

January 2025

Rio Arriba County, New Mexico Local Hazard Mitigation Plan Update

Encompassing:

- **Rio Arriba County**
- **Chama**
- **Espanola**
- **Ohkay Owingeh**
- **Rio Arriba School District**



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List of Commonly Used Acronyms

Acronym	Meaning
BRIC	Building Resilient Infrastructure and Communities
EAL	Expected Annual Loss
CRS	Community Rating System
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FMA	Flood Mitigation Assistance
GIS	Geographic Information System
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
LHMP	Local Hazard Mitigation Plan
MPC	Mitigation Planning Committee
NCEI	National Centers for Environmental Information
NFIP	National Flood Insurance Program
NID	National Inventory of Dams
NOAA	National Oceanic and Atmospheric Administration
NRI	National Risk Index
NWS	National Weather Service
NMDHSEM	New Mexico Department of Homeland Security and Emergency Management
RAPT	Resilience Analysis and Planning Tool
RACOEM	Rio Arriba County Office of Emergency Management
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USGS	United States Geologic Survey
WUI	Wildland/Urban Interface

Section 1 – Introduction, Assurances, Incorporation, and Adoption

1.1 Introduction

Hazard mitigation is commonly defined as sustained action taken to reduce or eliminate long-term risk to people and their property from hazards and their effects. Hazard mitigation planning provides communities with a roadmap to aid in the creation and revision of policies and procedures, and the use of available resources, to provide long-term, tangible benefits to the community. A well-designed hazard mitigation plan provides communities with realistic actions that can be taken to reduce potential vulnerability and exposure to identified hazards.

This Local Hazard Mitigation Plan (LHMP) was prepared to provide sustained actions to eliminate or reduce risk to people and property from the effects of natural and man-made hazards. This plan documents Rio Arriba County and its participating jurisdictions planning process and identifies applicable hazards, vulnerabilities, and hazard mitigation strategies. This plan will serve to direct available community and regional resources towards creating policies and actions that provide long-term benefits to the community. Local and regional officials can refer to the plan when making decisions regarding regulations and ordinances, granting permits, and in funding capital improvements and other community initiatives.

Specifically, this hazard mitigation plan was developed to:

- Update the 2013 LHMP
- Build for a safer future for all citizens
- Foster cooperation for planning and resiliency
- Identify, prioritize, and mitigate hazards
- Assist with sensible and effective planning and budgeting
- Educate citizens about hazards, mitigation, and preparedness
- Comply with relevant federal requirements

This plan has been designed to be a living document, a document that will evolve to reflect changes, correct any omissions, and constantly strive to ensure the safety of all citizens.

1.2 Assurances

In an effort to reduce natural disaster losses, the United States Congress passed the Disaster Mitigation Act of 2000 (DMA 2000) in order to amend the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act). DMA 2000 amended the Stafford Act by repealing the previous Mitigation Planning section (409) and replacing it with a new Mitigation Planning section (322). Section 322 of the DMA makes the development of a hazard mitigation plan a specific eligibility requirement for any local government applying for Federal mitigation grant funds. This LHMP was prepared to meet the requirements of the DMA 2000, as defined in regulations set forth by the Interim Final Rule (44 Code of Federal Regulations (CFR) Part 201.6 and CFR Part 201.7).

All adopting jurisdictions certify that they will comply with all applicable Federal statutes and regulations during the periods for which they receive grant funding, in compliance with 44 CFR 13.11(c), and will amend this plan whenever necessary to reflect changes in State or Federal laws and statutes as required in 44 CFR 13.11(d).

This hazard mitigation plan was prepared to comply with all relevant requirements of the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988, as amended by the Disaster Mitigation Act of 2000. This plan complies with all the relevant requirements of:

- Code of Federal Regulations (44 CFR) pertaining to hazard mitigation planning
- Federal Emergency Management Agency (FEMA) planning directives and guidelines
- Interim final, and final rules pertaining to hazard mitigation planning and grant funding
- Relevant presidential directives
- Office of Management and Budget circulars
- Any additional and relevant federal government documents, guidelines, and rules.

Additionally, this LHMP has been completed to address all State of New Mexico recommendations and requirements concerning hazard mitigation planning and the requirements of FEMA's Local Mitigation Planning Policy Guide that went into effect April 19, 2023.

1.3 Authorities

The LHMP relies on the authorities given to participating jurisdictions by its citizens and encoded in local and state law. This plan is intended to be consistent with all policies and procedures that govern activities related to the mitigation programming and planning. In all cases of primacy, State of New Mexico and local laws, statutes, and policies will supersede the provisions of the plan.

1.4 Hazard Mitigation Plan Incorporation and Integration

This hazard mitigation plan is an overarching document that is both comprised of, and contributes to, various county and local codes, plans, reports, and studies. The integration of these can provide the following community benefits:

- Align community goals, objectives, and prime concerns
- Avoid lost opportunities
- Eliminate duplication of effort

Rio Arriba County and participating jurisdictions will continue to actively work on incorporating elements of this hazard mitigation plan into any relevant plan, code or ordinance revision or creation. Whenever possible, Rio Arriba County and participating jurisdiction will use existing plans, policies, procedures, and programs to aid in the implementation of identified hazard mitigation actions.

On a local level, hazard mitigation plans can be integrated into various planning documents and initiatives to ensure a comprehensive and coordinated approach to reducing the impact of hazards. Local level plans where hazard mitigation strategies will be integrated include:

- **General Plans:** Helps guide long term community development to ensure future resilience against identified hazards.
- **Threat and Hazard Identification and Risk Assessment:** Utilizes information from the LHMP to understand the specific threats and hazards that may impact the community. This informs the development of strategies and resource allocation for emergency management capabilities, ensuring that the community is well-prepared to respond effectively.
- **Comprehensive Land-Use Plans:** Helps guide the development and zoning decisions in a way that minimizes vulnerability to hazards. This includes avoiding construction in high-risk areas and encouraging resilient building practices.
- **Emergency Operations Plans:** Contributes to detailing specific actions to be taken before, during, and after disasters to reduce vulnerability and enhance community resilience.
- **Climate Action Plans:** Can help address both short-term hazards and long-term climate-related risks. This includes considerations for extreme temperatures and changes in precipitation patterns.
- **Transportation Plans:** Helps ensure the resilience of transportation infrastructure to hazards such as floods, and earthquakes. This may involve designing infrastructure to withstand extreme weather events.
- **Infrastructure Master Plans:** Contributes to the design, construction, and maintenance of critical infrastructure, such as water supply systems, roads, bridges, and utility networks.
- **Community Development Plans:** Helps ensure that new development projects align with hazard resilience goals. This may involve establishing building codes that prioritize hazard-resistant construction.
- **Open Space and Recreation Plans:** Provides for the consideration of green infrastructure and open spaces for flood control, wildfire buffers, and other hazard mitigation purposes.
- **School Emergency Plans:** Enhances the safety and resilience of educational facilities. This may involve retrofitting buildings, establishing evacuation routes, and conducting regular drills.

Specifically, the following detail where the previous Rio Arriba County LHMP was utilized for jurisdictional plans:

- **Rio Arriba County:** Comprehensive Plan for Rio Arriba County (in progress), used hazard analysis and capability assessment
- **Chama:** Planning and zoning ordinance book, used for an understanding of community resilience.
- **Espanola:** Comprehensive Plan for Española, used for hazard analysis and capability assessment
- **Ohkay Owingeh:** Infrastructure Capital Improvement Plan 2023-2027, used for hazard analysis
- **Rio Arriba School District:** Facilities Master Plan, District Master Plan, used hazard analysis

Integrating hazard mitigation with FEMA programs and initiatives provides many benefits to Rio Arriba County and participating jurisdictions. These benefits include a streamlined planning and funding process for hazard mitigation projects, enhanced community resilience from the leveraging of federal programs to create a holistic approach to resilience, broad based data sharing allowing for an improved understating of community risk, and enhanced funding opportunities where jurisdictions can leverage multiple sources of federal funding to implement hazard mitigation actions. Programs currently being integrated into the LHMP include:

National Flood Insurance Program (NFIP):

- **NFIP:** The NFIP is a federal program, managed by FEMA, which exists to provide flood insurance for property owners in participating communities, to improve floodplain management practices, and to develop maps of flood hazard areas.
- **Community Rating System (CRS):** NFIP's CRS incentivizes communities to go beyond minimum floodplain management standards to reduce flood risk. Communities earn CRS points for implementing flood hazard mitigation activities, which can result in lower flood insurance premiums for residents. Hazard mitigation planning can guide communities in adopting flood-specific measures that qualify for CRS points.
- **Building Standards:** NFIP policies encourage communities to adopt and enforce building standards to minimize flood damage. By integrating hazard mitigation planning, communities can identify and prioritize infrastructure improvements that meet or exceed NFIP standards, especially in areas vulnerable to flooding.
- **Floodplain Management Plans:** Developing comprehensive floodplain management plans as part of hazard mitigation planning can support NFIP compliance while addressing risks specific to community needs.

Hazard Mitigation Assistance (HMA) Grants

- **Planning Support:** FEMA's HMA grant programs (including the Flood Mitigation Assistance (FMA), Pre-Disaster Mitigation (PDM), and Building Resilient Infrastructure and Communities (BRIC) grants) provide funding for hazard mitigation plans. These plans can help identify, prioritize, and implement mitigation projects that reduce risk and align with FEMA's overall resilience goals.
- **Eligible Project Types:** HMA grants fund a variety of projects (e.g., retrofitting infrastructure, elevating buildings, property acquisitions) that can align with community-specific hazard mitigation goals. By aligning local hazard mitigation strategies with HMA-eligible project types, communities can maximize available funding to address critical risks.
- **Funding Integration with Local Mitigation Projects:** Communities can leverage HMA grants to implement local mitigation projects that align with broader hazard mitigation goals. For example, using FMA funds to reduce flood risk in NFIP-insured properties or leveraging BRIC funds for innovative infrastructure resilience projects.
- **Tribal Resilience Grant Program:** Supports projects that enhance the resilience of tribal communities to climate change and extreme weather events.

Threat and Hazard Identification and Risk Assessment (THIRA)

- **Comprehensive Risk Identification:** THIRA provides a structured approach for communities to identify and prioritize their risks based on a full spectrum of hazards, including natural and human-caused events. Integrating

hazard mitigation planning with THIRA enables communities to address multi-hazard risks with targeted mitigation strategies.

- **Capability Targets Alignment:** THIRA also helps communities identify capability gaps and set targets for resilience. Hazard mitigation plans can use these targets to outline mitigation actions that align with capability-building priorities, such as improving emergency response infrastructure or fortifying lifeline systems.
- **Unified Risk and Capability Assessments:** By integrating hazard mitigation planning with the THIRA process, communities can develop a more cohesive picture of their risk and capability needs, allowing for more focused and impactful use of FEMA resources across initiatives.

Tribal partners have the additional benefit of integrating Bureau of Indian Affairs (BIA) programs into hazard mitigation plans at the tribal level can enhance resilience and preparedness. Here are some key programs from both agencies that can be integrated:

- **BIA Hazard Mitigation Planning Grant Program:** Provides funding for tribes to develop and update hazard mitigation plans, ensuring they meet federal requirements for FEMA approval.
- **Indian Reservation Roads Program:** Focuses on improving transportation infrastructure.
- **Tribal Forestry Program:** Supports forest management practices that reduce wildfire risk, promoting healthy forests and sustainable land use.
- **BIA Environmental Protection Programs:** Offers resources for managing environmental hazards and ensuring sustainable land use, which can be integrated into hazard mitigation strategies.
- **Tribal Historic Preservation Program:** Addresses the protection of culturally significant sites during hazard mitigation efforts, ensuring that preservation measures are included.

Integration of hazard mitigation into these various plans ensures that resilience efforts are embedded in the broader fabric of community development. Coordination and collaboration among different sectors and stakeholders are essential for the successful implementation of hazard mitigation strategies on the local level. Plan incorporation and integration is crucial for creating a cohesive and coordinated approach to address various aspects of hazard mitigation. All participating jurisdictions utilize similar internal procedures for plan incorporation and integration. The following represent utilized methods:

- **Cross-Referencing:** Identify and cross-reference relevant sections of different plans and policies. This involves explicitly noting connections between the goals, strategies, and actions outlined in one plan with those in others.
- **Consistency Checks:** Conduct consistency checks to ensure that the language, objectives, and strategies in different plans and policies align with each other.
- **Joint Planning Committees:** Establish joint planning committees or task forces that involve representatives from different departments or agencies responsible for various plans (for example, the MPC). These committees facilitate communication, collaboration, and the coordination of planning efforts across sectors.
- **Collaborative Workshops and Meetings:** Organize collaborative workshops and meetings to bring together stakeholders involved in different planning processes (as seen in the planning meetings for the LHMP). These forums provide an opportunity for stakeholders to share information and discuss common goals.
- **Alignment with State and Regional Plans:** Ensure that local plans align with broader regional and state plans. This involves considering regional and state priorities and incorporating them into local planning efforts to create a harmonized approach to development.
- **Data Sharing and Analysis:** Share relevant data among planning efforts and conduct joint data analysis. This helps in creating a common understanding of the challenges and opportunities, facilitating evidence-based decision-making across different plans.
- **Unified Implementation Strategies:** This involves identifying common actions and initiatives that contribute to the achievement of multiple goals outlined in various plans.

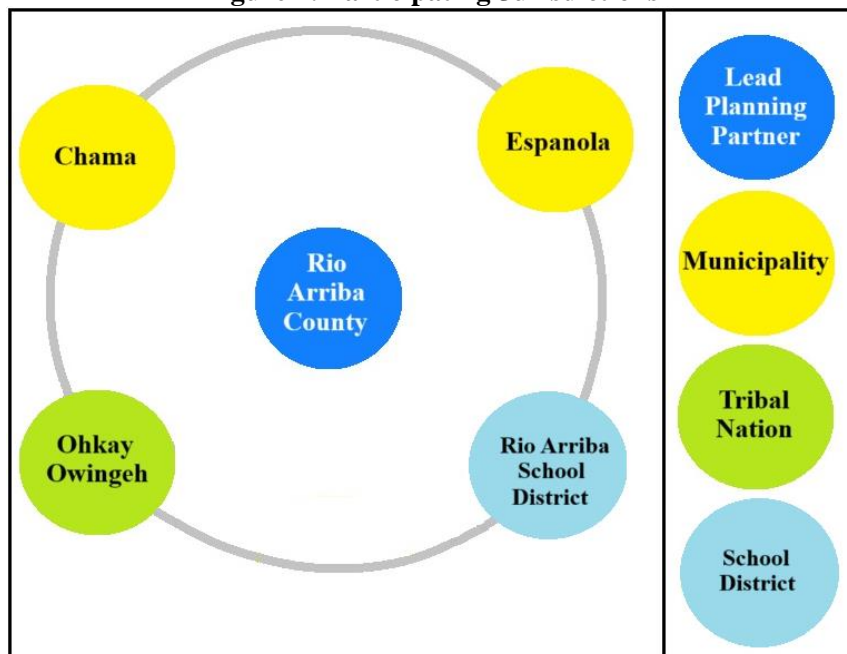
1.5 Adopting Jurisdictions

In order to have an approved hazard mitigation plan, DMA 2000 requires that each jurisdiction participate in the planning process. Each jurisdiction choosing to participate in the development of the plan was required to meet detailed participation requirements, which included the following:

- Participation in planning meetings
- Provision of information to support the plan development
- Identification of relevant mitigation actions
- Review and comment on plan drafts
- Fostering the public input process
- Formal adoption of the plan

Based on the above criteria, the following jurisdictions participated in the planning process, and will adopt the approved hazard mitigation plan:

Figure 1: Participating Jurisdictions



Please note that the Rio Arriba School District consists of five districts, Chama Valley Independent Schools District, Dulce Independent School District, Mesa Vista Consolidated School District, Penasco Independent School District and Espanola Public School District.

1.6 Plan Adoption

This plan was submitted to New Mexico Department of Homeland Security and Emergency Management (NMDHSEM) and FEMA Region VI prior to adoption (approval pending adoption protocol). This methodology allows for a single plan adoption by participating jurisdictions in the event of plan revisions during the review and approval process. Upon review and approved pending adoption status by FEMA Region VI, adoption resolutions will be signed by the participating jurisdictions. FEMA approval documentation and jurisdictional adoption resolutions may be found in Appendix A.

Administration and oversight of the hazard mitigation program is the responsibility of the Rio Arriba County Office of Emergency Management (RACOEM). The plan will be reviewed annually and will be updated every five years, or as required by changing hazard mitigation regulations or guidelines.

Section 2 – Documentation of the Planning Process

2.1 Guiding Principle

The guiding principle for the creation and utilization of this LHMP is as follows:

- Through partnerships among all local jurisdictions and Tribal partners, identify and reduce the vulnerability to natural hazards to protect the health, safety, quality of life, environment and economy of the diverse communities within Rio Arriba County.

