro Marshal's Department
Estimated Costs:	\$10,000
Possible Funding Sources:	Village of San Ysidro, New Mexico (NM) Department of Public Safety, FEMA Hazard Mitigation Proposal Grant.
Timeline for Implementation:	To be completed by the end of the fiscal year 2003-2004.
Cost-Benefit Analysis	Not applicable

Priority 7

NO VOTES: Install an Emergency Call Box at Each San Ysidro Municipal Complex

Comments:	Within the last year the local telephone system has lost 911 service or all phone service approximately five times. The plan will be to install a microwave phone line on the Municipal Complex from the Qwest phone service area. Emergency call boxes will be added to the Municipal Building and the Fire Department belonging to Sandoval County. To notify the local public, the San Ysidro Marshal's Department will publish a notice in the local papers and mail fliers to residents, telling them where to find the call boxes and how to operate them. This will provide better service to all residents in the Jemez Mountain area.
Responsible Organization:	San Ysidro Marshal's Department
Estimated Costs:	\$7,000
Possible Funding Sources:	NM Department of Public Safety, NM Department of Health, Private funding sources.
Timeline for Implementation:	Complete by December 2003.
Cost-Benefit Analysis	Not applicable

Priority n/a

NO VOTES: Extend Water Lines and Install Fire Hydrants on the Extended Lines to Areas Currently Not Served.

Comments:	By extending the water system lines and adding fire hydrants, the village will be able to provide water for fires in the Jemez Mountain, US 550, and State Road 4 areas. This also assists with the drought condition providing water for residents within and outside of the village limits for household use. Currently the village provides water to several residences that lie outside the village limits. The village also provides water to all fire departments. Increasing the ability to get water closer to the fire scene will decrease property damage and increase the safety of the fire fighters.
Responsible Organization:	Village of San Ysidro
Estimated Costs:	\$100,000
Possible Funding Sources:	New Mexico State Legislature, FEMA Hazard Mitigation Program Grant
Timeline for Implementation:	Three years.
Cost-Benefit Analysis	Average value of residences in area is \$150,000. At least ten residences at risk – aggregate value of 1.5 million.

Priority n/a

Sandoval County

1. Wildland-Urban Interface (Defensible Space).

Comments: Reduction of fuels in and near urban interface areas of Sandoval County that are identified as hazardous by USFS.

Responsible Organization: Sandoval County Emergency Services, Public Works

Estimated Costs: \$250,000

Possible Funding Sources: USFS, NM State Forestry

Timeline for Implementation: FY06 through FY08.

Cost-Benefit Analysis: 20,222 structures with aggregate value of over 2 billion dollars are at high risk for wildfire damage.

Priority 1

2. Develop a County Stormwater Management Plan.

Comments: Develop or update current flood/flash flood plan for the Bernalillo and Algodones areas of Sandoval County—covering both natural and artificial drainage systems—that identifies general hazards, deficiencies, and other problems and presents a strategy for addressing them over the long term.

Responsible Organization: Sandoval County Emergency Services, Planning and Zoning

Estimated Costs: TBD

Possible Funding Sources: Grants

Timeline for Implementation: Two years to final draft.

Cost-Benefit Analysis: Not applicable

Priority 2

Southern Sandoval County Arroyo Flood Control Authority

1. Provide Flood Protection while Reducing Sediment and Erosion at Calabacillas Watershed (Code #03CA1)

Comments: Project identified for flood protection.

Responsible Organization: SSCAFCA

Estimated Costs: \$40,000

Possible Funding Sources: SSCAFCA, City of Rio Rancho, Town of Bernalillo, Village of Corrales, FEMA Hazard Mitigation Grant Program

Timeline for Implementation: Upon notification of funding and contractor procurement.

Cost-Benefit Analysis: 90 structures at risk downstream from watershed valued at more than \$10 million.

Priority 5

**SECTION THREE: MITIGATION PLAN
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NO VOTES: Provide Flood Protection while Reducing Sediment and Erosion at Black Watershed (3 Elements).

Comments: Projects identified for flood protection within the Black Watershed are #03BL2, 19th St. Pond Design, ROW & Construction; #03BL3, Tulip Road Dam Design and Tulip Road Dam ROW & Construction; and #03BL4, Lisbon Channel, from Southern Boulevard to Arkansas.

Responsible Organization: SSCAFCA, City of Rio Rancho, Town of Bernalillo, Village of Corrales

Estimated Costs: Code 03BL2=\$ 40,000
Code 03BL3=\$ 65,000
Code 03BL4=\$ 50,000
Total Cost: \$155,000

Possible Funding Sources: SSCAFCA, City of Rio Rancho, Town of Bernalillo, Village of Corrales, FEMA Hazard Mitigation Grant Program

Timeline for Implementation: Upon notification of funding and contractor procurement.

Cost-Benefit Analysis

Priority n/a because the project did not receive votes

NO VOTES: Provide Flood Protection while Reducing Sediment and Erosion at Montoyas Watershed (5 elements).

Comments: Projects identified for flood protection within the Montoyas Watershed are #03M02, Montoyas Dam Site Engineering and ROW; #03M03, Lomitas Negras Overlay Zone; #03M04, Lomitas Negras ROW East of 528/Saratoga to 528; #03M05, Impact Study for Raising Corrales Road Bridge; and Lomitas Negras Soil Cement Investigation Part 2.

Responsible Organization: SSCAFCA, City of Rio Rancho, Town of Bernalillo, Village of Corrales

Estimated Costs: Code 03M02=\$175,000
Code 03M03=\$ 65,000
Code 03M04=\$ 75,000
Code 03M05=\$ 30,000
Code N/A= \$ 16,500
Total Cost: \$361,500

Possible Funding Sources: SSCAFCA, City of Rio Rancho, Town of Bernalillo, Village of Corrales, FEMA Hazard Mitigation Program Grant.

Timeline for Implementation: Upon notification of funding and contractor procurement.

Cost-Benefit Analysis

Priority n/a since project did not receive votes

NO VOTES: Provide Flood Protection while Reducing Sediment and Erosion at Venada Watershed (3 elements).

Comments: Projects identified for flood protection within the Venada Watershed are #03VE2, Middle Venada ROW #03VE3, Venada Dam Site Engineering and ROW; and Enchanted Hills Boulevard (EHB) Channel.

Responsible Organization: SSCAFCA, City of Rio Rancho, Town of Bernalillo, Village of Corrales

Estimated Costs: Code 03VE2=\$160,000
Code 03VE3=\$ 50,000
Code N/A= \$100,000
Total Cost: \$310,000

Possible Funding Sources: SSCAFCA, City of Rio Rancho, Town of Bernalillo, Village of Corrales, FEMA Hazard Mitigation Grant Program

Timeline for Implementation: Upon notification of funding and contractor procurement.

Cost-Benefit Analysis

Priority n/a since project did not receive votes

Corrales Note: As stated previously, the Village of Corrales list of mitigation actions are prioritized for the Village but are not integrated into the County-wide list of actions.