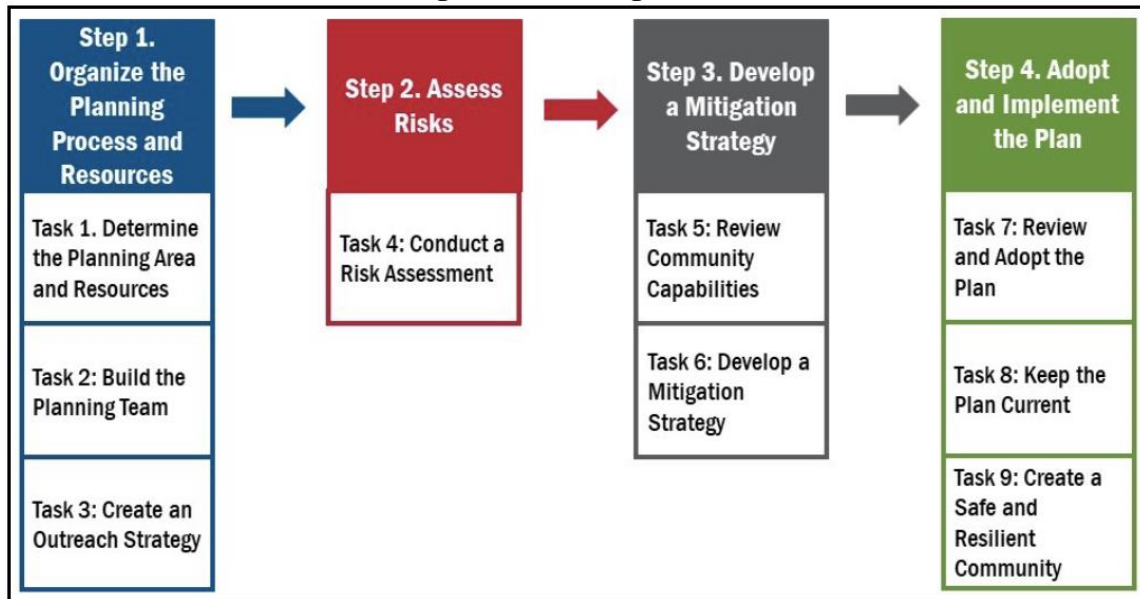
2.2 Planning Process

The process established for this planning effort is based on the Disaster Mitigation Act of 2000 planning and update requirements and the FEMA associated guidance for local hazard mitigation plans (Local Mitigation Planning Policy Guide (FP 206-21-0002), effective April 19, 2023). To accomplish this, the following planning process methodology was followed:

- Inform, invite, and involve other mitigation plan stakeholders throughout the state, including federal agencies, state agencies, regional groups, businesses, non-profits, underserved communities, and local emergency management organizations.
- Creation of a Mitigation Planning Committee (MPC) to codify and guide the planning process.
- Develop the planning and project management process, including methodology, review procedures, details about plan development changes, interagency coordination, planning integration, and the organization and contribution of stakeholders.
- Creation of a multi-pronged outreach strategy to engage stakeholders.
- Conduct a thorough review of all relevant current and historic planning efforts.
- Conduct a review of all related and relevant state and local plans for integration and incorporation.
- Collect data on all related state plans and initiatives, local plans' hazard risk, local plans' mitigation strategies and actions, critical facilities and community lifelines, flood plains, Repetitive Loss/Severe Repetitive Loss properties, hazard events, on-going and completed mitigation actions, and mitigation program changes since the development of the previous plan.
- Complete a risk and vulnerability assessment using data from the FEMA and other federal and state agency resources. Analyses were conducted at the state level, county by county, of state-owned facilities, and county by county drawing on local assessments.
- Develop and update the capability assessment of Rio Arriba County and all participating jurisdictions.
- Develop a comprehensive mitigation strategy effectively addressing Rio Arriba County's hazards and mitigation program objectives. This included reviewing pre and post disaster policies and programs, identifying objectives and goals, identifying mitigation actions and projects, and assessing mitigation actions and projects.
- Determination and implementation of a plan maintenance cycle, including a timeline for plan upgrades and improvements.

The following figure summarizes these steps:

Figure 2: Planning Process

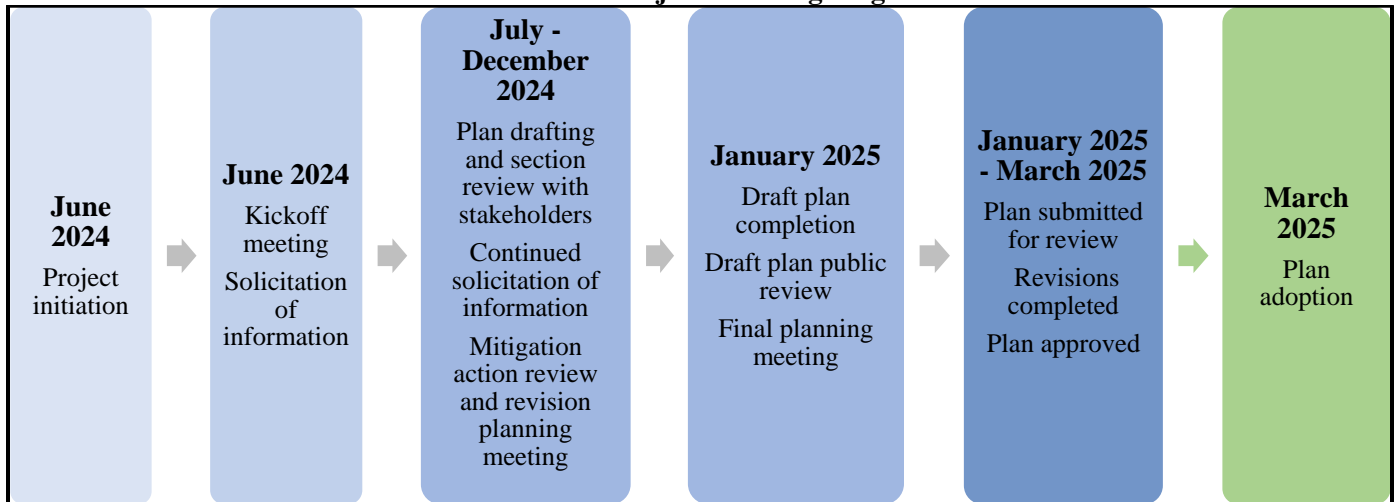


Source: FEMA

2.3 Project Timeline

The Rio Arriba County LHMP review and revision process began in June 2024, with the first public meeting held in Espanola, New Mexico. The following chart indicates the planning stages completed as part of this process:

Chart 1: Project Planning Stages



2.4 Plan Organization

This LHMP is both a reference document and an action plan. It has information and resources to educate readers and decision-makers about hazard events and related issues and a comprehensive strategy that participating jurisdictions, stakeholders, and community members can follow to improve resilience. This LHMP is composed of the following sections:

- **Section 1 - Introduction, Assurances, Incorporation, and Adoption:** Details the regulatory framework for plan development, participating jurisdictions, how the plan will be incorporated into other planning mechanisms, and adoption requirements.
- **Section 2 – Planning Process:** Outlines the steps taken to complete this LHMP, consideration of planning equity, the people involved in its creation, strategies to invite public participation, and technical and planning resources utilized in completing this plan.

- **Section 3 - Regional Profile and Development Trends:** Details demographic information, vulnerable populations, critical facility and community lifeline information, agricultural data, and a discussion of climate change parameters.
- **Section 4 – Capability Assessment:** Provides a comprehensive evaluation of existing abilities to effectively mitigate hazards and manage disaster risks. This assessment involves analyzing the community's current resources, policies, programs, and systems to determine how well it can implement mitigation strategies.
- **Section 5 - Hazard Identification and Risk Assessment:** Describes the hazards that can impact the planning area, including extent, previous occurrences, changing conditions, and vulnerabilities.
- **Section 6 - Mitigation Strategy:** Outlines the specific actions, policies, and projects designed to reduce or eliminate the risks and impacts of hazards on a community. These strategies are developed based on the findings from the hazard identification and risk assessment phases and are tailored to address the unique vulnerabilities and capabilities of the community.
- **Section 7 - Plan Maintenance:** Summarizes plan maintenance responsibilities, monitoring and update requirements, and opportunities for continued public involvement.
- **Appendices:** Provides supplementary detailed information and supporting documents. The appendices serve to enhance the main content by offering further clarification, data, and documentation that support the planning process and implementation.

2.5 2025 Plan Update

In undertaking this planning effort, Rio Arriba County determined that wide variances in planning format and data do not allow for effective continuous planning. To provide planning continuity every effort was made during this plan update to adhere as closely as possible to elements of the previous LHMP. As such, the level of analysis and detail included in this risk assessment is cumulative, allowing participating jurisdictions to have a robust base to further mold and improve their mitigation strategies over the next five years.

As part of this planning effort, each section of the previous mitigation plan was reviewed based on current and available data. The plan was reviewed against the following elements:

- Compliance with the current regulatory environment
- Completeness of data
- Correctness of data
- Capability differentials
- Current regional environment

Based on the above criteria, each section of the previous LHMP was revised as required. In addition to data revisions, the format and sequencing of the previous plan was updated for ease of use and plan clarity. Key updated elements from the previous LHMP include:

- Integration of the 2024 Rio Arriba County General Plan.
- Expanded definition and discussion of underserved communities and vulnerable populations.
- Updated goals and objectives, including a new goal and objectives.
- Updated critical facilities and community lifelines list.
- Expanded detailing of historic hazard event occurrences.
- Updated mapping using newly available data.
- Updated county and jurisdictional capabilities assessment
- Updated mitigation actions, including progress on previous actions

Participating jurisdictions hazard mitigation priorities have remained consistent for all participating jurisdictions since the last plan update. These priorities include a continued focus on reducing vulnerabilities, enhancing resilience, and addressing risks associated with natural hazards. Stakeholders remain committed to strengthening community

preparedness, protecting critical infrastructure, and minimizing potential losses through collaborative strategies and long-term planning.

2.6 Hazard Mitigation Planning Equity

Planning equity refers to the principle of fairness and justice in planning and development processes. It emphasizes the equitable distribution of resources, opportunities, and benefits among all members of a community, particularly those who have historically been marginalized or disadvantaged. The concept of planning equity recognizes that planning decisions can have significant impacts on different groups of people and aims to ensure that these decisions promote social justice and inclusiveness. It involves addressing spatial inequalities, such as disparities in access to housing, transportation, public services, green spaces, and employment opportunities.



Planning equity entails involving diverse stakeholders in decision-making processes, including community members, advocacy groups, and underrepresented populations. It seeks to empower marginalized communities by giving them a voice in shaping the development and planning policies that directly affect their lives.

Planning equity and hazard mitigation planning are closely related, as both aim to create more resilient and inclusive communities. As part of this planning effort, the following intersections were considered between planning equity and hazard mitigation planning:

- **Vulnerability Assessment:** Planning equity recognizes that certain communities, particularly marginalized and disadvantaged populations, may be more vulnerable to hazards due to social, economic, and environmental factors. When conducting a vulnerability assessment as part of hazard mitigation planning, it is important to consider equity issues and identify areas or groups that may experience disproportionate impacts.
- **Engaging Marginalized Communities:** Planning equity emphasizes the inclusion and participation of diverse stakeholders, including marginalized communities, in decision-making processes. In hazard mitigation planning it is crucial to engage these communities to understand their unique needs, concerns, and perspectives regarding hazards.
- **Addressing Social Disparities:** Hazard mitigation planning can help address social disparities by considering the unequal distribution of resources and opportunities in the context of hazards. This can involve implementing mitigation measures that specifically target vulnerable populations, such as affordable housing in safer areas or improved access to emergency services and transportation for underserved communities.
- **Equitable Distribution of Resources:** Planning equity promotes the equitable distribution of resources, and this principle can be applied to hazard mitigation planning. It involves ensuring that mitigation measures and investments are allocated fairly, with consideration given to communities that have historically received less attention or investment. This can help reduce existing disparities and enhance the resilience of marginalized communities.

By integrating planning equity into hazard mitigation planning, it becomes possible to develop strategies and actions that not only reduce the risks associated with hazards but also promote social justice, inclusivity, and resilience for all members of the community.

As part of this planning process, participating jurisdictions, planners, and stakeholders considered potential inequities and encouraged the participation of potentially vulnerable citizens and communities. This process began with recognizing that disparities exist within the region, including health outcomes and living conditions for people of color, people with disabilities, and historically disadvantaged communities. It was recognized that these populations may be at greater risk to the hazards identified in this plan and may be limited in their ability to adapt, respond, and recover if an event were to occur.

As recommended in FEMA’s “Guide to Expanding Mitigation,” Rio Arriba County took a whole community approach to this planning effort, including:

- Inviting historically underserved populations to participate in the planning and decision-making processes
- Inviting faith based and community organizations, nonprofit groups, schools, and academia to be plan stakeholders

These equity partners were contacted directly by RACOEM via phone and email and were invited to kickoff and review planning meetings. Additionally, these partners were provided with a draft copy of the LHMP for review and comment, and their valuable feedback further strengthened the plan. The following table identifies our equity partners who actively engaged in the LHMP planning effort:

Table 1: Equity Partners

Equity Partner	Representative and Title	Description
Rio Arriba County Department of Health and Human Services	Dr. Ahmed Dadzie	Provides a wide range of social services, mental health services, alcohol and drug treatment services, public health services, emergency preparedness and income assistance.
Jicarilla Apache Nation	Chris Holyfield, Emergency Manager	The general mission of Tribal governments is to promote the general welfare of all people, to establish equality and justice for tribal members, to preserve Tribal traditions, customs, language and ancestral rights, and to secure the continued rights to exercise self-governance. Tribal governments provide for governance and administration, leadership, judicial services, law enforcement, education, cultural education healthcare and social services, housing and infrastructure, housing assistance, infrastructure development economic development, job training and employment services, environmental and natural resources management, land management, environmental protection, public safety and emergency services, emergency management, cultural preservation, and legal and advocacy services.
Ohkay Owingeh	Aaron Miller, Fire Chief	
Santa Clara Pueblo	Mitchell Maestas, Tribal Police Department Chief	

These partners were leveraged to reach our underserved and isolated communities by providing them with the LHMP and all surveys relating to this plan. Please note that the Rio Arriba County Department of Health and Human Services serves all participating jurisdictions. All feedback comments, both written and verbal, were incorporated into the fabric of this plan as appropriate.

2.7 Mitigation Planning Committee

Project initiation began with the selection of a Mitigation Planning Committee (MPC), consisting of the Rio Arriba County Emergency Manager and representative staff from both Rio Arriba County and participating jurisdictions. From project inception to completion, the MPC was notified at each major plan development milestone through a combination of meetings and electronic communication.

In general, all MPC members were asked to participate in the following ways:

- Attend and participate in meetings
- Help establish project operating procedures and timelines
- Review planning elements and drafts
- Shepherd the plan adoption process

Members of the MPC were also asked to assist with the following:

- **Providing Localized Risk Assessment Data:** Contribute specific data and information about local hazards, vulnerabilities, and risks that are unique to their jurisdiction.
- **Identifying Mitigation Actions:** Help identify and prioritize mitigation actions that are most relevant to their jurisdiction.
- **Coordinating with Stakeholders:** Act as liaisons between the MPC and their respective stakeholders, including vulnerable communities, community members, local businesses, and other governmental agencies. This ensures that the plan reflects the concerns and needs of all relevant parties.
- **Ensuring Compliance and Integration:** Ensure that the mitigation strategies and actions proposed in the LHMP align with existing local plans, ordinances, and regulations. This integration helps to streamline implementation and ensures that the LHMP supports broader community goals.
- **Securing Resources and Funding:** Help identify potential resources, including funding opportunities, that can support the implementation of mitigation actions.
- **Reviewing and Updating the Plan:** After the initial development of the LHMP, MPC members are typically involved in regular reviews of the plan. This includes monitoring progress on mitigation actions, evaluating the effectiveness of strategies, and making necessary adjustments based on new data or changing conditions.
- **Public Engagement and Education:** Play a crucial role in engaging the public and educating community members about the LHMP and its importance.

By fulfilling these roles, MPC members help ensure that the LHMP is well-rounded, locally relevant, and effectively implemented across the entire planning area. Their involvement is key to the plan's success in reducing risks and enhancing community resilience to hazards. The following table represents members of the MPC:

Table 2: MPC Members

Jurisdiction	Name	Title
Rio Arriba County	Enrico Trujillo	Emergency Manager
Rio Arriba Sheriff's Office	Matthew Galleges	Captain
Rio Arriba Schools	Christian Lopez	Director of Security
Rio Arriba County Department of Health and Human Services	Dr. Ahmed Dadzie	Director
Village of Chama	Samuel LeDoux	Council Member
City of Espanola	Johnny Martinez	Fire Chief
Dixon	Steve Jenison	District Chief
Ohkay Owingeh	AJ Salazar	Tribal Judge
Ohkay Owingeh	Aaron Miller	Fire Chief (Retired)
Ohkay Owingeh	Roger Trujillo	Fire Chief

2.8 Participating Stakeholders

Rio Arriba County acknowledges that effective hazard mitigation planning should involve a diverse group of stakeholders, including government agencies, private sector entities, private non-profit organizations, quasi-governmental authorities, and special districts. The coordination and cooperation of these stakeholders assists with all aspects of plan development, including:

- Data collection
- Hazard and risk analysis
- Capability assessment
- Mitigation action review, revision, and development
- Plan implementation

These participating stakeholders were contacted directly by RACOEM via phone and email during the entirety of the planning process concerning plan progress and meeting information (including remote meeting login information and in person meeting address and time when applicable), and included:

- Local and regional agencies involved in hazard mitigation activities.
- Agencies that have the authority to regulate development.
- National Flood Insurance Program coordinators.
- Neighboring communities.
- Representatives of business, academia, and other private organizations.
- Non-profit and community-based organizations who work to provide support to socially vulnerable and underserved communities.

The following table details our participating stakeholders:

Table 3: Participating Stakeholders

Name	Title	Jurisdiction or Agency
Dr. Ahmed Dadzie	Director	Rio Arriba Department of Health and Human Services
Gil Vigil	Executive Director	Eight Northern Indian Pueblos Council, Inc.
Joaquin Valdez	Assessor	Rio Arriba Assessor Department
Gabriel Boyle	Planning and Zoning Director	Rio Arriba Planning and Zoning Department
Chris Holyfield	Emergency Manager	Jicarilla Apache Nation
Mel Tafoya	Tribal Administrator	Santa Clara Pueblo
Marcos Valdez	District Manager	East Rio Arriba Soil-Water District
Richard Tafoya	Director of Operations	Northern Rio Arriba Electric Co-op
Anna Pobar	Coordinator	Village of Chama Planning and Zoning
Ernest Martinez	Planning Director	City of Espanola Manager Planning and Land Use
Eric Lujan	City Manager	City of Espanola Manager

Emphasis was placed on inviting and engaging local building departments (Section 4.3) and local level departments with potential mitigation roles (Section 4.2) who played a critical role in creating and reviewing this LHMP. Their expertise was used to help identify local vulnerabilities and develop building-related mitigation measures. Additionally, jurisdictional NFIP coordinators played a key role in mitigation planning at the community level (Section 4.8). These coordinators were actively engaged and for their expertise on flood risk, mitigation strategies, and NFIP compliance. Outreach to these stakeholders was also carried out through MPC members to ensure compliance with planning requirements.

2.9 Coordinating Stakeholders

The Rio Arriba County MPC provided the opportunity for a wide variety of coordinating stakeholders to participate in the planning process. Coordinating stakeholders have information and resources that are important to the planning process, but do not participate fully in the planning process. While not all of these organizations attended meetings, each was actively courted to provide information, data, and feedback as necessary and as related to their areas of expertise.

The following provides a list of all coordinating stakeholders involved in the development of this LHMP:

- New Mexico Department of Agriculture
- New Mexico Department of Game and Fish
- New Mexico Department of Health
- New Mexico Department of Homeland Security and Emergency Management
- New Mexico Department of Transportation
- New Mexico of Energy, Minerals and Natural Resources Department
- New Mexico Indian Affairs Department
- New Mexico General Building Bureau, Construction Industries Division
- Los Alamos County Emergency Management (Beverley Simpson, Emergency Manager)
- San Juan County Emergency Management (Mike Mestas, Emergency Manager)

- Sandoval County Emergency Management (Dan Heerding, Emergency Manager))
- Santa Fe County Office of Emergency Management (Brad Call, Director)
- Taos County Office of Emergency Services (Bobby Lucero, Director)
- Conejos County Emergency Management, Colorado (Rodney King, Emergency Manager)
- Costilla County Emergency Management, Colorado (Lucas Casias, Emergency Management Coordinator)
- Las Animas County Emergency Management, Colorado (Joe Richards, Emergency Manager)
- United States Army Corps of Engineers
- United States Department of Agriculture (USDA)
- United States Geological Survey (USGS)
- National Weather Service (NWS)
- United States Census Bureau
- University of Wisconsin SILVIS Labs
- National Oceanic and Atmospheric Administration
- U.S. Department of the Interior, Bureau of Indian Affairs (BIA)

2.10 Community Outreach

All participating jurisdictions undertook a joint strategy to notify and include the public in the LHMP process. Members of the community (the public) were provided with numerous opportunities to contribute and comment on the creation and adoption of the plan. For participating non-tribal jurisdictions, the public was defined as any person with an interest in the resilience and welfare of Rio Arriba County. For the Ohkay Owingeh, the public was defined as any member of Ohkay Owingeh Tribe, or any person with a vested interest in the welfare and wellbeing of the Ohkay Owingeh and the county as a whole. These opportunities included:

- RACOEM webpage updates concerning all hazard mitigation activities, survey links, and meeting information.
- Flyers to post to advertised meeting locations and details.
- Online and paper surveys.
- Comment period, along with an online survey, upon completion of draft plan .

All open public meetings were held at easily accessible community locations. As many participating jurisdictions and citizens have limited communications capabilities, meeting notices were placed in high visibility locations and our MPC was asked to conduct a word-of-mouth campaign concerning the planning process to include as many participants as possible.

Figure 3: Kickoff Meeting Flyers




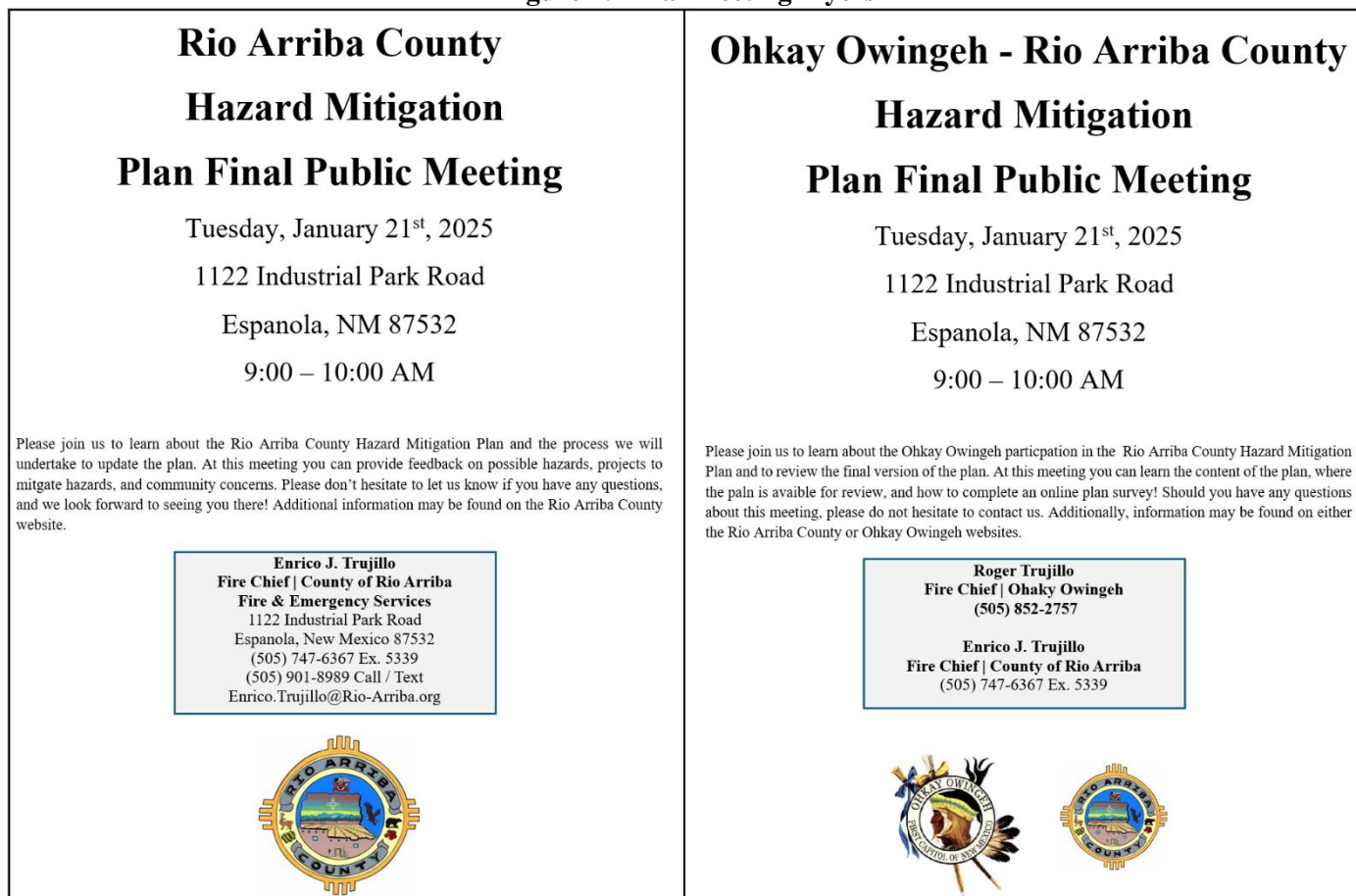
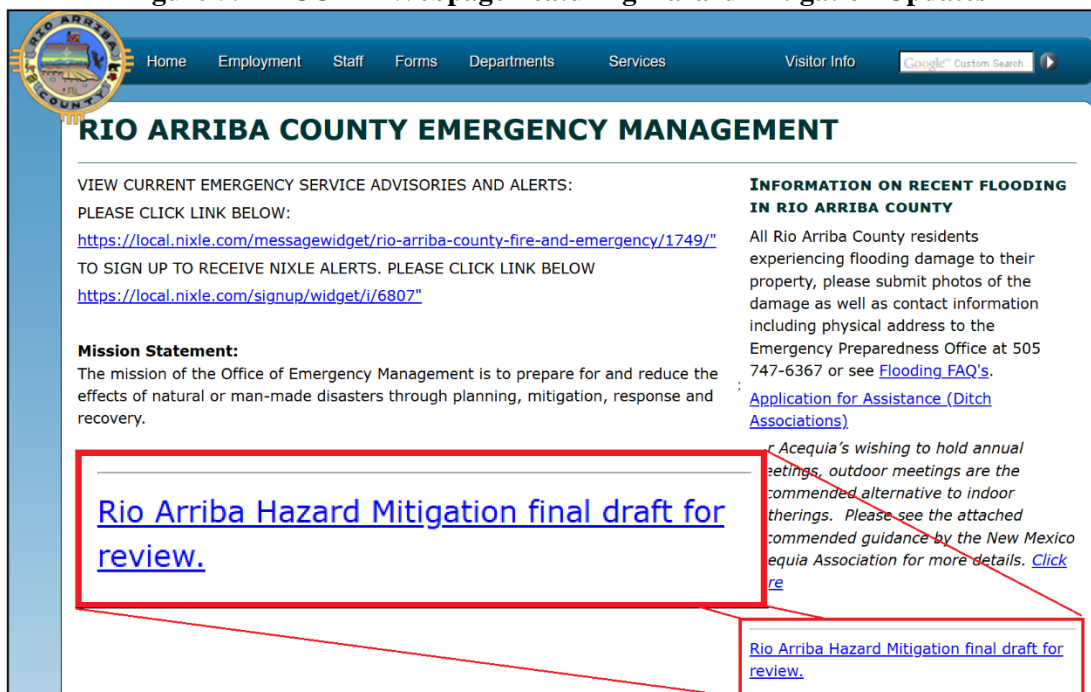
<div><h2>Rio Arriba County Hazard Mitigation Plan Kickoff Meeting</h2><p>Friday, June 21st, 2024 Alcalde Community Center 26 County Road 41A, Alcalde NM 1:30PM – 2:30 PM</p><p>Please join us to learn about the Rio Arriba County Hazard Mitigation Plan and the process we will undertake to update the plan. At this meeting you can provide feedback on possible hazards, projects to mitigate hazards, and community concerns. Please don't hesitate to let us know if you have any questions, and we look forward to seeing you there! Additional information may be found on the Rio Arriba County website.</p><div><p>Enrico J. Trujillo Fire Chief County of Rio Arriba Fire & Emergency Services 1122 Industrial Park Road Española, New Mexico 87532 (505) 747-6367 Ex. 5339 (505) 901-8989 Call / Text Enrico.Trujillo@Rio-Arriba.org</p></div></div>	<div><h2>Ohkay Owingeh - Rio Arriba County Hazard Mitigation Plan Kickoff Meeting</h2><p>Friday, June 21st, 2024 Alcalde Community Center 26 County Road 41A, Alcalde NM 1:30PM – 2:30 PM</p><p>Please join us to learn about the Ohkay Owingeh participation in the Rio Arriba County Hazard Mitigation Plan and the process we will undertake to update the plan. At this meeting you can provide feedback on possible hazards, projects to mitigate hazards, and community concerns. Please don't hesitate to let us know if you have any questions, and we look forward to seeing you there! Additionally, information may be found on either the Rio Arriba County or Ohkay Owingeh websites. ■</p><div><p>Aaron Miller Fire Chief Ohaky Owingeh (505) 852-2757</p><p>Enrico J. Trujillo Fire Chief County of Rio Arriba (505) 747-6367 Ex. 5339</p></div></div>
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Figure 4: Final Meeting Flyers



Along with public meetings, and to help generate community interest and participation, a parallel online outreach strategy was undertaken. Because Rio Arriba County encompasses has many rural communities, an online strategy was enacted. This allowed remote and underserved communities to participate fully in the process without having to travel long distances. Information concerning the hazard mitigation planning process, along with links to public surveys, links to meeting presentations, and recorded copies of meetings were provided through the RACOEM website.

Figure 5: RACOEM Webpage Featuring Hazard Mitigation Updates



Additionally, throughout the planning process numerous public surveys were released to allow community members to provide feedback and input on the LHMP update using a series of guided questions and open comment fields. The surveys used Google's auto translate feature to provide a host of languages to complete the forms.

Figure 6: Rio Arriba County Hazard Mitigation Public Survey

The image shows a web form titled "Rio Arriba County Hazard Mitigation Kickoff Survey". Below the title is a subtitle "Hazard Mitigation Survey". The form contains several input fields and dropdown menus. The first question is "What city do you live in (or nearest city)?" with a text input field labeled "Your answer". The second question is "Have you read, reviewed, or used the previous (2013) Hazard Mitigation Plan" with a dropdown menu labeled "Choose". The third question is "Should dam failure continue to be included in the Hazard Mitigation Plan:" with a dropdown menu labeled "Choose". The fourth question is "Should drought continue to be included in the Hazard Mitigation Plan:" with a dropdown menu labeled "Choose". On the right side of the form, there is a language translation dropdown menu titled "Language to translate into" with "English" selected. A list of other languages is visible, including Afrikaans, Akan, Albanian, Amharic, Arabic, Armenian, Assamese, Aymara, Azerbaijani, Bambara, Bangla, Basque, Belarusian, Bhojpuri, Bosnian, Bulgarian, Burmese, Catalan, Cebuano, Central Kurdish, Chinese (Simplified), Chinese (Traditional), Corsican, Croatian, Czech, Danish, Divehi, Dogri, Dutch, and English.

Input from the general public provided the MPC with a clearer understanding of local concerns, helped confirm identified hazards, helped shape proposed mitigation actions, and provided elected officials with a guide and tool to set local, regional, and ordinances and regulations. This public outreach effort was also an opportunity for adjacent jurisdictions and entities to be involved in the planning process. Additionally, as citizens were made more aware of potential hazards and the local process to mitigate against their impacts, it was believed that they would take a stronger role in making their homes, neighborhoods, schools, and businesses safer from the potential effects of natural hazards. Comments and feedback from the surveys are both incorporated in this LHMP and are included in Appendix B.

Public Comment: *Thank you for caring for this community.*

2.11 Planning Meetings

Numerous in-person meetings were conducted for the 2025 LHMP update. All of the meetings were held in a publicly accessible location and advertised as open to the public. These meeting were conducted to discuss the mitigation planning process as well as gain public support and input for the plan update. The following is a brief synopsis of those meetings.

- **LHMP Update Kick-Off and Public Information Meeting – June 21, 2024:** Rio Arriba County hosted a kick-off meeting for the MPC, stakeholders, and the public. The meeting was used to present the general structure and timeline for the LHMP process, discuss jurisdictional participation requirements, present data concerning changing demographics and development, review and discuss identified hazards that could impact the region, and present next steps. During the meeting, MPC members, plan stakeholders, and the public were invited to voice any concerns, ask questions, and provide input on the mitigation plan update. Additionally, MPC members were tasked with collecting contact information, and advised of future data collection requirements such as hazard history, facility information, and other pertinent information from participating jurisdictions.
- **LHMP Capability Review, and Mitigation Strategy Review Meeting – November 19, 2024:** Rio Arriba County had a virtual planning meeting for the MPC. Attendees reviewed and revised, as necessary, the hazards list and vulnerability assessment. MPC members also reviewed the mitigation strategy to ensure it was in-line with the current planning environment.
- **LHMP Update Final Review Meeting – January 21, 2025** Rio Arriba County hosted a public final plan review meeting for the MPC, stakeholders, and the public. At the meeting, MPC members, jurisdictional representatives, plan stakeholders, and the public were invited to voice any concerns, ask questions, and provide input on the mitigation plan update. Additionally, members of the public were invited to review a draft copy of the LHMP update posted to jurisdictional and county websites for two weeks prior to the final meeting, and prior to its submission to FEMA Region VI.

Formal meetings were supplemented with planning calls and frequent email communications

2.12 Planning Document Resources

The hazard mitigation plan is an overarching document that is both comprised of, and contributes to, various other jurisdictional plans. In creating this plan, all the planning documents identified below were consulted and reviewed, often extensively. In turn, when each of these other plans is updated, they will be measured against the contents of the hazard mitigation plan.

Below is a list of the various planning efforts, sole or jointly administered programs, and documents reviewed and included in this hazard mitigation plan. While each plan can stand alone, their review and functional understanding was pivotal in the development of this plan and further strengthens and improves a jurisdiction's resilience to disasters.

- **2013 Rio Arriba County Hazard Mitigation Plan**
The previous LHMP has been reviewed and is incorporated throughout this plan per FEMA requirements.
- **2023 New Mexico State Hazard Mitigation Plan**

Completed by the NMDHSEM, this plan was utilized to provide the framework for hazard mitigation. This plan set a baseline for standards and practices for hazard mitigation planning and was used as a resource for information and data.

- **2011 and 2024 (in progress) Rio Arriba County General Plan, City of Chama General Plan, 2017 City of Espanola Comprehensive Plan, and the 2000 Ohkay Owingeh Capital Projects Plan:**
These plans provide a local government's long-term framework for future growth and development. All specific plans, subdivisions, public works projects, and zoning decisions must be consistent with the general plan. These plans provided background information on the county and jurisdictions, information on risk and vulnerabilities, and a review of existing policies related to hazards and mitigation.
- **2017 Community Wildfire Protection Plan**
Created in collaboration with local governments, fire departments, and relevant stakeholders to address the risk of wildfire in the county. The primary goals are to enhance wildfire preparedness, reduce the risk of wildfire to life, property, and critical infrastructure, and improve community resilience.
- **2017-2022 East Rio Arriba County Soil and Water Conservation District Land and Resource Use Plan and Policy**
This plan identifies and applies goals, objectives, and policies to the state and federal regulatory framework that governs the management of private, state, and federal land and the rangeland, soil, water, and wildlife resources. The plan guides the County, private, state, and federal decision makers in addressing federal and state natural resource management issues.
- **2023 Rio Arriba County Emergency Operations Plans**
This plan is used to develop procedures for the protection of personnel, equipment, and critical records to help determine existing established policies that ensure the continuity of government and essential services during and after disasters.
- **2022 Ohkay Owingeh Land Use Master Plan**
A comprehensive document that guides the long-term development and management of land for the Ohkay Owingeh. This plan helps guide future development and promotes sustainable policies.
- **Planning and Zoning Documents and Ordinances**
Planning and zoning ordinances are tools used by local governments to regulate land use and development within their jurisdictions. These ordinances are essential for implementing a community's land development plan and ensuring orderly growth and development. These documents were reviewed, assessed, and cataloged to compile each participating jurisdiction's capabilities.

2.13 Technical Resources

A variety of technical resources during plan development. These technical resources were instrumental in completing an accurate vulnerability and risk assessment, and include:

- **FEMA Digital Flood Insurance Rate Maps:** FEMA's National Flood Hazard Layer data was instrumental in mapping floodplain locations and estimating potential flood impacts and loss estimates.
- **FEMA National Risk Index (NRI):** An online mapping application that identifies communities most at risk to natural hazards. The mapping service visualizes natural hazard risk metrics and includes data about expected annual losses from natural hazards, social vulnerability, and community resilience. The NRI's interactive web maps are at the county and Census tract level and made available via GIS services for custom analyses.
- **FEMA Resilience Analysis and Planning Tool (RAPT):** FEMA and Argonne National Laboratory created RAPT to support state, local, tribal, territorial analysis in identifying focus areas for building resilience, response, and recovery capabilities. RAPT is a geographic information system web map tool with clickable layers of community resilience indicators, infrastructure locations, and hazard data.
- **Homeland Infrastructure Foundation-Level Data (HIFLD)**
A program managed by the U.S. Department of Homeland Security (DHS) that provides authoritative geospatial data for use by government agencies, emergency responders, and other authorized users involved in homeland security, emergency management, and critical infrastructure protection. The primary goal of HIFLD is to support homeland defense, security, and emergency preparedness missions by offering high-quality, reliable geospatial information.