1. Increase water storage capacity with a new 50, 000-gallon storage tank.

Comments: Village water supply limited by present storage capacity; impacts ability to suppress wildland-urban fires
 Responsible Organization: Village of Corrales Public Works
 Estimated Costs: \$40,000
 Possible Funding Sources: USFS, NM State Forestry
 Timeline for Implementation: Within 18 months of adoption of plan
 Cost-Benefit Analysis: Structures at risk in Corrales Bosque wildland –urban zone valued at more than 40 million dollars.

Priority 1

2. Create a building code inspector position to work under the Fire Department and the Department of Planning and Zoning

Comments: Additional inspector would help to reduce threat to structures from hazards by consistently enforcing fire and building codes in new and renovated structures.
 Responsible Organization: Village Planning and Zoning
 Estimated Costs: \$50,000/year
 Possible Funding Sources: Village of Corrales, 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: Additional inspector would help to reduce threat to structures from hazards by consistently enforcing fire and building codes in new and renovated structures. New construction starts average 120 per year with average value of \$250,000 per home.

Priority 2

3. Develop a Geographic Information System –based mapping for the Village of Corrales.

Comments: GIS mapping can help identify more precisely areas that are vulnerable to specific hazards.
 Responsible Organization: Village of Corrales Planning and Zoning
 Estimated Costs: \$50,000 for software and training
 Possible Funding Sources: Pre-Disaster Mitigation Assistance funds administered by NMOEM, Hazard Mitigation Grant Program Technical Assistance funds administered by NMOEM
 Timeline for Implementation: Within 36 months of adoption of Plan
 Cost-Benefit Analysis: GIS mapping can help identify more precisely areas that are vulnerable to specific hazards and reduce costs associated with mitigation efforts by targeting most vulnerable areas.

Priority 3

4. Add fuel reduction and “non-native species removal” to Village Bosque Fire Plan

Comments: Village of Corrales Bosque identified as being vulnerable to wildfires
 Responsible Organization: State of NM Energy, Minerals, and Natural Resources Department, Forestry Division
 Estimated Costs: \$1500/acre – estimated total of \$200,000

SECTION THREE: MITIGATION PLAN AND IMPLEMENTATION STRATEGY

Possible Funding Sources:	State Fire Fund, 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	Value of homes in bosque wildland urban interface valued at more than 40 million.
Priority	4

5. Hold Public Meetings and send flyers to residents of Corrales to educate them on defensible space and construction

Comments:	Village of Corrales bosque identified as being vulnerable to wildfires
Responsible Organization:	Village of Corrales
Estimated Costs:	\$15,000
Possible Funding Sources:	State Fire Fund, Pre-Disaster Mitigation Assistance funds administered by NMOEM, Hazard Mitigation Grant Program Technical Assistance funds administered by NMOEM
Timeline for Implementation:	Within 12 months of adoption of Plan
Cost-Benefit Analysis	Not applicable

6. Update Emergency Operations Plan to include adherence to Homeland Security rules and regulations

Comments:	
Responsible Organization:	Sandoval County Emergency Manager
Estimated Costs:	\$5,000
Possible Funding Sources:	Pre-Disaster Mitigation Assistance funds administered by NMOEM, Hazard Mitigation Grant Program Technical Assistance funds administered by NMOEM
Timeline for Implementation:	Within 12 months of adoption of Plan
Cost-Benefit Analysis	Not applicable

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

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.

HAZARD MITIGATION PLANNING TEAM

A permanent entity needs to be responsible for maintaining the Plan and for monitoring, evaluating, and updating it. This Plan recommends creating a permanent planning group, the Sandoval County Mitigation Planning Team, with representation from all participating municipalities. The Team will represent citizen, municipal, business, educational, volunteer and County interests through a balanced membership. A Mitigation Coordinator would lead the Team, in conjunction with the County Coordinator of Emergency Services.

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 countywide mitigation efforts. The Team should meet quarterly to address all its responsibilities. It will serve in an advisory capacity to the Sandoval County Planning Commission and Department of Emergency Services.

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 provides adequate information to assess the status of mitigation actions. The Team will provide their feedback to the individual 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 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.
- ✓ Completing a Wildland-Urban Fire Assessment to identify additional site-specific mitigation measures to reduce the future risk of wildfires.
- ✓ 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 action plan. 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	Sandoval 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

- About, Inc. Energy/Power, 2003. *Accidents, Leaks, Failures and Other Incidents in the Nuclear Industrial and Military 1947-1991* (<http://power.about.com>).
- Albuquerque Tribune, 2002. *Pros wring hands over dry spell*, Sue Vorenberg, Tribune Reporter (<http://www.abqtrib.com/archives/news01/101002>). October 2002.
- Albuquerque Journal, 2001. *Vulnerable Fire Areas to Get Aid*, Deborah Baker, Associated Press (<http://www.abqjournal.com/paperboy>). January 4, 2001.
- American City Business Journals Inc., 2002. Albuquerque Biz Journals, *New Mexico's drought conditions lead to USDA disaster designation*, June 21, 2002 (<http://albuquerque.bizjournals.com/albuquerque/stories/2002/06/17>). February 2003.
- City of Albuquerque Planning Department, (U.S. Census Bureau, 2000 Census). *Housing Occupancy and Tenure Statistics for New Mexico Places*.
- Cohen, Jerry, 2003. *The Impact of Fire on Ecosystem*, University of Texas.
- Defense Nuclear Facilities Safety Board, 2003. LANL (http://www.dnfsb.gov/pub_docs/lanl/index.html). January 2003.
- Experimental CPC Product. 2003. Palmer Drought Index Percentiles, Weekly Value for Period Ending 25 Jan 2003 (<ftp://ftp.ncep.noaa.gov/pub/cpc/sabol/palmer/rpd07drs.gif>). January 2003.
- Federal Emergency Management Agency (FEMA), 2001. Major Disaster Declarations, January 1, 1972–December 31, 2000 (<http://www.fema.gov/library/diz72-98.shtm>). January 2003.
- Federal Emergency Management Agency (FEMA), 2001. National Flood Insurance Program, *Community Rating System*, (<http://www.fema.gov/nfip>). November 2002.
- Federal Emergency Management Agency (FEMA), 2000. *Historical Presidential Disaster Declarations* (<http://www.fema.gov/graphics/library/dd-1946.gif>). January 2003.
- Federal Emergency Management Agency (FEMA), 2000. Emergency Managers, *National Situation Update*, June 7, 2001 (<http://www.fema.gov/emanagers/2001>). December 2002.
- Federal Emergency Management Agency (FEMA). *Application for Participation in the National Flood Insurance Program, Sandoval County, New Mexico*. May 11, 1998.
- Los Alamos County, 2003. *Los Alamos County – County Departments & Divisions*. January 2003.
- 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.
Los Alamos County Clerk's Office, 505-662-8080.
- Middle Rio Grande Council of Governments of New Mexico, Focus 2050, Regional Plan, 2000.