- **National Oceanic and Atmospheric Administration (NOAA)/National Centers for Environmental Information (NCEI):** Provided weather data and historical events occurrence data.
- **U.S. Army Corps of Engineers (USACE):** Provided dam and flood control data.
- **U.S. Department of Agriculture (USDA):** Provided drought and agricultural data.
- **U.S. Geological Survey:** Provided geologic hazard occurrence and probability data.
- **National Weather Service (NWS):** Provided meteorological and storm event occurrence and probability data.
- **U.S. Drought Monitor:** Provided drought occurrence and intensity data.
- **New Mexico Geological Society:** Provided data about Rio Arriba County's geology and seismology.
- **FEMA Map Service Center:** The official public source for flood hazard information produced in support of the National Flood Insurance Program (NFIP).
- **BIA:** The BIA provides access to geographic information system data and other mapping tools that are vital for assessing hazards such as floods, wildfires, and earthquakes. This data helps tribes in creating detailed maps that identify areas at risk and plan appropriate mitigation measures.
- **United States Census Bureau:** Data concerning populations, socially vulnerable populations, and housing.
- **NMDHSEM:** LHMP planning guidance and technical support.

Section 3 – Regional Profile and Development Trends

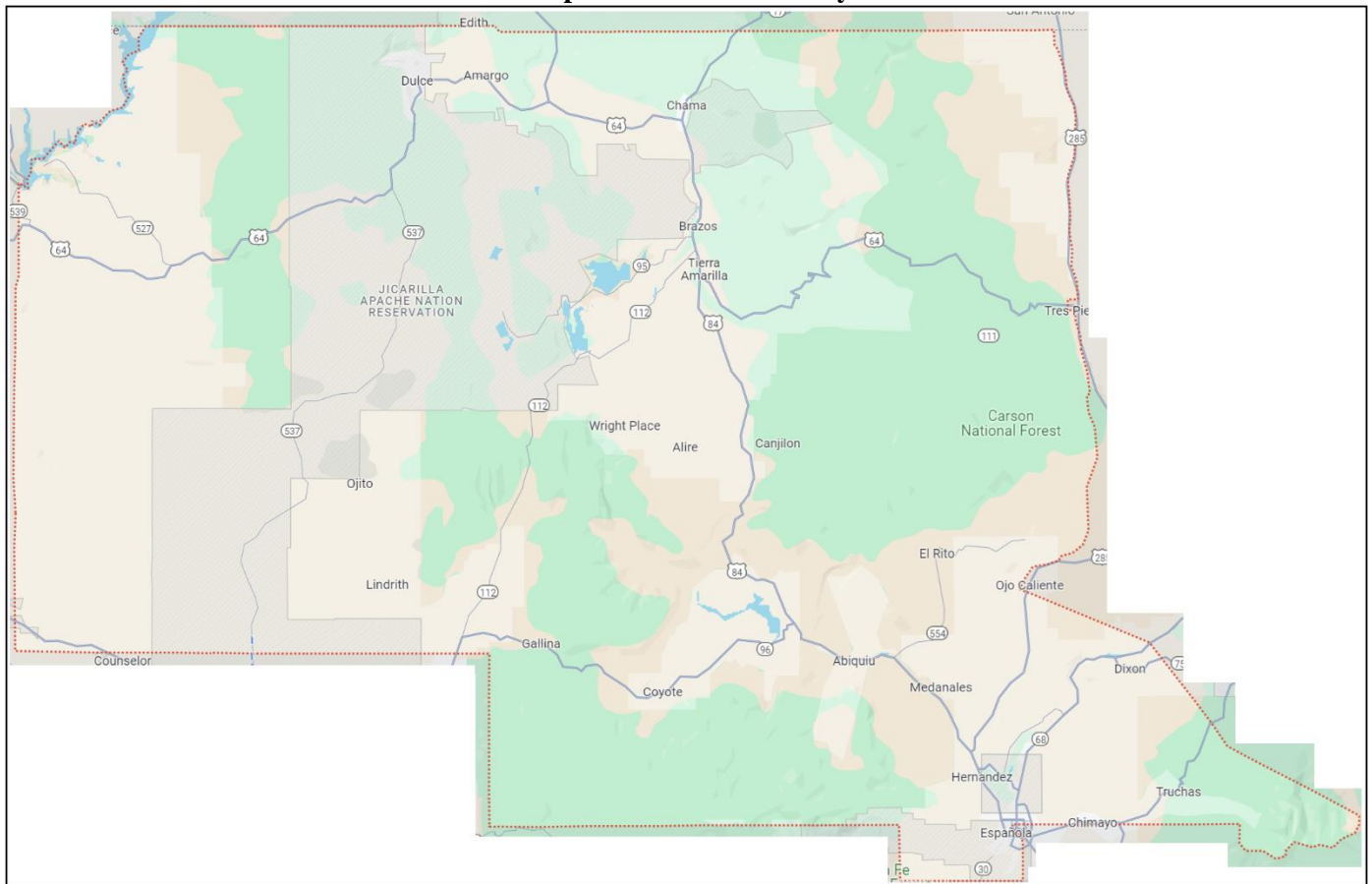
3.1 Introduction

Data concerning development trends and conditions is of great importance in determining regional and local risk and vulnerability to identified hazards, especially in locations which are susceptible to identified hazards. In general, any increase in population or development in hazard susceptible areas tends to increase both the risk and the vulnerability to that hazard. As such, the information presented in this chapter details relevant population and building statistics for Rio Arriba County. Details concerning participating jurisdictions may be found in their specific Annex. This data will then be used to determine and refine potential hazard vulnerability in succeeding sections.

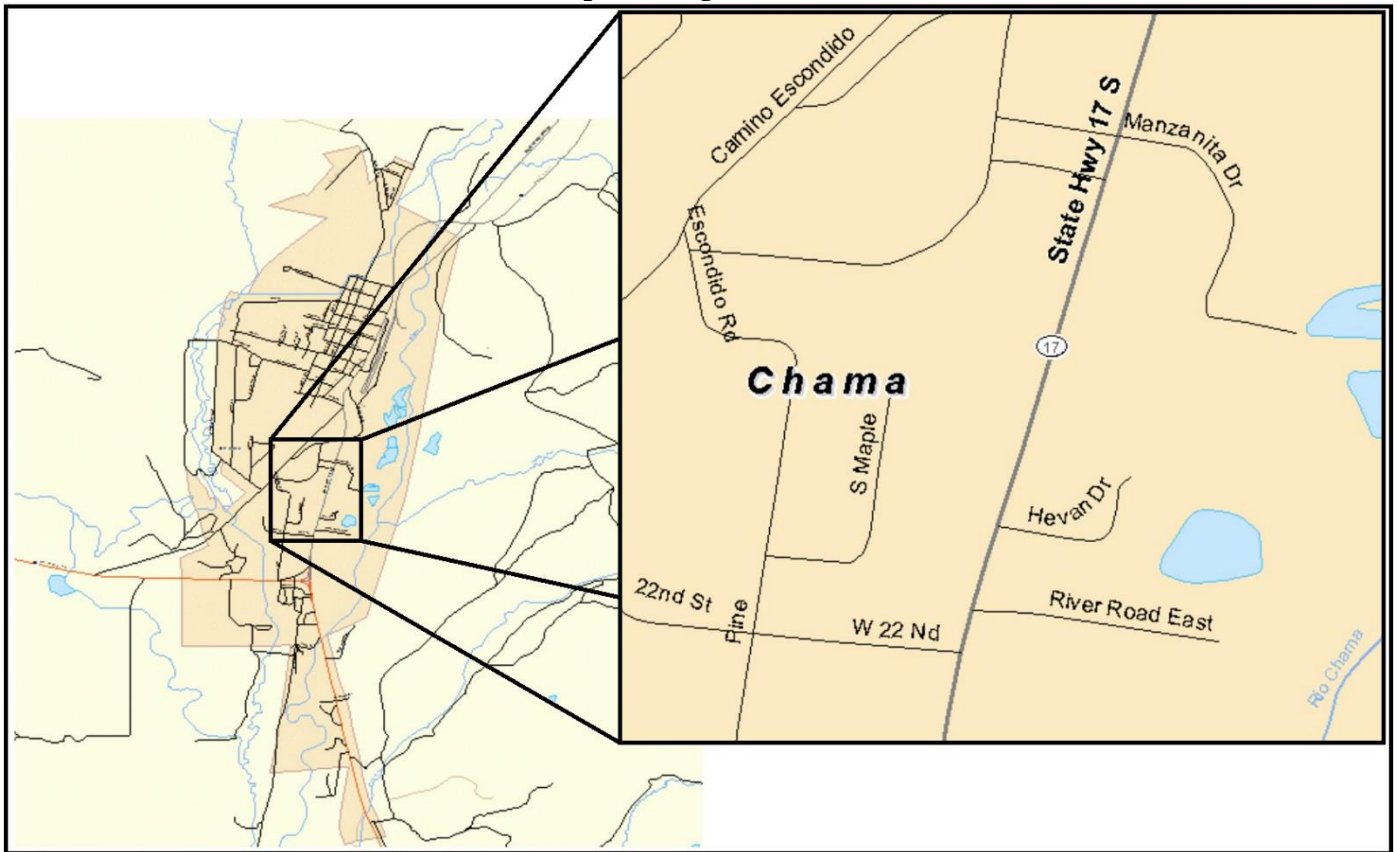
3.2 Jurisdictional Maps

The following map details the locations of Rio Arriba County and participating jurisdictions:

Map 1: Rio Arriba County

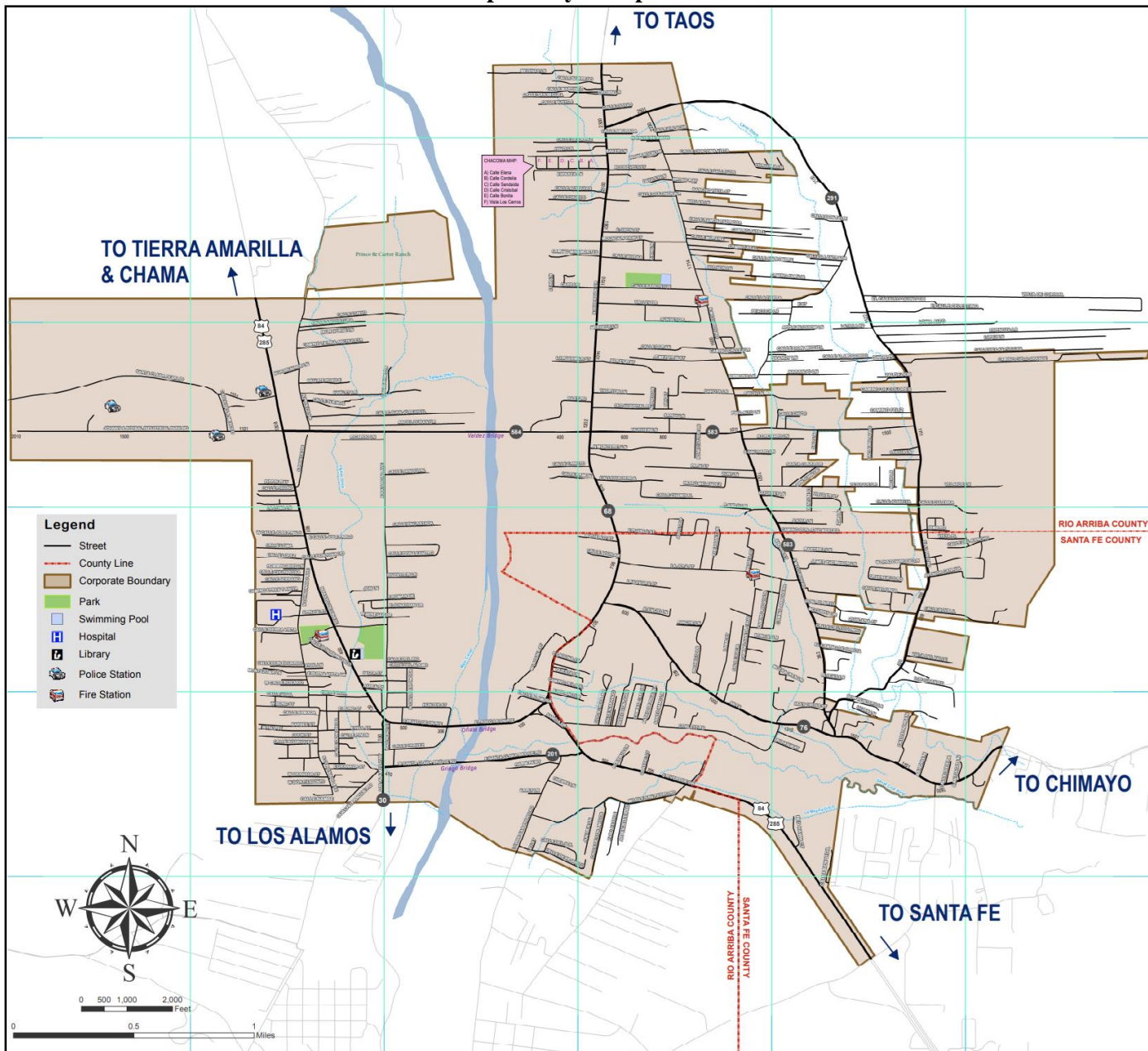


Map 2: Village of Chama



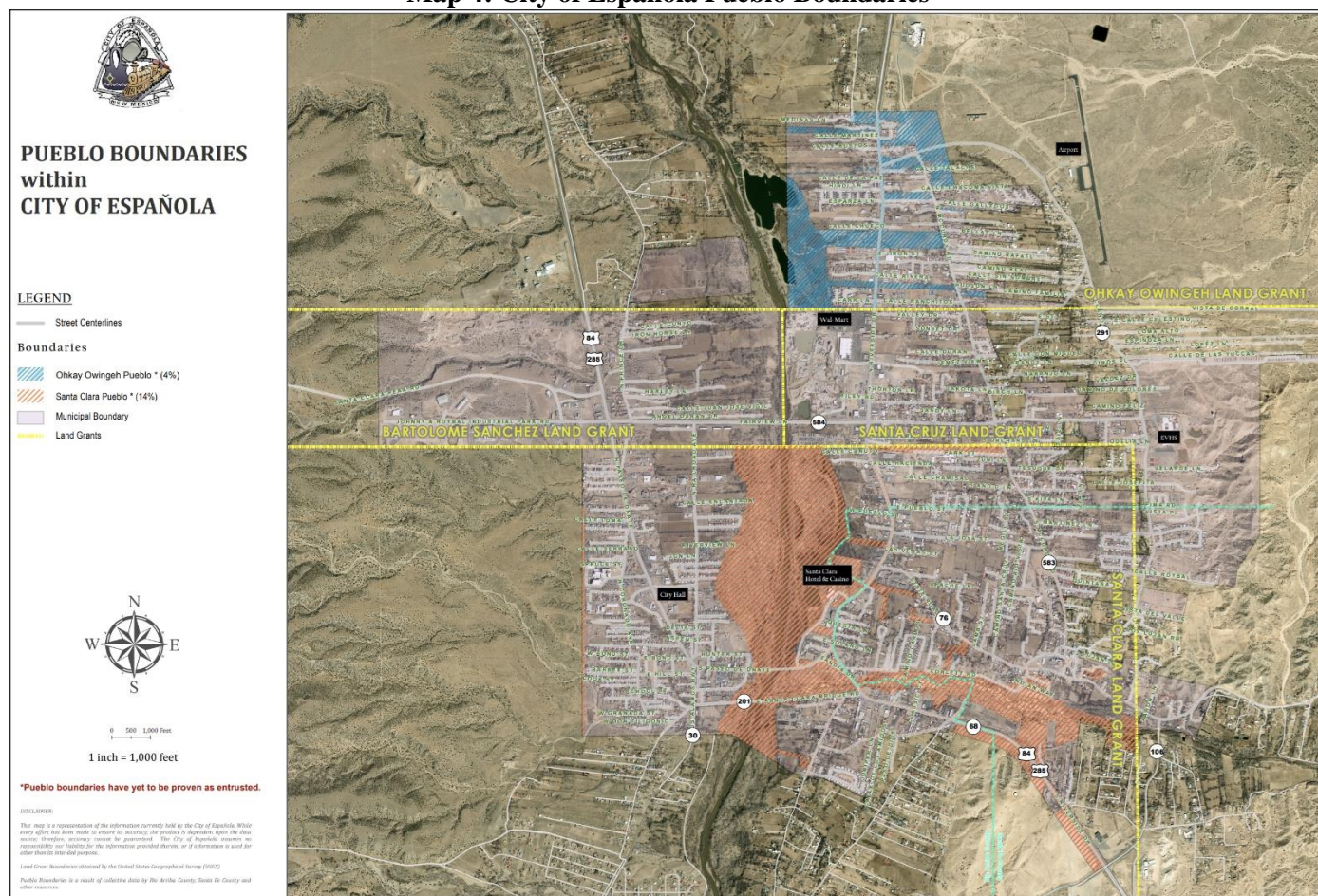
Source: Village of Chama

Map 3: City of Espanola



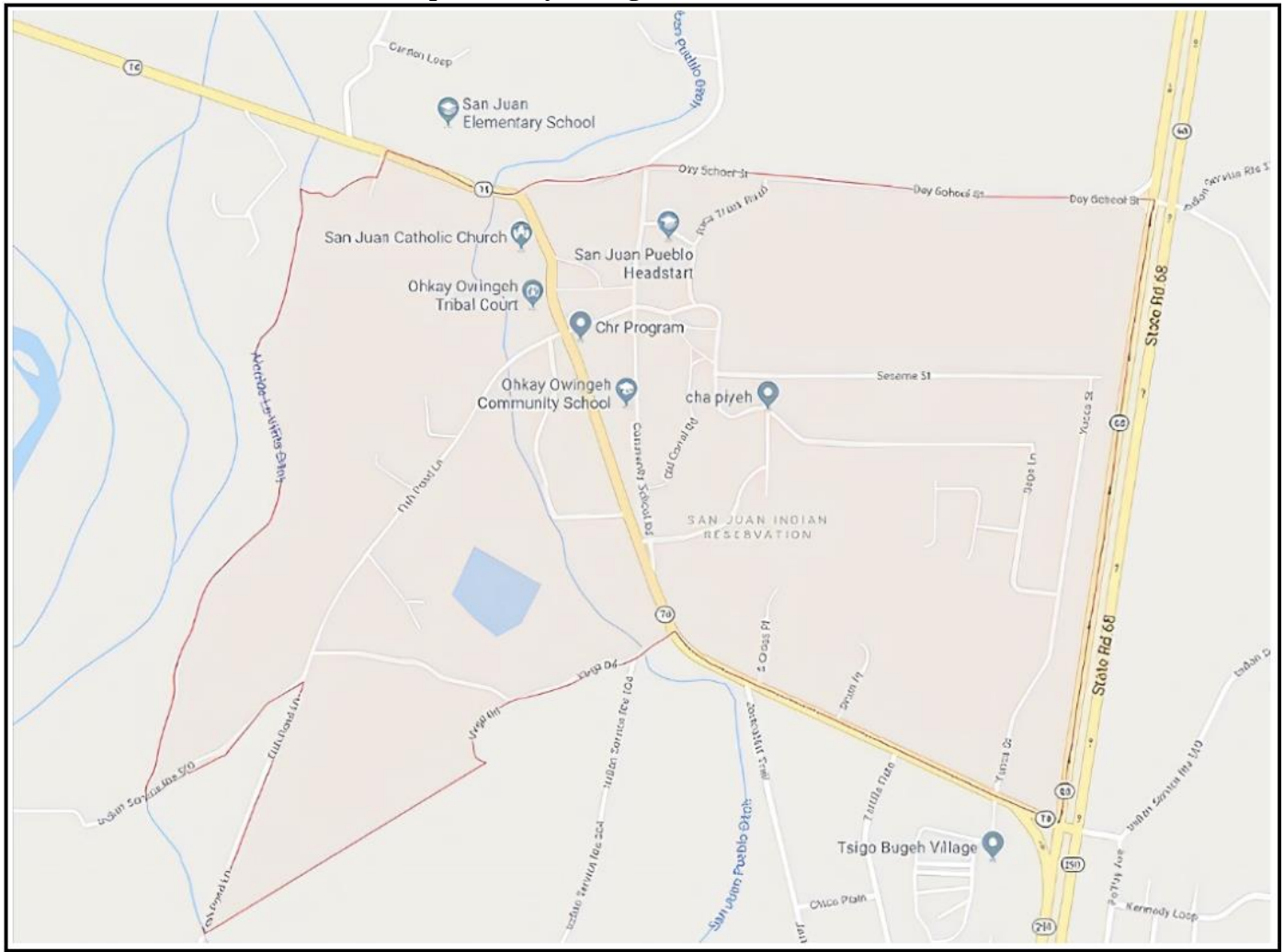
Source: City of Espanola

Map 4: City of Espanola Pueblo Boundaries



Source: City of Espanola

Map 5: Ohkay Owingeh Pueblo Boundaries



Source: Ohkay Owingeh

3.3 Population Data

The following table, and associated charts, present population data for Rio Arriba County and participating jurisdictions:

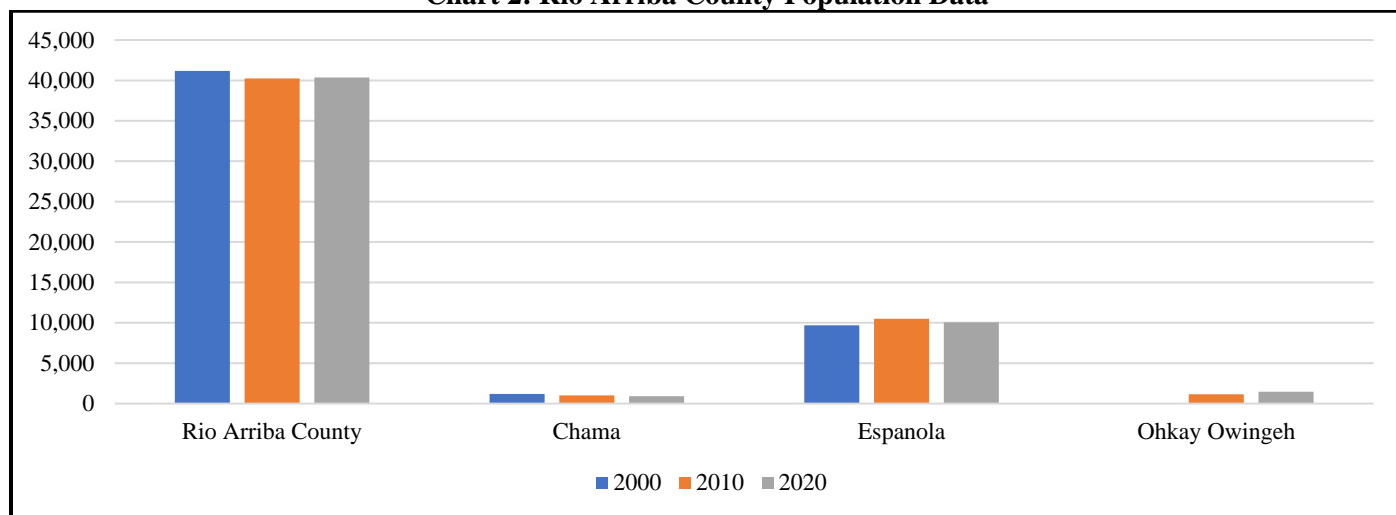
Table 4: Rio Arriba County Population Data

Jurisdiction	Population			Percentage Population Change 2000-2020	Total Land Area (Sq. Mi.)	Population Density
	2000	2010	2020			
Rio Arriba County	41,190	40,246	40,363	-2.0%	5,896.0	7
Chama	1,199	1,022	917	-23.5%	2.6	353
Espanola	9,688	10,495	10,071	4.0%	21.9	460
Ohkay Owingeh	-	1,143	1,464	28.1%	0.03	48,800

Source: US Census Bureau

-: No data

Chart 2: Rio Arriba County Population Data



Source: US Census Bureau

3.4 Socially Vulnerable and At-Risk Populations

As a subset of the population data, Rio Arriba County has socially vulnerable and at-risk populations, populations that may have difficulty with medical issues, poverty, extremes in age, and communications due to language barriers. Several principles may be considered when discussing potentially at-risk populations, including:

- Not all people who are considered at risk are at risk
- Outward appearance does not necessarily mark a person as at risk
- The hazard event will, in many cases, affect at risk population in differing ways

The National Response Framework defines at risk populations as "populations whose members may have additional needs before, during, and after an incident in functional areas, including but not limited to: maintaining independence, communication, transportation, supervision, and medical care."

Public Comment: *I have concerns about protecting the elderly in our community.*

Identifying socially vulnerable populations is a cornerstone of effective hazard mitigation planning because it helps ensure that all community members are protected. Socially vulnerable groups often face heightened challenges in preparing for, responding to, and recovering from disasters. By recognizing these populations, future mitigation efforts can design targeted interventions, such as accessible evacuation routes, culturally appropriate communication strategies, and prioritized resource distribution, to reduce risks and improve outcomes. Addressing social vulnerabilities also fosters equity, ensuring that no group bears a disproportionate share of a disaster's impacts.

The following tables presents information on potential at risk populations within Rio Arriba County and participating jurisdictions using 2020 census data:

Table 5: Rio Arriba County Vulnerable Population Data

Jurisdiction	Population 5 and Under	Population 65+	Speaking Language Other Than English	Living Below Poverty Level	Disability, Under the Age of 65
Rio Arriba County	2,543	3,229	24,097	9,203	2,815
Chama	0	84	474	151	156
Espanola	735	806	5,751	2,357	745
Ohkay Owingeh	30	122	1,216	301	-

Source: US Census Bureau

-: No data

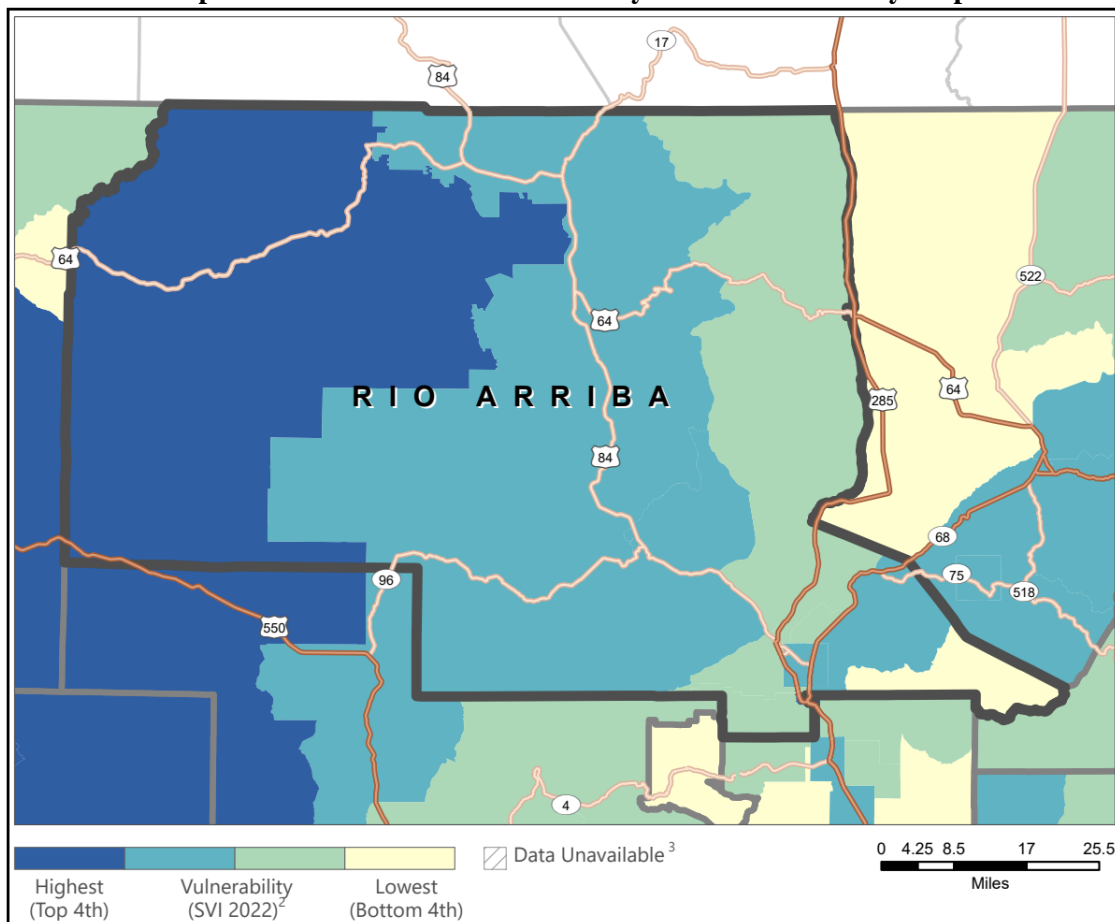
Table 6: Rio Arriba County Socially Vulnerable and At-Risk Populations as Percentage of Total Population

Jurisdiction	Percentage of Population Age Five and Under	Percentage of Population Age 75+	Percentage of Population Speaking Language Other Than English	Percentage of Population Living Below Poverty Level	Percentage of Persons with a Disability, Under the Age of 65
Rio Arriba County	6.2%	7.8%	58.5%	22.3%	6.8%
Chama	0.0%	9.2%	51.7%	16.5%	17.0%
Espanola	7.3%	8.0%	57.1%	23.4%	7.4%
Ohkay Owingeh	2.1%	8.3%	83.1%	20.6%	-

Source: US Census Bureau

-: Data unavailable

The Centers for Disease Control's Social Vulnerability Index Map shows the relative social vulnerability of communities based on factors such as socioeconomic status, household composition, disability, minority status, language, housing type, and transportation access. This map highlights areas where populations may have increased difficulty preparing for, responding to, and recovering from the impacts of hazard events. The following map helps identify vulnerable populations that may require additional resources and targeted support during mitigation planning and response efforts. By integrating this data, participating jurisdictions can prioritize investments, tailor outreach strategies, and ensure equitable distribution of resources to reduce disaster impacts on those most at risk.

Map 6: FEMA NRI Rio Arriba County Social Vulnerability Map

Source: CDC

A Community Disaster Resilience Zone is a designated area that has been identified as particularly vulnerable to natural disasters and other hazards. The goal of establishing such zones is to focus resources, planning efforts, and mitigation strategies on areas that need the most support to improve their resilience to disasters. These zones are typically selected based on factors such as the frequency and severity of past disasters, the level of community vulnerability, and the

potential impact of future events. Communities designated as Community Disaster Resilience Zone can receive increased financial and technical assistance to plan and implement resilience projects. For example, they are eligible for Building Resilient Infrastructure and Communities grant funds at an increased federal cost share of up to 90%, relative to the baseline of up to 75%. As of this plan, no communities within Rio Arriba County have received this designation.

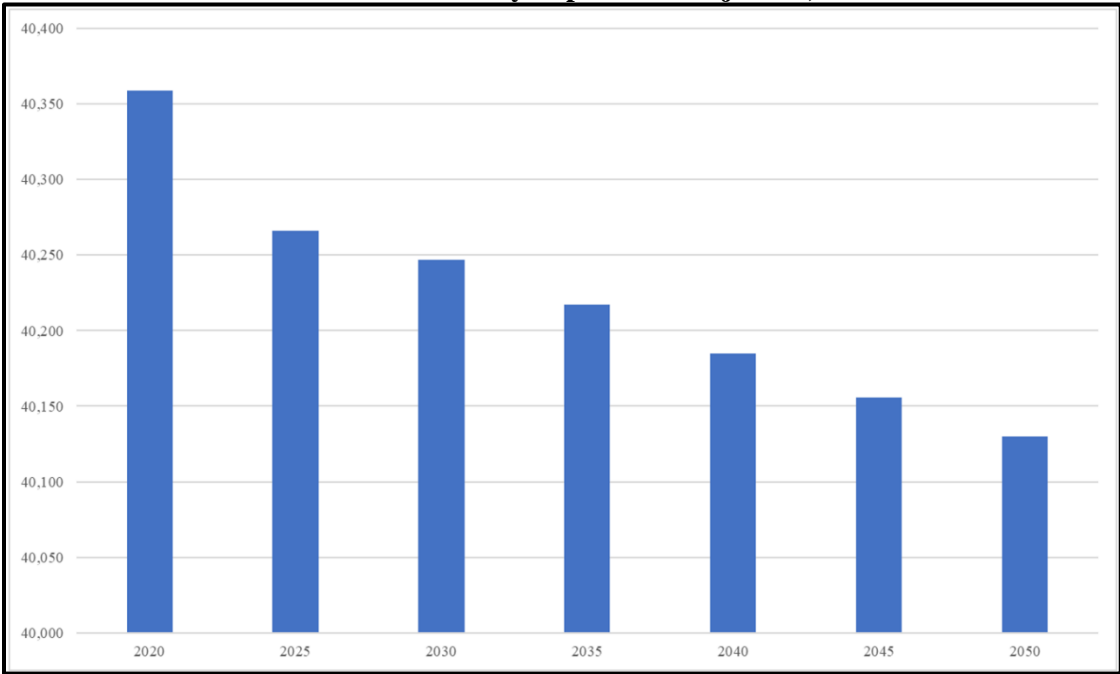
3.5 Regional Population Migration

Rio Arriba County is experiencing consistent population decline as people increasingly migrate from rural areas to urban centers. This transformation reflects broader demographic trends witnessed across the United States. Demographic research indicates that this migration is occurring due to the following factors:

- **Economic Opportunity:** A primary driver of the population movement from rural to urban areas is the quest for better economic prospects. Urban centers such as Sacramento offer a diverse range of employment opportunities in sectors like manufacturing, healthcare, finance, and technology. These opportunities often come with higher wages and better access to educational and healthcare facilities compared to rural areas.
- **Access to Education and Training:** Urban centers are often home to educational institutions, including colleges, universities, and vocational schools. Young people from rural areas often migrate to these urban settings to pursue higher education and vocational training.

The rural-to-urban population movement has significant implications for Rio Arriba County. Communities may experience declining populations, school closures, and reduced economic activity. The following chart, using data from the University of New Mexico Geospatial and Population Studies, indicates a decreasing population for Rio Arriba County through 2050.

Chart 3: Rio Arriba County Population Projection, 2020-2050



Source: University of New Mexico Geospatial and Population Studies

3.6 Housing Data

Closely tracking population data, but tending to lag population changes, housing data is a good indicator of changing demographics and growth. The following table and associated charts, using data from the U.S. Census, present occupied housing unit information for Rio Arriba County.

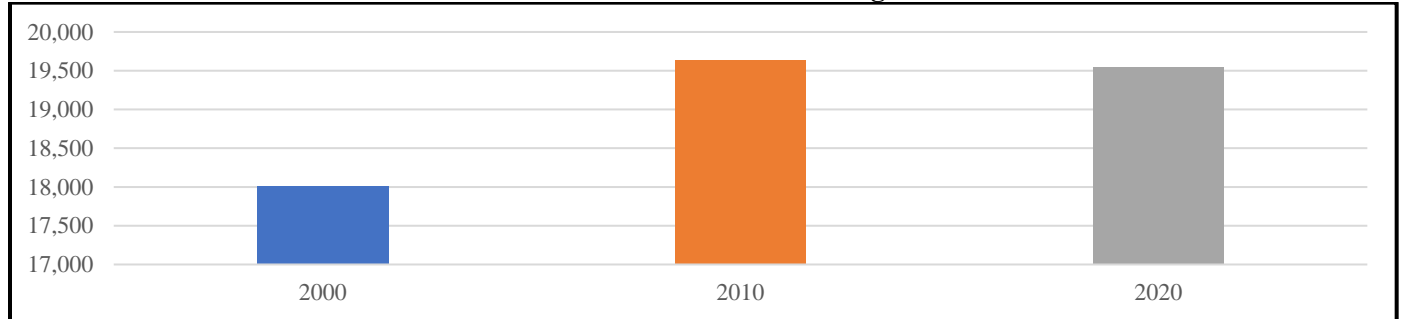
Table 7: Rio Arriba County Housing Data

Jurisdiction	2000		2010		2020		2000 - 2020	
	Total	Occupied	Total	Occupied	Total	Occupied	Numeric Change	Percent Change
Rio Arriba County	18,016	15,044	19,638	15,768	19,545	16,122	1,529	8.5%
Chama	656	491	596	454	550	410	-106	-16.2%
Espanola	4,077	3,769	4,432	3,987	4,574	4,177	497	12.2%
Ohkay Owingeh	-	-	442	394	479	463	37 (2010-2020)	8.4% (2010-2020)