- Natural Heritage Institute, 2002. Rio Grande River Basin, The Bi-National Rio Grande/Rio Bravo Physical Assessment Project (<http://www.n-h-i.org/Projects/InternationalRivers/RioGrande>). December 2002.
- National Oceanic and Atmospheric Administration, 2002. *Billion Dollar U.S. Weather Disasters 1980-2001*, National Climatic Data Center (<http://www.ncdc.noaa.gov>). January 2003.
- National Weather Service, 2003. Climate Prediction Center, *U.S. Drought Monitor* (<http://www.cpc.ncep.noaa.gov/>). January 2003.
- National Weather Service, 2003. Hydrologic Outlook 8 AM MST Fri Jan 24, 2003 (<http://www.srh.noaa.gov/data/ABQ/ESF/ABQESFABQ.1.txt>). January 2003.
- National Weather Service Office of Meteorology Severe Weather Awareness Homepage, 2003. *New Mexico Flash Flood & Lightning Awareness* (<http://www.srh.noaa.gov/abq/preparedness>). June 2002.
- N.M. Construction Industry Division, 505-41-8020, Snow Load Rating for Sandoval County. March 2003.
- New Mexico Department of Labor. *NM Area Economic Activity* (<http://www.dol.state.nm.us>). July 2002.
- N.M. Economic Development Department, 2003. County Statistics, Sandoval County, *Agriculture, Farms*, Sources N.M. Department of Agriculture and U.S. Department of Agriculture. March 2003.
- New Mexico Economic Development Department, *Factbook: Utilities, Energy and Communication, Map of Independent Carriers* (<http://www.edd.state.nm.us>). July 2002.
- New Mexico Economic Development Department, *County Statistics, Sandoval County* (<http://www.edd.state.nm.us>). June 2002.
- New Mexico Emergency Management Bureau, *New Mexico Emergency Management Bureau Contact List, Sandoval County*, (<http://www.dps.nm.org/emergency>). June 2002.
- N.M. Energy, Minerals and Natural Resources Department, State Forestry Division, 2001. *Protecting Our Communities Through Better Forest Management, Twenty Most Vulnerable Urban Interface Communities* (<http://www.emnrd.state.nm.us/forestry>). February 2003.
- N.M. Office of Emergency Services & Security, Recovery & Mitigation Section, Evonne Gantz, 505-476-9684 (egantz@dps.state.nm.us). August 2002.
- N.M. Office of the State Engineer, Dam Safety Bureau, Elaine Pacheco, 505-827-6111, March 2003.
- N.M. Office of the State Engineer, Dam Safety Bureau, January 2002. *Water Line* (the agency newsletter), *New Dam Safety Design and Operation Criteria*, Elaine Pacheco, P.E. (<http://www.ose.state.nm.us/publications/waterlines>). March 2003.

- New Mexico State University, 2002. New Mexico Drought Plan, Revised May 31, 2002 (<http://weather.nmsu.edu/drought>). March 2003.
- Rio Rancho Economic Development Corporation, 2002. New Mexico Business Relocation, (<http://www.rredc.org>). September 2002.
- Rio Rancho New Mexico Resource Guide (<http://www.pe.net/~rksnow/nmcountyriorancho.htm>). September 2002.
- Sandoval County, New Mexico. *Sandoval County, New Mexico County Map and County History Facts & Figures*, (<http://www.sandovalcounty.com>). July 2002.
- Sandoval County, New Mexico, 1990. *Sandoval County Comprehensive Plan*. Adopted Sandoval County Commission, July 1989.
- Sandoval County, New Mexico. *Sandoval County Flood Damage Prevention Ordinance*. Adopted Sandoval County Commission.
- Sandoval County, New Mexico. *Comprehensive Zoning Ordinance of Sandoval County, New Mexico*, May 2001.
- Sandoval County GIS/Planning & Zoning. *Sandoval County Zoning Maps 1-12*.
- Sandoval County website (<http://www.nmcounties.org/counties/sandoval.html>) July 2002. Sandoval County Statistics.
- Sandoval County. 2001. *Hazard History for Rio Rancho, New Mexico, October 16, 1962–September 14, 2001*.
- Santa Fe New Mexico, 2002. *El Niño May Deliver Relief From Drought*, Judith Kohler, Associated Press (<http://www.sfnewmexican.com>). October 2002.
- University of New Mexico website (<http://www.unm.edu>) 2002. *BEARFACTS, Sandoval, New Mexico 1999–2000*, June 2002.
- University of Texas website. Cerro Grande Fire Map Fire Perimeter 5/12/2000, (<http://www.ce.utexas.edu/prof/maidment/giswr2000/student/nov30/rebecca.ppt>). 2000.
- U.S. Census Bureau, 2000. *DP-1. Profile of General Demographic Characteristics: 2000*, Geographic Area: Sandoval County, New Mexico from the American FactFinder website (<http://factfinder.census.gov>). June 2002.
- U.S. Census Bureau, 2000. *State and County QuickFacts, Sandoval County, New Mexico*, (<http://quickfacts.census.gov>). June 2002.
- U.S. Census Bureau, Small Area Income and Poverty Estimates Program, 2000. *Model-Based Income and Poverty Estimates for Sandoval County, New Mexico in 1997* (<http://www.census.gov>). July 2002.
- U.S. Department of Agriculture, 2003. Farm Service Agency, Fact Sheet, Agricultural Assistance Act of 2003 (<http://www.fsa.usda.gov>). February 2003.

- U.S. Department of Agriculture, 2003. New Mexico Drought Map, Drought Status as of February 20, 2003 (<http://www.nm.nrcs.usda.gov/drought>). February 2003.
- U.S. Department of Agriculture Forest Service, 2003. *The National Fire Plan, Research in Support of Hazardous Fuel Reduction*, (<http://www.na.fs.fed.us/nfp/research>). February 2003.
- U.S. Department of Agriculture Forest Service, 2003. *The National Fire Plan, Key Point – Hazardous Fuel Reduction*, (<http://www.na.fs.fed.us/nfp/hazfuel/reports>). February 2003.
- U.S. Department of Health and Human Services, Health Resources and Services Administration (HRSA), 2000. *Community Health Status Report, Sandoval County, New Mexico*, FIPS Code 35-043, July 2000.
- U.S. Department of the Interior Bureau of Reclamation, 2002. Water Operations, Upper Colorado Region, San Juan-Chama Project, *Albuquerque Area Office, Operations Fact Sheet Cochiti Lake* (<http://albuq.uc.usbr.gov/info/wo/SanJuanChama/Reservoirs/cochiti>). December 2002.
- U.S. Drought Monitor, 2000. National Drought Mitigation Center, *Mitigating Drought* (<http://www.drought.unl.edu/mitigate>). February 2003.
- U.S. Forest Service, 2003. *2003 Western States Wildland/Urban Interface Grant Program* (http://www.fs.fed.us/r4/sfa_grants/new_mexico). 2003