Source: US Census Bureau

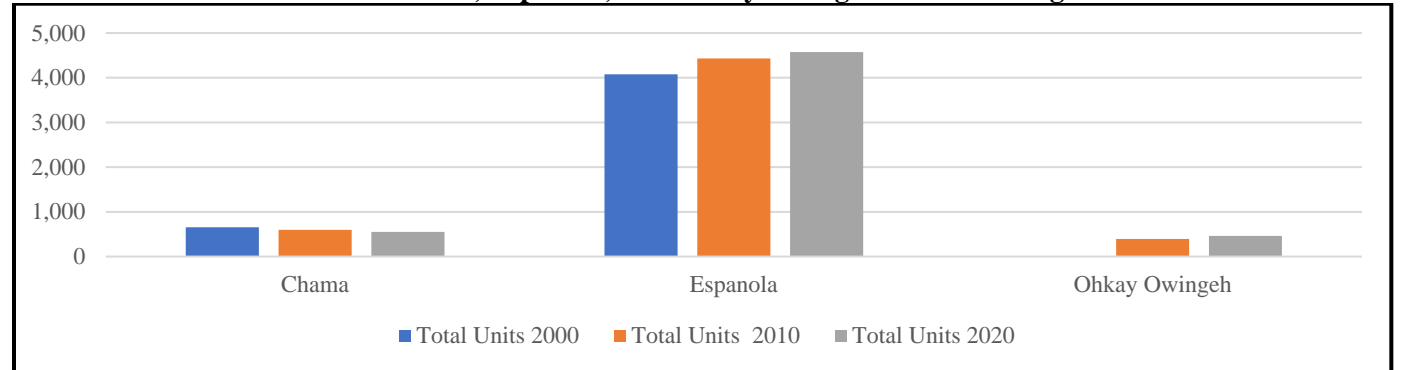
:- No data

Chart 4: Rio Arriba Total Housing Units



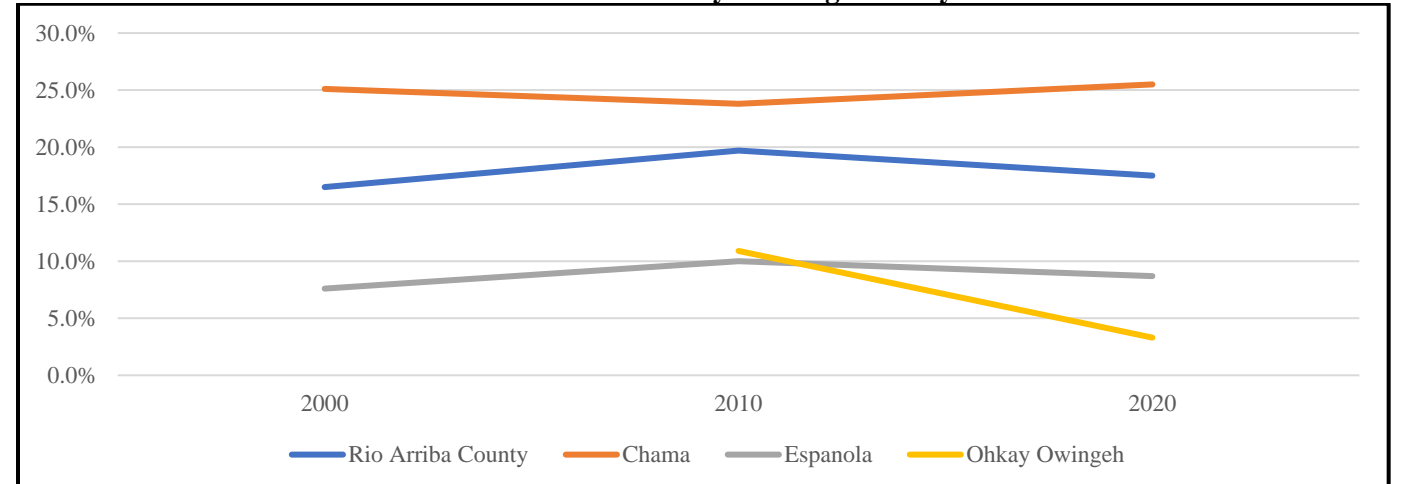
Source: US Census Bureau

Chart 5: Chama, Espanola, and Ohkay Owingeh Total Housing Units



Source: US Census Bureau

Chart 6: Rio Arriba County Housing Vacancy Rates



Source: US Census Bureau

Of particular concern when considering housing data is mobile home residences. Data from the NOAA National Severe Storms Laboratory reports that people living in mobile homes are especially at risk for injury and death as even anchored mobile homes can be seriously damaged when winds gust over 80 miles per hour. Additionally, study data from Michigan State University reported that the two biggest factors related to wind event fatalities were housing quality (measured by mobile homes as a proportion of housing units) and income level. When a tornadic wind strikes, a county with double the number of mobile homes as a proportion of all homes will experience 62% more fatalities than a county with fewer mobile homes, according to the study data. The following indicates the percentage of mobile homes for each Rio Arriba County participating jurisdiction:

Table 8: Rio Arriba County Mobile Home Data

Jurisdiction	2000		2010		2020		2000 - 2020
	Total	Percentage of Total Housing Units	Total	Percentage of Total Housing Units	Total	Percentage of Total Housing Units	Numeric Change
Rio Arriba County	5,758	32.0%	7,580	38.6%	4,686	24.0%	-1,072
Chama	232	35.4%	213	35.7%	188	34.2%	-44
Espanola	1,438	35.3%	1,755	39.6%	1,244	27.2%	-194
Ohkay Owingeh	-	-	128	28.9%	63	13.2%	-65

Source: US Census Bureau

-: No data

3.7 Valuation Data

FEMA's Hazus is a nationally standardized risk modeling methodology that uses GIS-based data to identify areas with high risk for natural hazards. Hazus also details the valuation of all buildings within a county. Hazus estimates that:

- There are 21,424 buildings in the county
- 76.7% of these building are residential in nature

Data from the FEMA Hazus system indicates the total value of property within Rio Arriba County is \$6,953,000,000 (excluding contents), as detailed in the following table:

Table 9: Rio Arriba County Hazus Property Valuations

Agricultural	Commercial	Government	Industrial	Residential	Educational	Religious
\$2,417,000	\$913,870,000	\$138,800,000	\$99,379,000	\$5,331,676,000	\$457,401,000	\$9,635,000

Source: FEMA HAZUS

The Rio Arriba County Assessor's Office was contacted to determine if a valuation of properties was available for participating jurisdictions. It was determined that, due to the reporting format of available data, determining valuations for each jurisdiction was not feasible. As such, data on building valuation for participating jurisdictions was sourced from the FEMA NRI by Census tract, presented in the following table:

Table 10: Participating Jurisdiction Building Valuation

Jurisdiction	Census Tract	Building Valuation
Chama	35039000500	\$1,369,955,683
Espanola	35039940700	\$853,655,790
Ohkay Owingeh	35039944100	\$711,269,810

Source: FEMA NRI

3.8 School District Data

Children are among the most vulnerable populations during disasters, requiring special consideration in preparedness and response efforts. A community with high school enrollment typically has a significant portion of its population

dependent on schools for safety, education, and emergency support during crises. Additionally, disruptions to education during disasters can have long-term impacts on children’s well-being and development. Communities with higher school enrollment may face increased challenges in ensuring the safety and continuity of education during hazard events, making it essential to prioritize schools in mitigation planning and resource allocation.

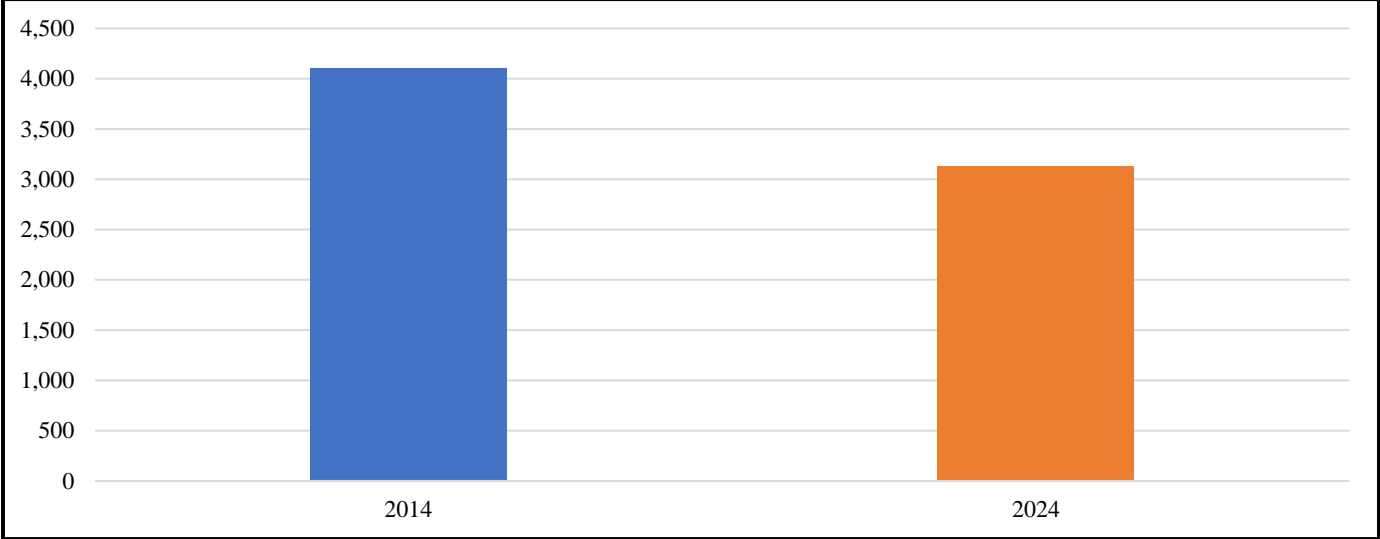
The following table presents school enrollment information from the New Mexico Public Education Department for school years 2013-2014 and 2023-2024:

Table 11: Rio Arriba County School Enrollment Information

Jurisdiction	School Name	Grades	2013-2014 Enrollment	2023-2024 Enrollment	Change, 2014 - 2024
Chama Valley	Chama Elementary	Elementary School	93	69	-24
Chama Valley	Escalante Middle/High School	High School	146	169	23
Chama Valley	Tierra Amarilla Elementary	Elementary School	106	93	-13
Espanola	Abiquiu Elementary	Elementary School	116	79	-37
Espanola	Alcalde Elementary	Elementary School	139	157	18
Espanola	Carlos F. Vigil Middle	Middle School	541	399	-142
Espanola	Chimayo Elementary	Elementary School	102	114	12
Espanola	Dixon Elementary	Elementary School	72	60	-12
Espanola	Espanola Valley High	High School	932	810	-122
Espanola	Salazar Elementary	Elementary School	337	348	11
Espanola	Hernandez Elementary	Elementary School	176	78	-98
Espanola	James Rodriguez Elementary	Elementary School	412	235	-177
Espanola	Los Ninos Elementary	Elementary School	148	66	-82
Espanola	San Juan Elementary	Elementary School	431	163	-268
Espanola	Quintana Elementary	Elementary School	255	232	-23
Espanola	Velarde Elementary	Elementary School	100	54	-46

Source: New Mexico Public Education Department

Chart 7: Rio Arriba County School Enrollment Trends



Source: New Mexico Public Education Department

3.9 Critical Facilities and Infrastructure

Critical facilities have a net positive value on the community as they contribute to the public good by facilitating the basic functions of society. These locations help maintain order, public health, education, and help the economy function. Additionally, components are integral to disaster response and recovery operations. The following is a list of considered critical facilities:

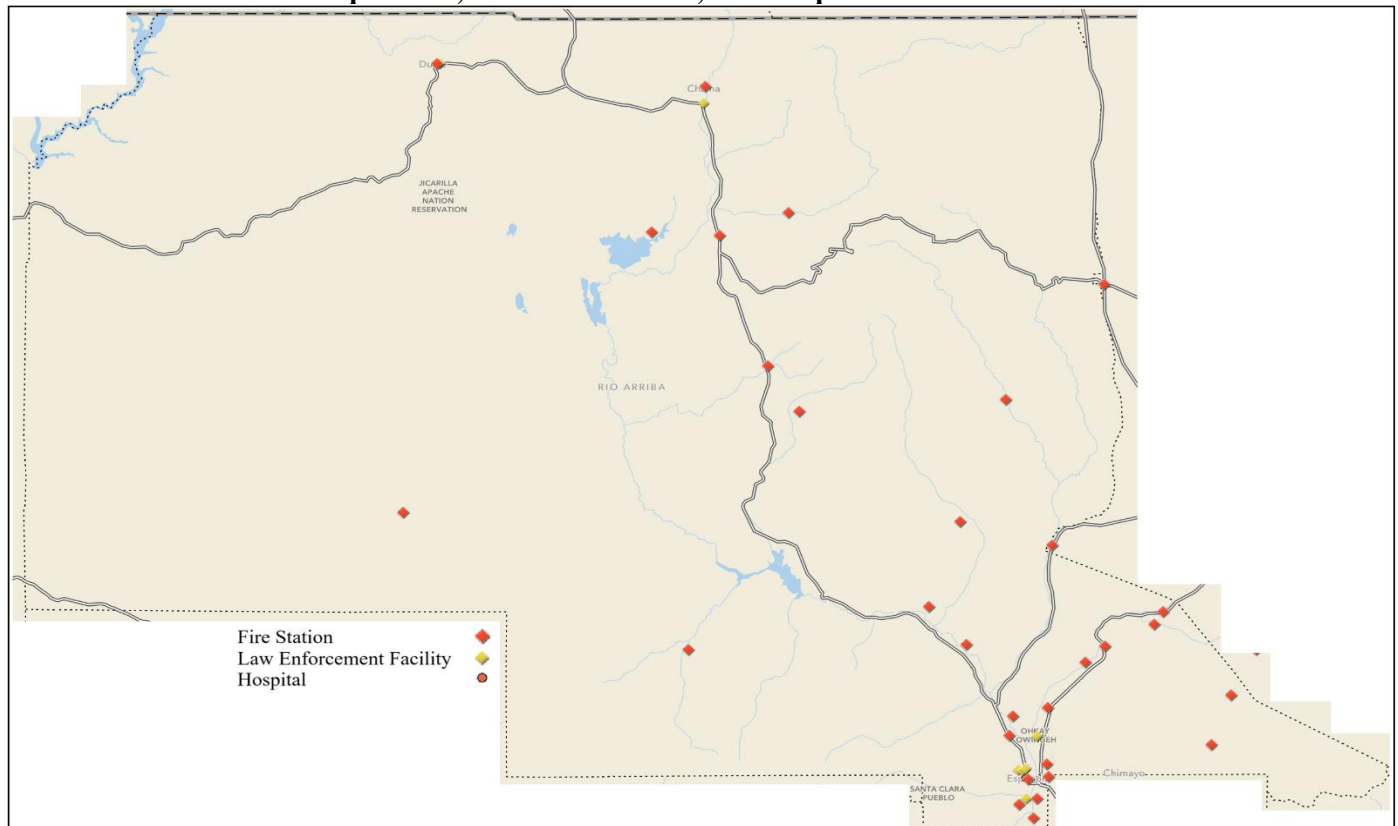
- Communication facilities
- Fire facilities
- Government facilities
- Law enforcement facilities
- Medical facilities
- Schools

Critical infrastructure refers to the essential systems, assets, and services that are vital for the functioning of society and the economy. These infrastructures are necessary for public safety, economic stability, and quality of life. If disrupted or destroyed, the impacts could be severe, affecting the community's ability to function. The following is a list of considered critical infrastructure:

- Transportation Infrastructure
- Communications
- Energy generation and regulation
- Roads
- Water and wastewater treatment

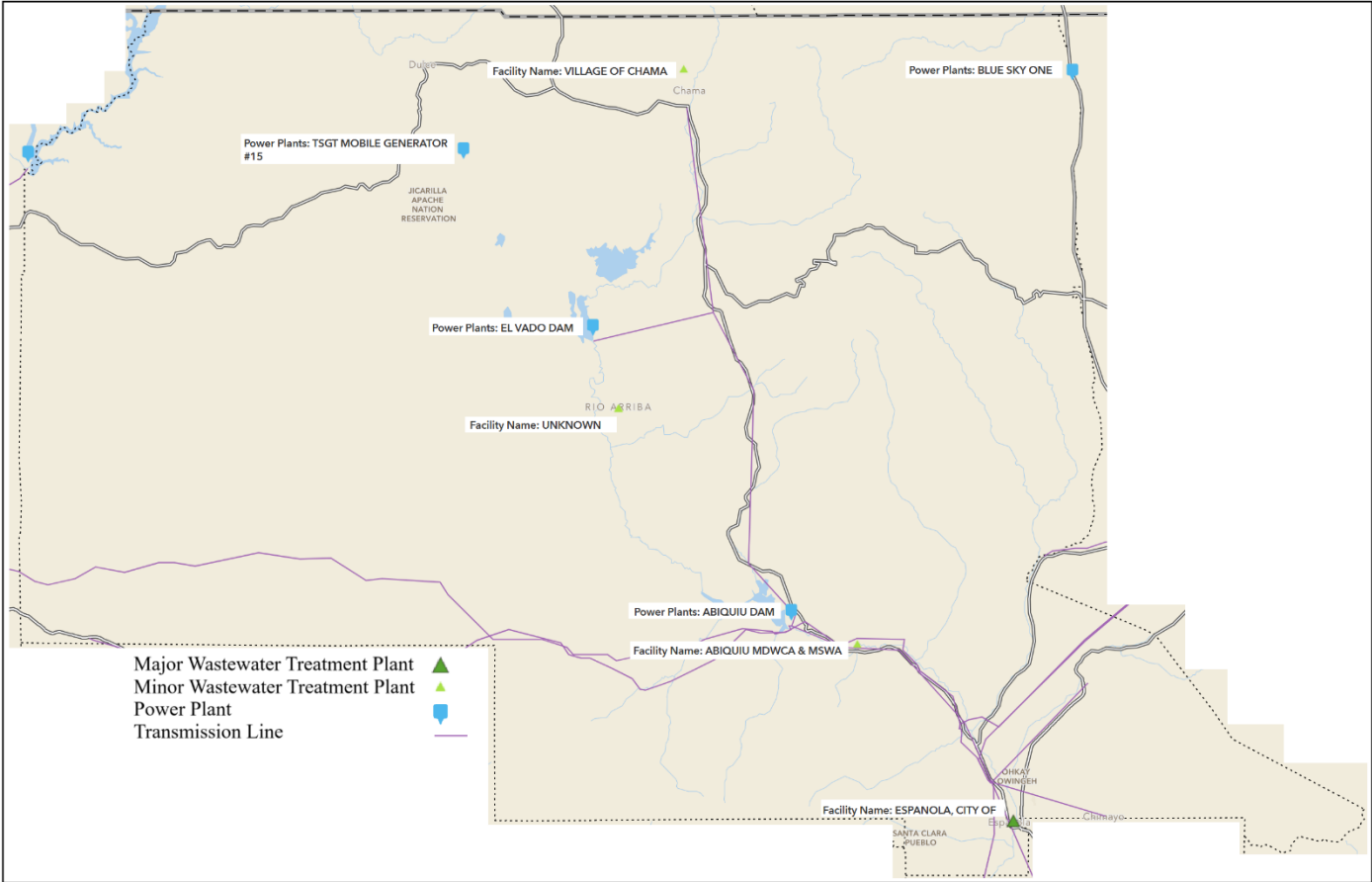
Jurisdictional GIS data was very limited concerning the location of critical facilities. The following maps break down community critical facilities and infrastructure by jurisdiction using available data:

Map7 : Fire, Law Enforcement, and Hospital Critical Facilities



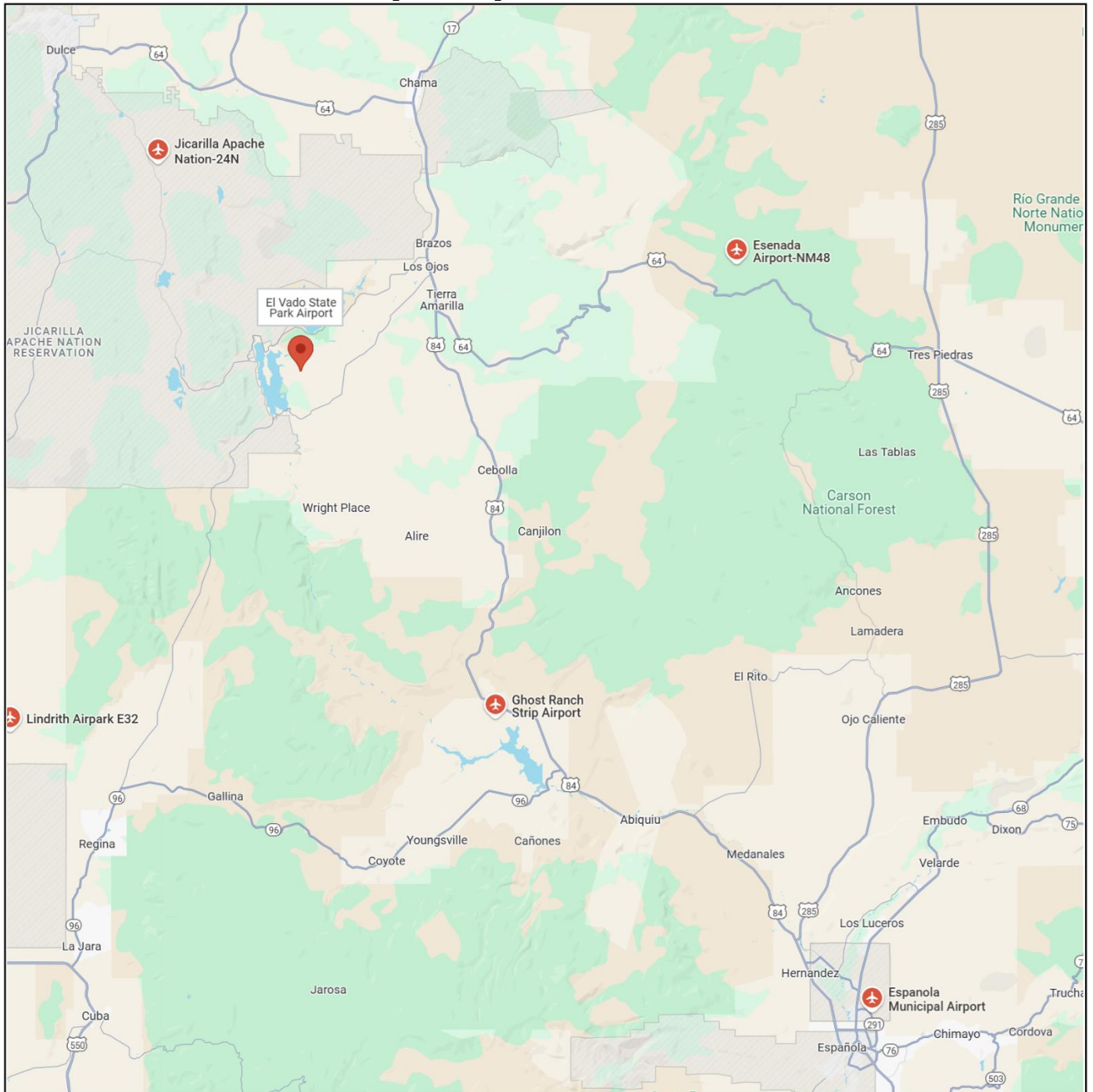
Source: FEMA RAPT

Map 8: Electrical Generation, High Capacity Transmission Lines, and Wastewater Treatment

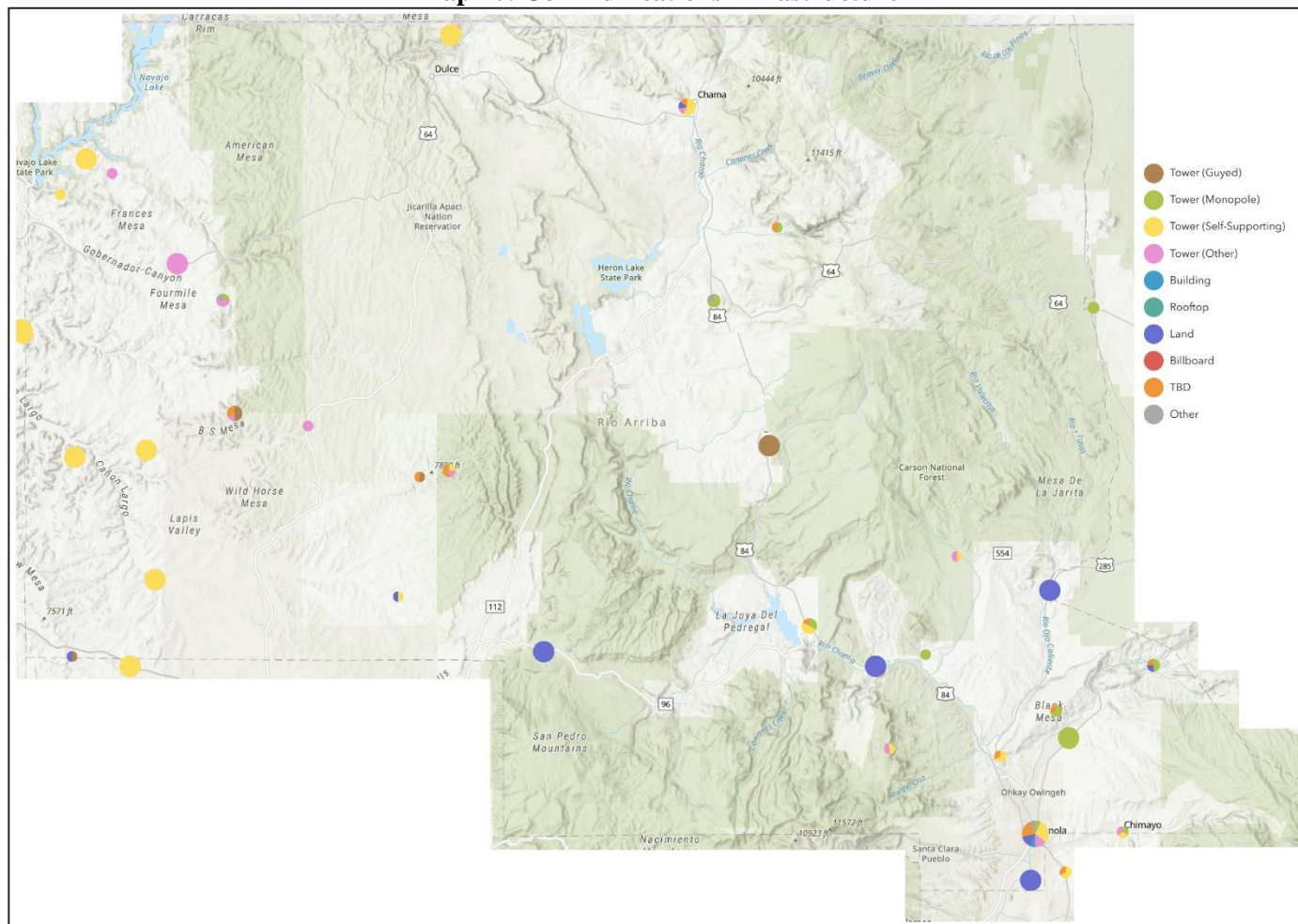


Source: FEMA RAPT

Map 9: Transportation Infrastructure



Map 10: Communications Infrastructure



Source: Tower Maps

3.10 Ohkay Owingeh Sacred Sites

Tribal sacred sites are specific locations that hold significant spiritual, cultural, or religious importance to Indigenous peoples or Native American tribes. These sites often serve as places of worship, ceremonies, or other cultural practices that are deeply rooted in the tribe's history and traditions. Sacred sites can include mountains, rivers, forests, caves, burial grounds, and other natural formations or landscapes. Key Characteristics of Tribal Sacred Sites may include:

- **Spiritual Significance:** These sites are often connected to the tribe's creation stories or ancestral spirits. They may be places where important spiritual events are believed to have occurred.
- **Cultural Practices:** Sacred sites are frequently used for ceremonies, rituals, and gatherings that are essential to the tribe's cultural identity and continuity. This can include rites of passage, healing ceremonies, or seasonal celebrations.
- **Protection and Stewardship:** Indigenous tribes often view themselves as caretakers of these sacred sites, maintaining and protecting them according to traditional practices. Many tribes advocate for legal protections to prevent desecration or destruction by external forces, such as development or resource extraction.
- **Connection to Land:** For many, the land itself is sacred, and specific sites within the land hold particular importance. This connection to the land is often holistic, encompassing physical, spiritual, and cultural dimensions.

Due to the sensitive nature of these sites, and in consultation with Tribal leaders, the Ohkay Owingeh elected not to disclose either the location or nature of these sites. However, it was determined that these sites are no more or less vulnerable to the hazards identified in this plan than non-sacred sites.

3.11 Historic Places

Historic buildings are generally more vulnerable to natural hazards due to their age, materials, and construction methods. These structures were often built before modern building codes and may lack the structural reinforcements required to withstand hazards. Additionally, the materials used in historic buildings, like old brick, wood, or mortar, may have deteriorated over time, further reducing their resilience. However, the MPC has determined that, in general, these locations are no more or less vulnerable to the identified hazards within this plan.

Preserving historic buildings poses unique challenges in hazard mitigation because retrofitting or upgrading them to meet modern safety standards must balance maintaining their historical integrity. This vulnerability underscores the importance of integrating historic preservation with hazard mitigation planning, ensuring that these culturally significant structures are protected while minimizing risks to public safety. For cultural and historic locations within Rio Arriba County the following resources were consulted:

- **National Register of Historic Places:** The official list of the United States' historic properties deemed worthy of preservation for their significance in American history, architecture, archaeology, engineering, or culture. Administered by the National Park Service under the Department of the Interior, it includes districts, sites, buildings, structures, and objects. Established by the National Historic Preservation Act of 1966, the register seeks to recognize and protect cultural heritage. While listing does not impose restrictions on private property, it provides eligibility for preservation incentives.
- **New Mexico State Register of Cultural Properties:** An official listing of sites, buildings, structures, objects, and districts deemed significant to the history, culture, architecture, or archaeology of New Mexico. Administered by the New Mexico Historic Preservation Division, the register aims to recognize and protect the state's rich heritage. Properties listed in the register are evaluated based on their historical importance, architectural merit, and cultural contributions. Inclusion in the register not only acknowledges a property's significance but also provides opportunities for preservation grants, technical assistance, and tax incentives. It also ensures that state-funded projects consider the impact on these cultural assets, promoting stewardship and sustainable preservation efforts.

The following table details properties and locations in Rio Arriba County and participating jurisdictions listed on these registers.

Table 12: Rio Arriba County Historic Places

Location	Jurisdiction	National Register	New Mexico Register
Abiquiu Mesa Grid Gardens	Abiquiu	x	x
Adams Canyon Site (LA 55824)	Abiquiu	x	x
Adolfo Canyon Site (LA 5665)	Blanco	x	x
Apodaca, Martin, Homestead	Blanco	x	
Archeological Site No. AR-03-10-02-357	Coyote	x	
Becker, George, House, Bunk House and Barn	Los Ojos	x	x
Blanton Log House	Los Ojos	x	x
Bond, Frank, House	Espanola	x	x
Boulder Fortress (LA 55828)	Blanco	x	x
Burns Lake Bungalow	Los Ojos	x	x
Burns, T. D., Store	Los Ojos		x
Burns-Kelly Store	Chama		x
Cabresto Mesa Tower Complex (LA 2138)	Blanco	x	x
Cagle's Site (LA 55826)	Blanco	x	x
Canjilon Mountain Lookout Cabin	Canjilon		x
Canyon View Ruin (LA 55827)	Blanco	x	
Casa Mesa Diablo (LA 11100)	Blanco	x	x
Casados House	Los Ojos	x	x
Castles of the Chama (AR-03-10-01-216)	Llaves	x	x

Table 12: Rio Arriba County Historic Places

Location	Jurisdiction	National Register	New Mexico Register
Cerrito Recreation Site, Abiquiu Reservoir	Abiquiu		x
Cerro Colorado Archeological District (LA 307)	Abiquiu		x
Chama Jail House	Chama		x
Chimayo Trading Post and Trujillo, E.D., House	Espanola	x	x
Christ-in-the-Desert Monastery	Ghost Ranch		x
Citadel, The (LA 55828)	Blanco	x	x
Compressor Station Ruin (LA 5658)	Blanco	x	x
Corral Canyon Pueblo Site	Espanola	x	x
Corral Mesa Cavate Pueblo Site	Espanola	x	x
Crevice Ruin (LA 13218)	Blanco	x	x
Crow Canyon Archaeological District	Blanco	x	x
Crow Canyon Site (LA 20219)	Blanco	x	x
Cultural Devs. on Pajarito Plateau in N. Cent. NM	Espanola	x	x
Cumbres & Toltec Scenic Railroad	Chama	x	x
Delgadito Pueblito	Blanco	x	x
Delgado Hall, Northern New Mexico Comm. College	El Rito	x	x
Dogie Canyon School	Counselor	x	x
Dunham Log House (Palmer-Dunham House)	Chama	x	x
East Morada at Abiquiu	Abiquiu	x	x
El Barranco Community Ditch	Los Brazos	x	x
El Buen Pastor Cemetery	Counselor	x	x
El Porvenir Community Ditch	Ensenada	x	x
El Vado Dam	Tierra Amarilla	x	x
Embudo Gauging Station	Embudo	x	x
Embudo Historic District	Embudo	x	x
Ensenada Community Ditch (NPS has Encenada)	Ensenada	x	x
Foothold Ruin (LA 9073)	Blanco	x	x
Forest Service Site No. AR-03-10-01-374	Coyote	x	
Forest Service Site No. AR-03-10-01-390	Coyote	x	
Foster Hotel (Chama Hotel)	Chama	x	x
Frances Canyon Ruin	Blanco	x	x
Franklin MacFie House	Hernandez	x	x
Fruitland Trading Company	Fruitland	x	x
Garcia Canyon Pueblito (LA 36608)	Blanco	x	x
Gavilan Mercantile Company Buildings	Lindrith	x	x
Georgia O'Keeffe Ghost Ranch House	Abiquiu	x	x
Gomez Canyon Ruin (LA 55831)	Blanco	x	x
Gomez Point Site (LA 55832)	Blanco	x	x
Gonzales, Tomas, House	Abiquiu	x	x
Gould Pass Ruin	Blanco	x	x
Haynes Trading Post Site	Counselor	x	x
Hill Road Ruin (LA 55833)	Blanco	x	x
Historic Resources of La Tierra Amarilla	Tierra Amarilla	x	x
Historic Settlement of Upper Largo Canyon	Counselor	x	x
Hooded Fireplace Ruin (LA 5662)	Blanco	x	x
Hupobi'uinge Archeological District (LA 380)	Ojo Caliente	x	x
Jaramillo, Ramon, House and Barn	Ensenada	x	x
Jicarilla Apache Historic District	Dulce	x	x
Kin Naa daa' (Maize House)	Blanco	x	x
Kin Yazhi (Little House)	Blanco	x	x
Ku'ouinge Archeological District	Chili	x	x
La Capilla de San Francisco de Asis	Estaca	x	x
La Jara Site (Vicenti Site) (LA 14318)	Dulce	x	x

Table 12: Rio Arriba County Historic Places

Location	Jurisdiction	National Register	New Mexico Register
La Puente Community Ditch	La Puente	x	x
La Puente Historic District	La Puente	x	x
Largo School Ruin (LA 5657)	Blanco	x	x
Largo-Gallina Unit House (LA 12062)	Llaves	x	x
Late Prehist. Cultural Devs. Along Rio Chama...	Espanola	x	x
Leafwater Archeological District (LA 300, LA 918)	Medanales	x	x
Los Brazos Historic District	Los Brazos	x	x
Los Luceros Hacienda	Los Luceros	x	
Los Ojos (Parkview) Historic District	Los Ojos	x	x
Los Ojos Fish Hatchery & Burns Lake Bungalow	Los Ojos	x	x
Luciano Miera Store--Homestead	Counselor	x	x
Manzanares, Tony, House	Los Ojos	x	x
Margarita Martinez Homestead	Counselor	x	x
Martin Apodaca Homestead	Counselor	x	x
Martinez, Gilbert, Barn	Los Ojos	x	x
Martinez, Margarita, Homestead	Counselor	x	
Martinez, Mathew Sr., House	Truchas		x
Martinez, Teodoro, House	Los Ojos	x	x
Mesa Prieta Petroglyphs	Velarde	x	x
Miera, Luciano,Store-Homestead	Counselor	x	
Nogales Cliff House Archaeological District	Llaves	x	x
Nuestra Senora del Rosario Church	Truchas		x
O'Keeffe, Georgia, Home and Studio NHL	Abiquiu	x	x
Old Fort Ruin	Blanco	x	x
Ortega, Victor, Cabin	Cebolla	x	
Our Lady of Lourdes Grotto	Los Ojos	x	x
Overlook Site (LA 10732)	Blanco	x	x
Palisade Archeological District (LA 3505)	Abiquiu		x
Parkview Community Ditch	Los Ojos	x	x
Pesedeuinge Archeological District (LA 299)	Chili		x
Plaza Blanca Community Ditch	Plaza Blanca	x	x
Plaza Blanca Historic District	Plaza Blanca	x	x
Pointed Butte Ruin (LA 10733)	Blanco	x	x
Ponsipa'akeri Archeological District (LA 297)	Ojo Caliente	x	x
Pork Chop Pass Site (LA 5661)	Blanco	x	x
Pose'ouinge Archeological District (LA 632)	Ojo Caliente	x	x
Poshuinge Archeological District	Abiquiu	x	x
Pueblito Canyon Ruin (LA 1684)	Blanco	x	x
Pueblito East Ruin (LA 55834)	Blanco	x	x
Puye Ruins NHL	Santa Clara Pueblo	x	x
Ranchito de Natividad	Abiquiu		x
Rancho de Los Luceros (formerly Hacienda)	Alcalde		x
Rattlesnake Ridge Site	Llaves	x	x
Red Hill Archaeological Sites	Cebolla		x
Ridge Top House (LA 6287)	Blanco	x	x
Rincon Largo Ruin	Blanco	x	x
Rincon Rockshelter (LA 55835)	Blanco	x	x
Rio Arriba County Courthouse	Tierra Amarilla	x	x
Rio Chama Site	Coyote	x	x
Rio Grande Bridge at San Juan Pueblo	San Juan Pueblo	x	x
Romine Canyon Ruin (LA 55836)	Blanco	x	x
Romine Ranch Ruin (LA 55837)	Blanco	x	x
San Antonio de Padua Morada	Alcalde	x	x