AGENDA

TUESDAY, SEPTEMBER 17, 2002

Meeting Time: 700 pm - Cuba High School

Sandoval County Hazard Mitigation Planning Workshop

Moderator: Jess J. Lewis, Emergency Manager, Sandoval County

6:30 PM to 7:00 PM Public Review of Exhibits

7:00 PM to 8:00 PM **Introduction**

Jess Lewis, Emergency Manager, Sandoval County

- **Disasters in Sandoval County**
- **Who We Are: The Sandoval Mitigation Planning Team**
- **Recent Activities**

Presentation

Victoria Locklear, Project Manager, URS Corporation

- **What Is Hazard Mitigation Planning?**
- **Benefits of Hazard Mitigation**
- **The Sandoval County Mitigation Planning Process**
 - Organize resources
 - Assess risks
 - Develop the mitigation plan
 - Implement the plan and monitor progress
- **Citizen Involvement**
 - Outline of upcoming activities

8:00 PM to 8:30 PM Discussion with the Audience

Upcoming Workshops and Public Meetings (All dates tentative):

October 2002: Presentation of the Draft Hazard Mitigation Plan

December 2002: Public Hearing with Sandoval County Commissioners

January 2002: Final Presentation of the Plan

For more information about hazard mitigation or the planning process, please contact:

Jess J. Lewis, Director
Sandoval County Emergency
Management
505-867-0244
JessLewis@sandovalcounty.com

Victoria Locklear, Project Manager
URS Corporation
301-670-5473
Victoria_Locklear@urscorp.com

Sandoval County Mitigation Planning Committee Meeting

Meeting Minutes, March 19, 2003
Corrales Fire Department Meeting Room
10:00 am

The meeting began with introductions of the URS personnel and any new members attending as substitutions for absent members. A Record of Attendance sheet is attached.

Lora Sedore, URS, gave an update of the Mitigation Plan status and the steps necessary for completion of the data-gathering phase for the final Draft Plan.

She also explained that the main purpose of this meeting was to determine a countywide prioritization of all 21 Actions that each individual community had previously identified and prioritized.

Bel Marquez, URS, explained the process of how the prioritization would take place by voting. She reviewed the poster sheets that contained all of the Actions identified by each community, the considerations that needed to be taken into account, the goals and objectives that had been previously identified, and hazard priorities before any votes were cast. The committee members spoke on behalf of their community to explain why they felt their Actions were important to them and provided discussion when clarification was needed. Listed are the discussions from each representative:

- **Town of Cochiti Lake** representative, Debra Welsh, voiced concerns over the drought that they are experiencing and the bark beetle infestation. She believes that a firebreak is needed to protect Cochiti Lake because of all the dead wood and trees that surround the community. Cochiti Lake is at a 'dead-end' for many of the public utilities and if there were a major fire, they would be cut off from the rest of the county.
- Wildland Urban Interface planning is a countywide concern and issue within **Sandoval County**. The Committee felt that several of the Actions identified would be addressed in such a document.
- **Sandoval County** also felt that the lack of accessibility of water for fighting fires, especially using helicopters, would be a major problem in this area. By having such a plan, it would identify the strengths and deficiencies of the County and what projects they could implement immediately concerning wildfires.
- Other points raised by the **County** concerning the Actions were stormwater diversion projects, flash flooding, and defensible space countywide.
- The representative from **City of Rio Rancho**, Robert Schulz, stated that his concerns were for floods. He would like to plan for 'long term' flood and erosion. Another concern was for drainage.
- Daniel White represented the **Village of San Ysidro**. His concerns were fire hazards and surrounding vegetation that would contribute to a fire. Long-term plans for the Village are to install call boxes, fire hydrants, and an early warning type of system.

- **Southern Sandoval County Arroyo Flood Control Authority (SSCAFCA)** Actions were for watersheds and drainage projects for flood control.

When all members cast their 10 “voting dots,” the Actions were prioritized based on the number of votes received. All of the committee members agreed with the outcome of the Action priorities. Any Actions that were tied or did not receive any votes were left in the order identified by each community. A summary of the voting results is included.

Also discussed was the adoption process of the Mitigation Plan for each community. The Town of Bernalillo will adopt the plan along with the County.

A summary of how each community will adopt the plan is also provided. URS will need to follow up with the entities that were not in attendance today.

The committee members requested a one-page fact sheet that would assist them in explaining to their community officials the purpose and importance of adopting the Sandoval County Mitigation Plan. They all felt this would be of great assistance in educating them ahead of time, before they presented the Draft Plan to them. Evonne Gantz, State Mitigation Officer, requested she review it prior to distribution on URS letterhead. They also wanted the fact sheet to stress that this plan is not committing the community to implement the Actions identified but is required by FEMA in order to receive disaster funds, and it can be used to obtain other grants from other agencies. No funding is required or requested for the adoption of the Plan.

Evonne Gantz stated she would attend the Council meetings where the Plan was being presented to the community officials and support the committee member as an advocate for adoption of it.

The team decided Jess Lewis would present the Plan first to the Sandoval County Commission for adoption. The other communities will then follow suit, learning from this first adoption process.

Priority of Mitigation Actions by Multi-voting

1. Countywide Wildland/Urban Interface project.
2. Develop a county stormwater management plan for flood and erosion in Sandoval County.
3. Develop a city stormwater management plan for Rio Rancho.
4. Develop the Barrancas Arroyo Reach plan for flood and erosion.
5. Provide flood protection while reducing sediment and erosion at Calabacillas Watershed.
6. Create a firebreak around the town of Cochiti Lake and surrounding areas.
7. Install an emergency communication system that is not dependant on local telephone and electrical services for Cochiti Lake.
8. Build levees, culverts, and dirt work to channel water away from roads and homes in Jemez Springs.
9. Install early warning devices for critical facilities in the village of San Ysidro.
10. Ensure engineering services provide specifications for backup generators and fuel tanks to provide the town of Cochiti Lake with a continuous source of electrical power.
11. Thin trees and clean up defensible spaces around Jemez Springs.
12. Investigate and promote alternative economic resources to tourism that is based on the surrounding National Forests.

13. Develop a functioning GIS within the City of Rio Rancho's Emergency Management Operations.
14. In Rio Rancho, increase the number of Code Enforcement Officers in the Department of Public Safety Code Enforcement Division from 5 to 8 within two years.
15. Utilize a GIS for identifying "sensitive area" Properties in Rio Rancho.
16. Acquire citywide drainage ROW.
17. Install an emergency call box at each San Ysidro Municipal Complex.
18. Extend water lines and install fire hydrants on the extended lines to areas currently not served.
19. Provide flood protection while reducing sediment and erosion at Black Watershed.
20. Provide flood protection while reducing sediment and erosion at Montoyas Watershed.
21. Provide flood protection while reducing sediment and erosion at Venada Watershed.

Below is a summary of the adoption process for each community. Follow-up is needed on some.

Town of Bernalillo – To Be Determined

Village of Cochiti Lake – Debra Welsh, Town Administrator, presents to the Governor of Cochiti Pueblo for adoption by the Tribal Council. (1) copy.

Village of Corrales – Tanya Latin presents to Village Council. (5) copies.

Village of Cuba – To Be Determined

Village of Jemez Springs – To Be Determined

City of Rio Rancho – Rick Bassi/Kris Axtell, Emergency Management Coordinator and Assistant respectively, present to City Council. (7) copies.

SSCAFCA - Jim Service - To Be Determined

Village of San Ysidro – Danny White, Marshal, presents to Village Council. (7) copies.

Sandoval County – Jess Lewis, Deputy Fire Marshall, Emergency Services Coordinator, presents to County Commission. (10) copies.

Sandoval County Hazard Mitigation Plan

After the Cerro Grande Fire, Congress authorized funds for mitigation for the communities affected by the Fire. The funds were made available through FEMA. Using these funds Sandoval County has initiated a plan to create a realistic strategy to reduce damage from hazards with a process known as hazard mitigation planning. A planning team from the community has been formed that includes emergency response, safety, disaster volunteers, and employees from Sandoval County and all the incorporated communities, along with URS to draft a Pre-Disaster Mitigation Plan for the community. The team has met multiple times to implement this planning process.

Please take a few minutes and complete this questionnaire and return it after the meeting or forward it to Jess Lewis, Sandoval County Emergency Services, P.O. Box 40, Bernalillo, NM 87004. The completed questionnaire will be reviewed and your recommendations will be incorporated into the Sandoval County Hazard Mitigation Plan.

- 1. Please rank the following hazards in order of concern, numbering them 1-5 or 6. Please designate #1 for the hazard of most concern, #6 for the hazard of the least concern, using each number only once.

___ 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 _____

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ALTERNATIVE FLOOD MITIGATION ACTIONS

The following discussion of flood hazard mitigation options presents alternative actions that can be taken to mitigate flood hazards and evaluates the feasibility of the alternatives based on the vulnerability assessment.

Several categories of flood hazard mitigation actions are possible for neighborhoods and structures within flood hazard areas. The following mitigation alternatives were considered when developing recommendations:

Structural Flood Control Methods

Dikes, levees, dams, channelization, channel widening, and stream realignment are structural projects that keep floodwaters away from flood-vulnerable structures by creating a barrier or conveying the water away from the structures. Structural projects tend to be expensive to build and maintain; they can increase flooding downstream or on the side of the waterway opposite the flood control measure. Reliance on structural flood control measures can create a false sense of security, which often leads to even greater destruction when these structural projects fail during a large flood event. However, localized structural measures are often necessary to protect existing critical facilities, such as water and wastewater treatment plants, that must locate near water. In Sandoval County, these measures may be most appropriate where flash floods occur often and increased conveyance is a requirement to protect the population and assets, such as the Village of Jemez Springs and the City of Rio Rancho, since the U.S. Census Blocks indicate that both municipalities have some development in the identified floodplains.

Planning and Development Regulations

Comprehensive Plans – These plans specify where development should and should not occur in a community. Through these plans, uses allowed in the floodplain can be limited to those that won't be harmed by flood. Flood-prone areas can be reserved for parks, golf courses, backyards, or natural areas. These plans may have limited authority, but they often drive other local measures, such as zoning and subdivision ordinances. Sandoval County has a flood damage prevention ordinance in place that regulates future development in the floodplain, so this action is ongoing.

Stormwater Management Plans – Stormwater management plans lay the foundation for regulations that require developers to build on-site detention basins for runoff caused by new subdivisions, malls, and other developments that contain large areas of impervious surface. Stormwater is not allowed to leave the property at a rate higher than before the site was developed. The problem of sedimentation, which can fill channels and lakes and reduce their ability to carry or store floodwaters, can be addressed by requiring sedimentation and erosion controls at construction sites. These controls keep sediment from flowing off the site and into nearby streams and rivers. Stormwater management plans can also incorporate drainage maintenance requirements to help reduce flooding. This alternative is one of the most appropriate for Sandoval County, since flash flooding occurs due to local topography and excess runoff from neighboring areas.

Warning Systems

A flood threat recognition system provides early warning of an impending flood. The warning can be disseminated via sirens, a mobile public address system, radio, or television. A flood warning system does not provide the long-term damage reduction that is gained through a comprehensive flood mitigation program; however, an early warning system gives residents time to evacuate. This measure is appropriate for Sandoval County, especially for smaller municipalities that do not have the capability to undertake more expensive flood mitigation actions.

Emergency Response Planning

A thorough emergency response plan is appropriate for facilities that are critical to the continuous operation of the government. The Sandoval County Courthouse is considered a vulnerable critical facility; historical flooding has resulted in estimated flood depths of less than 1 foot, but the floods have caused repetitive damage to the lower levels and disruption to the services provided there. Not only should flood mitigation actions be identified as soon as possible, but methods of maintaining services and emergency response during a disaster should also be planned.

Property Protection

Since the flood hazard in Sandoval County is primarily associated with flash flooding, property protection actions such as floodproofing, elevation, acquisition, and relocation are of limited value, because they are more appropriate for riverine flooding. Also, the detailed information required for using these methods (first floor elevations, age and condition of structures, etc., as discussed under Data Limitations in Section 1) is not available. These alternatives are discussed so they can be employed when detailed information becomes available for particularly vulnerable buildings.

Acquisition: With acquisition, the municipal government purchases structures in the floodplain and either relocates or demolishes them. The land is permanently deed-restricted for open space uses in order to restore the natural and beneficial functions of the floodplain. Structures that have been repeatedly flooded, or that experience high flood depths, velocities greater than 5 feet per second, or flooding of long duration, tend to be the best candidates for acquisition. Acquisition is considered one of the most effective flood mitigation measures because it entirely removes structures from the pathway of floods. However, it can damage intact neighborhoods. It is cost-effective for structures with high flood vulnerability, but the process of obtaining the homeowner's approval, securing funds, and managing the implementation of the project can be difficult.

Barriers: Barriers constructed of soil (berms), or concrete or steel (floodwalls), keep floodwaters from reaching structures. To be effective, earthen berms require 3 horizontal feet for each vertical foot.

Dry Floodproofing: Dry floodproofing means making impervious the part of a structure that sits below the base flood elevation. Walls can be coated with a waterproofing compound or plastic sheeting. Openings such as doors, windows, and vents are closed, either permanently or with removable shields. Dry floodproofing is appropriate for buildings on sound slab foundations that are subject to less than 3 feet of flooding. Most walls and floors are not strong enough to

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withstand the hydrostatic pressure from more than 3 feet of water. However, this method does not remove the structure and its contents from the path of floods.

Wet Floodproofing: Wet floodproofing entails letting floodwaters inside the structure and moving assets like furniture or appliances out of harm's way. Wet floodproofing avoids the problems of pressure from floodwaters presented by dry floodproofing. Wet floodproofing is usually used for basements and garages and is not used for one-story houses because the flooded areas would be the living areas.

Elevation: Raising a building above the base flood elevation is the best on-site property protection method. Water flows under the building, causing little or no damage to the structure or its contents. Alternatives are elevation on an open foundation, on continuous foundation walls (creating an enclosed space below the building), or on compacted earthen fill (which can be more costly than open foundation or continuous foundation walls). If open foundation or continuous foundation walls raise the structure 8 or more feet, the lower area can be floodproofed and used for parking or storage.

Elevation is suitable where flood depths are less than 10 feet and have low velocity (less than 5 feet per second). Elevation is also suitable for off-channel areas that have minimal potential for damaging floating debris. Elevation is not suitable for areas with long-duration flooding, because gaining access to the structures would be difficult or unsafe in flood situations. Factors such as foundation type, soil type and bearing capacity, weight of the house, lateral forces on the house from water (and other natural hazards such as winds and earthquake), condition of the house, and height of the proposed elevation above the grade influence the method for elevating a specific house. Politically and socially, elevation may be the most feasible option, because it leaves neighborhoods intact, prevents damage from floods, and allows residential structures used primarily for water-related recreation to remain near the water.

When appropriate information becomes available, as discussed in the beginning of the Property Protection discussion, the decision matrix shown in Table F1 may be used to pick the most suitable method for individual properties. Properties that are at or above base flood elevation (other than those with basement foundations) are not considered in the following decision matrix because they are considered to be outside the regulatory floodplain and are of low mitigation priority compared to other flood structures.

Table F1: Property Protection Decision Matrix		
First Floor 100 year Flood Depth	First Recommendation	Second Recommendation
Slab		
< 2 feet	Barrier	Dry Floodproof
≥ 2 feet	Elevate	Relocate/Acquire
> 9 feet	Relocate/Acquire	Relocate/Acquire
Crawlspace		
≥ 0 feet	Elevate	Elevate
> 9 feet	Relocate/Acquire	Relocate/Acquire
Basement		
≥ 0 feet	Elevate, fill in basement	Relocate/Acquire
> 9 feet	Relocate/Acquire	Relocate/Acquire
Pier/Pilings		
≥ 0 feet	Elevate	Elevate
> 9 feet	Relocate/Acquire	Relocate/Acquire

PRIORITIES FOR FLOOD MITIGATION ACTIONS

From the above discussion, the STAPLE+E can be used to rate the options. Methods receive a “1” or “fair” as the default rating if there are no particularly notable poor or good potential consequences of the method.

Table F2: STAPLE+E Criteria for Flood Mitigation Actions						
	Structural Flood Control Methods	Planning and Development Regulations	Warning Systems	Emergency Management	Property Protection	
S ocial	1	0	1	1	1	
T echnical	3	3	0	1	0	
A dministrative	1	1	1	1	1	
P olitical	1	0	1	1	1	
L egal	1	1	1	1	1	
E conomic	0	1	1	0	0	
E nvironmental	0	1	1	1	1	
Total	7	7	6	6	5	

0 = Poor, 1 = Fair, 2 = Good, 3 = Excellent

ALTERNATIVE WILDFIRE MITIGATION ACTIONS

The assets vulnerable to wildfire include 22,314 structures scattered throughout forested areas in the County.

Wildfire mitigation can and should involve a variety of actions ranging from public education to strategies for managing vegetation.

PARTNERSHIPS

One key to solving the wildland-urban interface problem is the development of a unified, collaborative partnership among federal agencies; Tribal, State, and local governments; and the private sector. This partnership should identify risks, hazards, values, and responsibilities. To be successful, the emphasis must be at the local level, supported by the State and coordinated with federal agencies. This fire protection and prevention issue cannot be solved by any one entity acting independently. Meanwhile, these long-term issues do not preclude federal agencies from developing a compatible policy for wildland-urban protection on the lands they administer.

PUBLIC EDUCATION

Citizens should know how to create a defensible space around structures located in the wildland-urban interface. Local officials, in partnership with the private and non-profit sectors, could develop a public education campaign targeting residents in the wildland-urban interface area. In addition, information should be developed to make residents aware of what to do in the event of a wildfire in their communities.

LANDSCAPING

Defensible Spaces: Structures, especially roofs, can be protected through the creation of buffer spaces around buildings. By simply pruning back the vegetation that grows near the house, a property owner can reduce the threat of flames spreading from a wildfire to the house. Mitigation action items should be targeted to properties and residents in vulnerable areas.

RESPONSE ENHANCEMENTS

Warning systems: Warning systems could be installed for areas vulnerable to the wildfire.

Training: Appropriate training for responding to wildfire hazards should be provided locally or at the State level.

REGULATIONS

Building Codes/Safety Codes: Zoning and land use restrictions are useful for protecting people from hazards that come from the forest and for protecting forests from the people. Zoning and land use requirements are essential to establishing livable and defensible spaces within the forest. Building codes requiring fire resistant building materials, especially for roofs, and defensible areas around structures can save lives as well as property.

All jurisdictions within Sandoval County, including the County government, use the statewide building code UBC 97.

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Vegetation Management/Fuels Reduction: Vegetation management (fuel reduction) projects are key to mitigating wildfires and restoring forest health. Vegetation management or fuel reduction is a process of tree thinning and controlled burns to reduce fuels in areas of high wildfire risk. Since the danger of wildfire extends over much of the County, emphasis should first be placed on the wildland-urban interface areas. There are a variety of forest ecosystems throughout the County that will require a variety of prescriptions, based on factors such as location, slope, vegetation type, and wildlife.

PRIORITIES FOR WILDFIRE MITIGATION ACTIONS

From the above discussion, the STAPLE+E can be used to rate the options. Methods receive a “1” or “fair” as the default rating if there are no particularly notable poor or good potential consequences of the method.

Table F3: STAPLE+E Criteria for Wildfire Mitigation Actions						
	Public Education	Landscape Improvements	Warning Systems	Training	Building/Safety Codes	Vegetation Management
S ocial	3	3	3	3	3	3
T echnical	3	0	3	3	3	3
A dministrative	3	0	3	3	3	0
P olitical	3	3	3	3	3	3
L egal	3	2	3	3	3	3
E conomic	3	3	3	3	3	3
E nvironmental	3	3	3	3	3	3
Total	21	14	21	21	21	18

0 = Poor, 1 = Fair, 2 = Good, 3 = Excellent

ALTERNATIVE DROUGHT MITIGATION ACTIONS

Drought is a regular event in New Mexico. It occurs in the state in recurring cycles. Major long-term droughts occurred in New Mexico during 1931–41 and 1942–79, and is currently the situation throughout the State. Due to the unpredictable nature of droughts, planning is required decades before an event occurs. In the past, the State has been able to weather droughts. However, due to the increase in population during the last decade, water supplies are less able to meet demand during a drought. Community planning is essential if the County is to be better prepared for the decreased water supplies caused by drought.

PLANNING

Planning for droughts is key to mitigation. A water conservation and drought contingency plan should be prepared for the County. Precipitation for a region cannot be reliably predicted, and by the time a drought is recognized, it has been going on for some time. Since the County is currently in a drought and residents are more aware of the future implications of an extended drought, the County should immediately begin the planning process for a drought contingency plan. Hard choices such as limiting growth are never easy, and political support is often missing, but heightened awareness of drought will serve to facilitate the implementation of a plan. The sooner mitigation begins, the better prepared the community will be when the drought is severe and long-term.

Warning Systems

Since drought is not a one-time event and has no recognizable starting point, a warning system would include a program to monitor drought conditions in Sandoval County. The U.S. Drought Monitor is available at the website <http://drought.unl.edu/dm>.

Public Awareness/Education Programs

Programs to educate the public on the importance of water conservation and to increase cooperation with voluntary conservation measures are an important first step in drought mitigation. Public awareness will also keep residents informed on the status of drought, which is important when conservation measures become restrictive.

Water Survey, Maintenance, and Retrofit Programs

Before meaningful conservation can begin, a survey of commercial and residential users should be completed to evaluate water uses. The surveys can be used to develop water conservation strategies, such as the installation of low-flow plumbing fixtures and repairs of existing water systems to maintain efficient operation.

PRIORITIES FOR DROUGHT MITIGATION ACTIONS

From the above discussion, the STAPLE+E can be used to rate the options. Methods receive a “1” or “fair” as the default rating if there are no particularly notable poor or good potential consequences of the method.

Table F4: STAPLE+E Criteria for Drought Mitigation Actions				
	Drought Plan	Warning Systems	Public Awareness/ Education Programs	Water Survey
S ocial	3	3	3	3
T echnical	3	3	3	2
A dministrative	3	3	3	1
P olitical	3	3	3	3
L egal	3	3	3	1
E conomic	3	3	3	3
E nvironmental	3	3	3	3
Total	21	21	21	16

0 = Poor, 1 = Fair, 2 = Good, 3 = Excellent

ALTERNATIVE SEVERE WINTER STORM MITIGATION ACTIONS

A number of mitigation actions can be used to mitigate wind and weather hazards. Unlike flood and wildfire, wind and weather hazards affect the entire County; there is no particular zone that is more likely to experience wind or weather damage than other areas in the County. Therefore, some wind and weather mitigation strategies affect individual structures with known or assumed vulnerability, particular critical facilities; others affect the entire County, usually through public education, improved County capabilities, or stronger regulations.

The following is a list of wind hazard mitigation actions with information about their suitability for use in Sandoval County. These actions are technically feasible and should be used in combination with each other. Other than regulatory improvements, most of these actions should be implemented by property owners with assistance from County and municipal governments.

REGULATIONS

Building Codes/Safety Codes: Properly constructed buildings can resist the force of high winds. Model building codes are designed using wind-speed maps produced by ASCE that are based on a constant probability of occurrence in different parts of the County. The designs based on these wind speeds can resist the majority of tornadoes and other strong winds if the building is constructed properly. Building codes are also important for preventing the collapse of buildings under heavy snow loads. [Source: Natural Hazard Mitigation Insights, Institute for Business and Home Safety]

All jurisdictions within Sandoval County, including the County government, use the statewide building code UBC 97.

BUILDING STRENGTHENING

Manufactured home tie-downs: Manufactured homes are quite vulnerable to high winds because they have thin walls that cannot withstand wind pressure and wind-blown projectiles. Manufactured homes also have a large surface area relative to their weight, making them susceptible to overturning. Furthermore, many manufactured homes are not adequately installed. When manufactured homes are properly tied down with the correct number of anchors and the correct type of anchors for the soil conditions, they are less vulnerable to wind damage. Education and inspection programs can aid in the upgrading of manufactured homes.

Sandoval County has a number of manufactured home parks containing structures for which tie-downs may be appropriate. Manufactured homes installed on permanent foundations, especially double-wide manufactured homes on permanent foundations, are significantly less vulnerable to wind hazards than other manufactured homes and should be a lower mitigation priority. The County or concerned property owners will have to identify which manufactured homes are in need of tie-downs.

Retrofitting tie-downs cost about \$1,000 to \$1,500 to install. For low-income property owners, this can be a significant cost. The County and municipal governments should assist with loans and grants where possible.

Retrofits: Retrofits like safety glass, roof bracing, structural connectors, or storm shutters can strengthen existing structures. Not every building will need such measures. Those built to modern codes should be sturdy enough to withstand most strong winds. Those built before the codes were in place are more susceptible to wind and snow damage and should be a greater mitigation priority. The County tax assessment database can be used to identify buildings built before contemporary codes took effect.

LANDSCAPING

Buffers and Windbreaks: Structures can be protected by a buffer zone around them. Simply by pruning back overhanging or dead branches from trees, property owners can prevent damage to their buildings—especially to the roofs—from falling limbs.

On the other hand, tall trees on the northern exposure can serve as a windbreak. The typical windbreak has several components: (1) dense conifer trees to reduce wind velocity; (2) conifer trees to extend the area of protection; (3) low shrubs to trap snow, provide wildlife habitat, and/or provide aesthetic value.

Because most structures can benefit from simple attention to landscaping and vegetation, all property owners should be informed of this mitigation action.

WARNING SYSTEMS

Sirens: Sirens or other warning systems can alert residents when tornadoes or other hazards threaten vulnerable areas. Manufactured home parks (for both permanent residents and vacationers) are especially vulnerable to severe storms; to reach adequate shelter, residents may need the extra time that a warning from a siren or National Oceanic and Atmospheric Administration (NOAA) weather radio can provide.

SHELTERING

Emergency Shelters: For extreme wind events like tornadoes, ordinary, in-house protection measures, such as basements or in-house safe rooms, are not available for people living in manufactured homes. For them, community shelters offer protection from severe storms. A community shelter is defined as a shelter that is designed and constructed to protect a large number of people from a natural hazard event. Community shelters include stand-alone shelters, which are separate buildings (not within or attached to any other building) designed to withstand high winds and the impact of windborne debris (missiles) during tornadoes, hurricanes, or other extreme wind events.

Internal shelters: These are rooms or areas within or attached to larger buildings, but they are designed to be structurally independent and to provide the same wind and missile protection as a stand-alone shelter. These shelters are intended to provide protection during a short-term high-wind event (an event that lasts no more than 36 hours). They are not recovery shelters intended to provide services and housing for people whose homes have been damaged or destroyed by fires or other disasters. Both stand-alone and internal community shelters may be constructed near or within school buildings, hospitals, nursing homes, commercial buildings, and other facilities designed to be occupied by large numbers of people. Stand-alone community shelters may be constructed in neighborhoods where existing homes lack their own individual safe rooms. Community shelters may be intended for the occupants of buildings that contain the shelters or are located nearby, or they may be intended for residents of surrounding

APPENDIX F: ALTERNATIVE MITIGATION ACTIONS

neighborhoods or designated areas. [Source: FEMA 361, *Design and Construction Guidance for Community Shelters*, http://www.fema.gov/pdf/fima/361_ch01.pdf]

PUBLIC INFORMATION AND EDUCATION

Many of the mitigation measures presented can be economically implemented by property owners who are educated about them. Public information is the most effective method of mitigating the effects of severe storms. It involves the issuance of timely and accurate weather forecasts and public safety warnings, which alert people to impending severe weather and give them time to take protective action.

PRIORITIES FOR SEVERE WINTER STORMS MITIGATION ACTIONS

From the above discussion, the STAPLE+E can be used to rate the options. Methods receive a “1” or “fair” as the default rating if there are no particularly notable poor or good potential consequences of the method.

Table F5 : STAPLE+E Criteria for Severe Winter Storm Mitigation Actions					
	Regulations	Building Strengthening	Warning Systems	Sheltering	Public Information and Education
Social	1	0	1	1	0
Technical	3	3	0	1	0
Administrative	1	1	1	1	1
Political	1	0	1	1	1
Legal	1	1	1	1	1
Economic	0	1	1	0	0
Environmental	0	1	1	1	1
Total	7	7	6	6	4

0 = Poor, 1 = Fair, 2 = Good, 3 = Excellent

ALTERNATIVE HUMAN-CAUSED HAZARDS MITIGATION ACTIONS

Human-caused hazards are difficult to mitigate since they depend on the unpredictable nature of people. Hazardous materials and nuclear facilities must comply with State and federal regulations, including meeting design standards, notifying the appropriate authorities in case of an accident, and having emergency response plans in place. What actions the community can take fall primarily in the response category: knowing what to do in the event of an accident or attack. Thus, educating the public to be aware of these hazards and to take appropriate actions is important for reducing loss of life and property. Communities can also work with the private sector and local officials to enhance response measures. Finally, communities can take human-caused hazards into account when making land-use planning decisions.

PUBLIC EDUCATION

Citizens should be aware of the procedures to follow after a hazardous materials incident. Local officials, in partnership with the private and non-profit sectors, could develop a public education campaign targeting residents within the SARA Title III ½-mile buffer and ¼-mile highway buffer. Another campaign could be developed to educate the general public about response procedures in the event of a terrorism incident, and how to become more aware of their surroundings.

RESPONSE ENHANCEMENTS

Highway call boxes: Trucks carrying hazardous materials travel the two major transportation routes in the County, Highway I-25 and U.S. Route 550. Call boxes could be installed at various points along the highway so that emergency services can respond more quickly to an accident involving hazardous materials.

Warning systems: Citizens should be able to monitor the media for emergency information and bulletins. The community should designate certain radio stations to carry emergency messages to alert citizens to hazard events when they happen. Warning systems could be installed for areas vulnerable to the human-caused hazards identified in Section Three.

Training: Training should be provided locally or at the State level to ensure an appropriate response to human-caused hazards.

LAND USE PLANNING

Segregation of transportation routes: Segregating hazardous material trucks from other traffic could help reduce the risk from a transportation accident. Alternate routes should be considered during the preparation of future transportation improvement programs and comprehensive plans for the County.

Siting of hazardous material facilities: Hazardous material facilities should be prohibited in areas prone to natural hazards. Best management practices should be required in less hazard-prone areas.

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Buffer zones around hazardous material facilities: When siting new facilities, or where space permits around existing facilities, appropriate buffer zones should be established. This can be accomplished through a buffer-zone ordinance or voluntary program.

Reconstruction in less hazard-prone areas: In the event of a disaster, affected structures that fall within the buffer zones of SARA Title III facilities or highways should be relocated or rebuilt outside of buffer areas or in less hazard-prone areas.

PRIORITIES FOR HUMAN-CAUSED HAZARDS MITIGATION ACTIONS

From the above discussion, the STAPLE+E can be used to rate the options. Methods receive a “1” or “fair” as the default rating if there are no particularly notable poor or good potential consequences of the method.

Table F6: STAPLE+ E Criteria for Human-Caused Hazards Mitigation Actions									
	Public Education	Highway Call Boxes	Warning Systems	Training	Segregation of Transportation Routes	Facility Buffer Zones	Facility Siting	Reconstruction	Noise Buffer Zones
S ocial	3	1	3	3	3	3	3	1	3
T echnical	3	1	3	3	3	3	3	1	3
A dministrative	3	1	1	1	1	1	1	1	1
P olitical	3	1	1	1	1	1	1	1	1
L egal	3	1	1	1	1	1	1	1	1
E conomic	3	1	3	3	0	1	1	1	3
E nvironmental	3	1	3	3	3	3	3	1	3
Total	21	7	15	15	12	13	13	7	15

0 = Poor, 1 = Fair, 2 = Good, 3 = Excellent

ALTERNATIVE EARTHQUAKE MITIGATION ACTIONS

Earthquake damage to existing buildings can be mitigated by retrofitting; damage to new buildings can be mitigated by constructing them according to the most recently developed seismic design specifications as set forth in building codes.

Technical Studies

Buildings in the County that are more susceptible to earthquake damage because of their age or method of construction should be identified by the County or interested jurisdictions. There is a Rapid Visual Screening Method devised by FEMA to score [rate?] buildings to reflect their relative vulnerability to earthquakes. The screening method is based on an inspection that records information on the building's construction type, age, use, occupancy, and condition. The buildings identified as most susceptible could be provided technical and financial assistance for retrofitting. Such a process would be suitable for historic buildings and critical facilities such as hospitals, fire stations, and schools.

Building Codes and Standards

Builders that use building codes in the United States generally use one of the three prominent national model building codes, published by three different private organizations. The UBC is published by The International Conference of Building Officials, the National Building Code by Building Officials Code Administrators, and Standard Building Code by Southern Building Code Congress International. The seismic provisions of all three codes are substantially equivalent to the provisions of the National Earthquake Hazard Reduction Program that contain technically advanced and widely accepted seismic design specifications. [Source: *Building For the Earthquakes of Tomorrow: Complying with Executive Order 12699*, FEMA, 1995.]

All jurisdictions within Sandoval County, including the County government, use the statewide building code UBC 97.

Public Awareness

Nonstructural mitigation measures can be implemented by people themselves if they are aware of them. Actions such as anchoring tall bookcases and file cabinets, installing latches on drawers and cabinet doors, restraining desktop computers and appliances, using flexible connections on gas and water lines, mounting framed pictures and mirrors securely, anchoring and bracing propane tanks and gas cylinders, all reduce the risk of injury and damage that these items cause during an earthquake. Public awareness is politically and legally favorable and is not detrimental socially, technically, administratively, economically, or environmentally; it is applicable to both existing and future development.

PRIORITIES FOR EARTHQUAKE MITIGATION ACTIONS

From the above discussion, the STAPLE+E can be used to rate the options. Methods receive a "1" or "fair" as the default rating if there are no particularly notable poor or good potential consequences of the method.

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Table F7: STAPLE+E Criteria for Earthquake Hazard Mitigation Actions			
	Technical Studies	Building Codes	Public Awareness
S ocial	1	1	1
T echnical	1	3	0
A dministrative	1	0	1
P olitical	1	0	1
L egal	1	1	1
E conomic	1	1	1
E nvironmental	1	1	1
Total	7	7	6

0 = Poor, 1 = Fair, 2 = Good, 3 = Excellent