Table 12: Rio Arriba County Historic Places

Location	Jurisdiction	National Register	New Mexico Register
San Antonio de Padue del Quemado	Cordova	x	x
San Gabriel de Yungue-Ouinge NHL	San Juan Pueblo	x	x
San Joaquin Church	Ensenada	x	x
San Juan, Pueblo of	San Juan Pueblo	x	x
Sanchez, Samuel Barns	Los Brazos	x	x
Sanchez, Samuel, House	Los Brazos	x	x
Sanchez-March House	Los Ojos	x	x
Santa Clara, Pueblo of	Santa Clara Pueblo	x	x
Santa Rosa de Lima de Abiquiu	Abiquiu	x	x
Sapawe Archeological District (LA 306)	El Rito		x
Senon S. Vigil Homestead	Counselor vicinity		x
Shaft House	Blanco	x	x
Split Rock Ruin	Blanco	x	x
Tapacito Ruin (LA 2298)	Blanco	x	x
Te'ewi Archeological District (LA 272)	Chili	x	x
Three Corn Ruin (LA 1871)	Tierra Amarilla	x	
Tierra Amarilla AFS P-8 Historic District	Tierra Amarilla	x	x
Tierra Amarilla Community Ditch	Tierra Amarilla	x	x
Tierra Amarilla Historic District	Tierra Amarilla	x	x
Tower of the Standing God (LA 55839)	Blanco	x	x
Truby's Tower	Blanco	x	x
Trujillo Mill	Cordova		x
Trujillo, Fernando, Sr., House	Los Ojos	x	x
Trujillo, Manuelita, House	Los Ojos	x	x
Tsama Archeological District (LA 908, LA 909)	Medanales	x	x
Tsicumo	Santa Clara Pueblo	x	x
Tsiping Archeological District	Canones	x	x
Turkey Springs Archeological Site (Turkey Spgs 2)	Canjilon		x
Unreachable Rockshelter (LA 55841)	Tierra Amarilla	x	
Valdez, Miguel, Barn	Ensenada	x	x
Vicenti Site	Dulce	x	
Vigil, Senon S., Homestead	Counselor	x	
Wall, The (LA 55840)	Blanco	x	x
West Ranch Tower Site	Llaves		x
Whitaker Dinosaur Quarry	Abiquiu	x	x

Source: National Register of Historic Places, New Mexico State Register of Cultural Properties

3.12 Economic Conditions

As of current U.S. Census Bureau data, approximately 15,542 civilian residents were in the workforce in 2022, as shown in the following table:

Table 13: Jobs Held by Rio Arriba County Residents, by Type of Industry, 2022

Industry Type	Number Employed
Agriculture, forestry, fishing and hunting, and mining	554
Construction	1,342
Manufacturing	176
Wholesale trade	123
Retail trade	1,420
Transportation and warehousing, and utilities	499
Information	92
Finance and insurance, and real estate and rental and leasing	474

Table 13: Jobs Held by Rio Arriba County Residents, by Type of Industry, 2022

Industry Type	Number Employed
Professional, scientific, and management, and administrative and waste management services	3,001
Educational services, and health care and social assistance	3,866
Arts, entertainment, and recreation, and accommodation and food services	1,588
Other services, except public administration	1,017
Public administration	1,390

Source: U.S. Census Bureau, 2018-2022 American Community Survey 5-Year Estimates

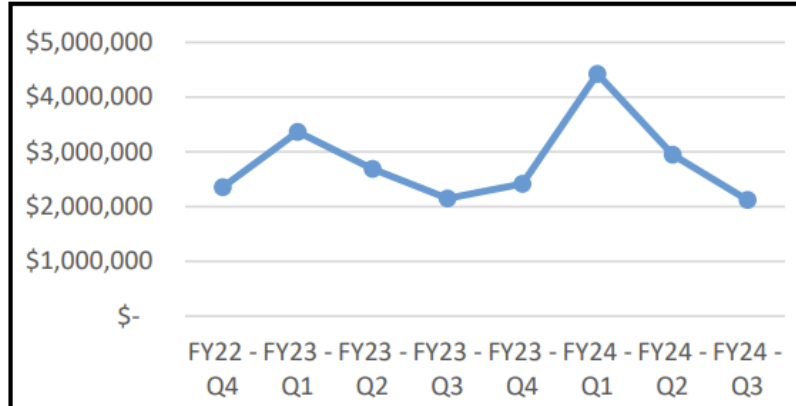
U.S. Census data provides key insights into the working-age population actively participating in the economy. This data helps measure the labor force participation rate, a critical economic indicator reflecting the proportion of the eligible population contributing to the workforce. It excludes certain groups, such as retirees, students, or those not seeking employment, giving a clearer picture of economic engagement and workforce trends.

Table 14: Population in Labor Force

Jurisdiction	Population over 16	In Labor Force	Employed	Unemployed
Rio Arriba County	32,295	16,558	15,542	993
Chama	760	357	292	65
Espanola	8,056	4,446	4,209	237
Ohkay Owingeh	990	552	513	39

Source: U.S. Census Bureau, 2018-2022 American Community Survey 5-Year Estimates

County government quarterly gross receipts tax is an important tool for generating local revenue to fund essential services. The following chart, from the New Mexico Economic Development Department, indicates quarterly gross receipts tax for Rio Arriba County from the fourth quarter of 2022 through the third quarter of 2024:

Chart 8: Rio Arriba Quarterly Gross Receipts Tax

Source: New Mexico Economic Development Department

Community activities of value are initiatives that promote engagement, collaboration, and well-being within a community. These activities may include volunteer programs, cultural festivals, educational workshops, and recreational events that foster connections among residents and enhance the quality of life. They often address local needs, celebrate diversity, and build a sense of shared identity and purpose, contributing to a more resilient and vibrant community. The following is a brief list of notable activities of value throughout the county:

- **Rio Arriba County:** County Fair, El Rito Arts Festival
- **Chama:** Chama Western Heritage Days, Chama Valley Art Festival, Snoball Rally
- **Espanola:** Española Valley Fiesta, Annual Electric Light Parade
- **Ohkay Owingeh:** Turtle Dance, Christmas Celebration

3.13 Physical Setting and Land Cover

Rio Arriba County is characterized by several significant mountain ranges including:

- **San Juan Mountains:** The eastern slopes of the San Juan Mountains extend into Rio Arriba County. This range is part of the larger Rocky Mountains and is known for its rugged terrain and scenic beauty.
- **Tusas Mountains:** Located in the northern part of the county, the Tusas Mountains are a subrange of the San Juan Mountains. This range includes various peaks and offers numerous recreational opportunities.
- **Jemez Mountains:** The southern part of Rio Arriba County is home to the Jemez Mountains. This volcanic range includes several notable peaks and geological features, such as the Valles Caldera, a large volcanic caldera that is now a National Preserve.
- **Sangre de Cristo Mountains:** The southeastern corner of Rio Arriba County is touched by the Sangre de Cristo Mountains, which are part of the southernmost subrange of the Rocky Mountains. These mountains are known for their dramatic elevations and picturesque landscapes.

Rio Arriba County is home to several significant river, including:

- **Rio Grande:** The Rio Grande runs through Rio Arriba County and flows southward from the Colorado Rockies through New Mexico and forms part of the border between the United States and Mexico.
- **Chama River:** A major tributary of the Rio Grande, the Chama River flows through Rio Arriba County, originating in the San Juan Mountains of Colorado and joining the Rio Grande near Española.
- **El Rito Creek:** El Rito Creek is another tributary of the Rio Chama. It flows through the village of El Rito and contributes to the agricultural irrigation systems in the area.
- **Santa Cruz River:** This river flows into the Rio Grande and passes through the town of Española. The Santa Cruz River supports local agriculture and has historical significance for the communities along its banks.
- **Ojo Caliente River:** Flowing near the town of Ojo Caliente, this river is known for its hot springs and contributes to the local hydrology before eventually joining the Rio Chama.
- **Rio Puerco:** A tributary of the Rio Grande, the Rio Puerco flows through the southern part of Rio Arriba County. It is a smaller river but still plays an important role in the local watershed.

Rio Arriba County in New Mexico is currently undergoing a significant hydrogeologic study conducted by the New Mexico Bureau of Geology and Mineral Resources. This study, which began in July 2023, aims to evaluate the quantity and quality of water in the regional aquifers.

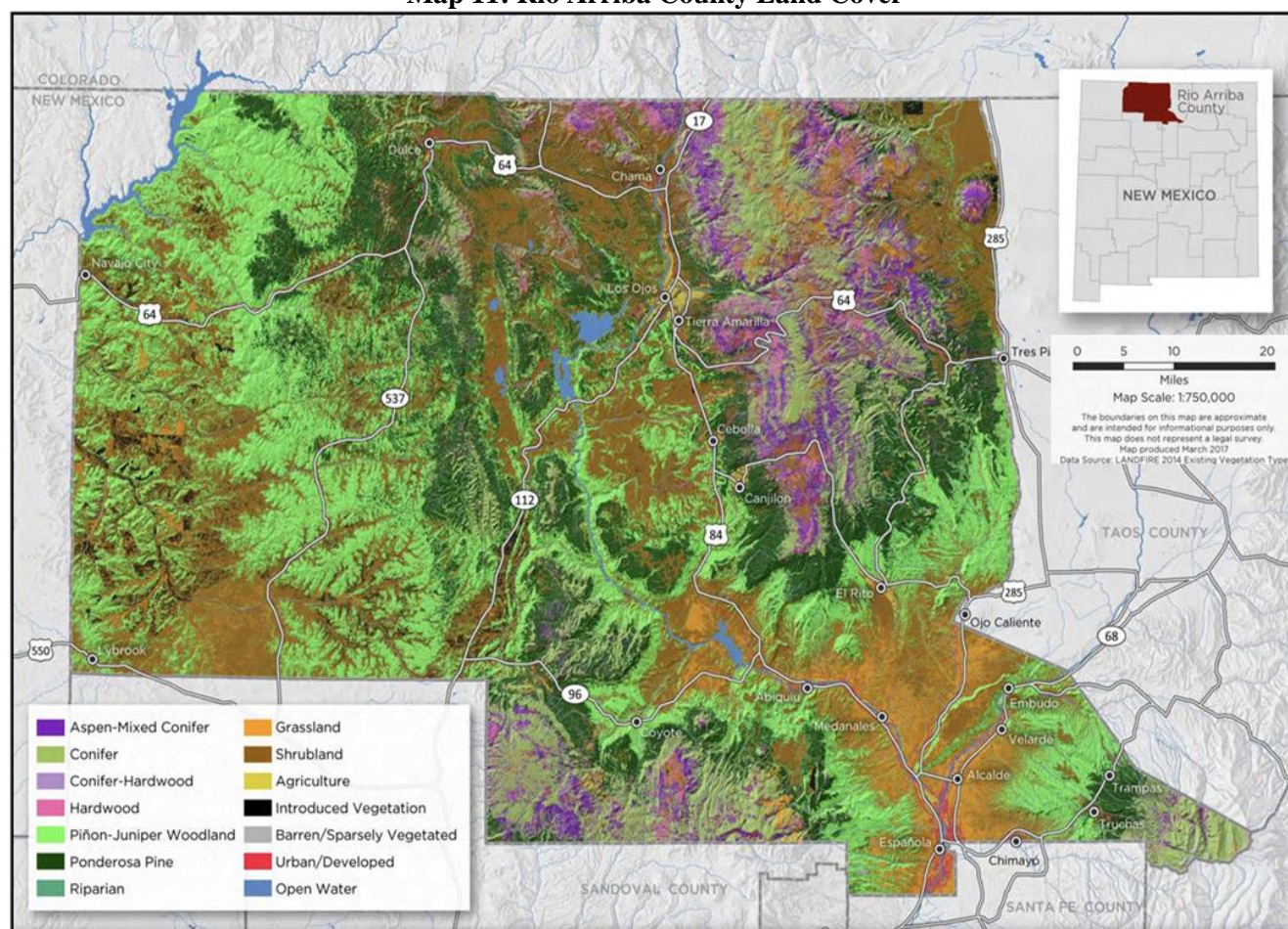
Land use in a region has a profound and lasting impact on future development. The way land is allocated and utilized can shape the economic, social, and environmental aspects of a region for decades, and can impact:

- **Economic Development:** Land use decisions influence the location and type of economic activities in a region. Zoning regulations that encourage the development of industrial zones can attract manufacturing businesses, while zoning for commercial and residential areas can promote retail and housing development. These decisions can have long-term implications for job creation, revenue generation, and overall economic health.
- **Transportation and Infrastructure:** Land use planning is closely tied to transportation infrastructure. The location of roads and other transportation facilities is determined in part by land use decisions. Well-planned land use can lead to efficient transportation networks, reducing congestion, and improving mobility. Poorly planned land use, on the other hand, can result in traffic congestion and increased infrastructure costs.
- **Housing and Urbanization:** Land use policies influence the availability and affordability of housing in a region. Zoning regulations, for example, can determine the density of residential areas and the types of housing permitted. Inadequate or restrictive land use policies can lead to housing shortages and higher costs, while well-planned policies can support diverse housing options and affordability.

- **Resilience to Climate Change:** Land use planning plays a critical role in a region's ability to adapt to climate change. Smart land use decisions can reduce vulnerability to natural disasters, such as flooding and wildfires, by avoiding high-risk areas and implementing resilient building codes and infrastructure.
- **Long-Term Costs:** Land use decisions can affect the long-term costs of development. Efficient land use planning can reduce the need for costly infrastructure extensions and maintenance, while inefficient or sprawling development can strain municipal budgets.

As indicated by the following map from the USGS 2021 Nation Land Cover Database, land cover in Rio Arriba County consists largely of forest and woodland, with no large cities or urban areas and large rural areas:

Map 11: Rio Arriba County Land Cover



Source: Rio Arriba County

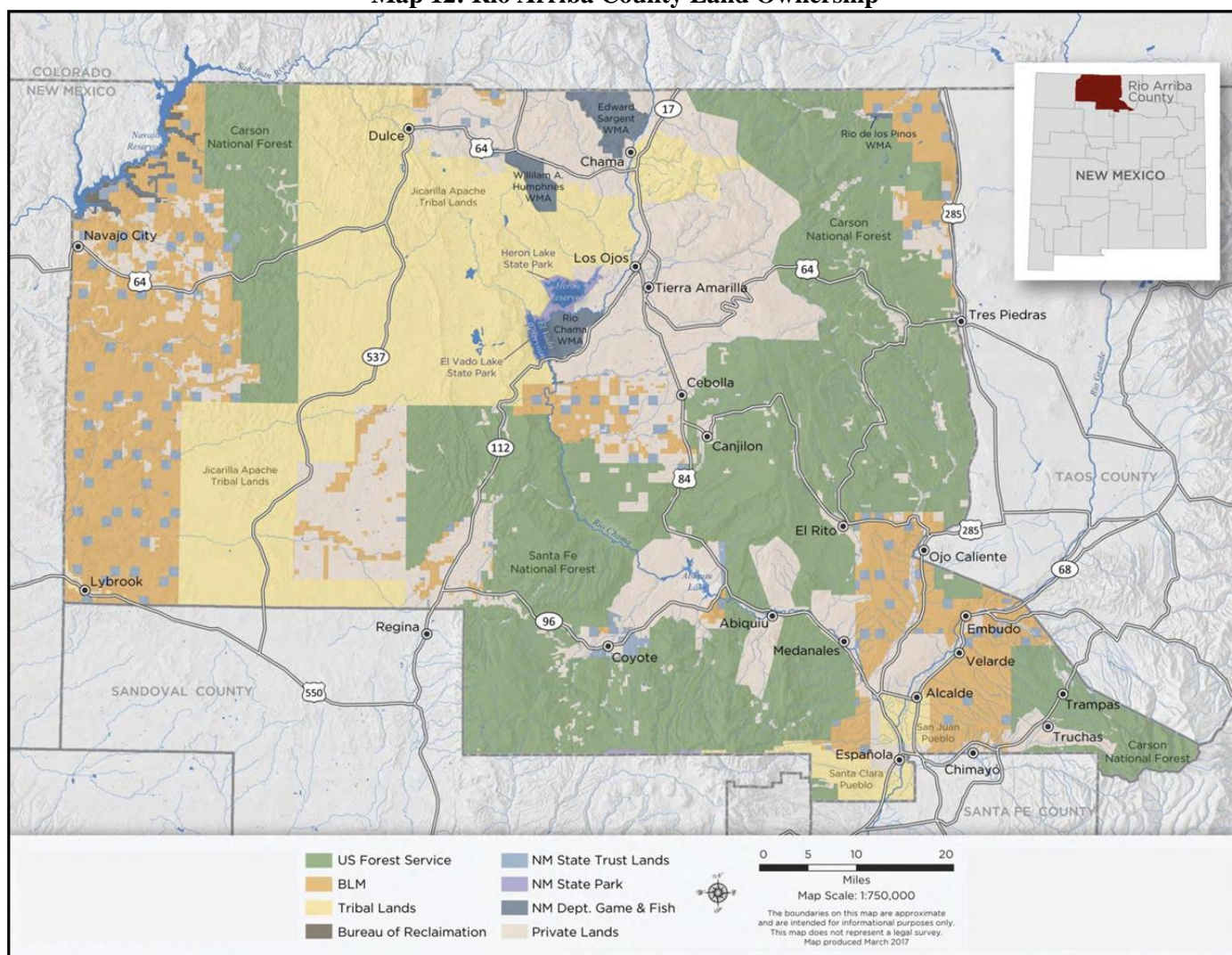
Rural areas tend to retain their rural nature over time, but there are several factors that can influence the evolution of these areas, including:

- **Economic Conditions:** The economic viability of agriculture can vary significantly over time due to factors like crop prices, weather patterns, and changes in agricultural technology. Economic challenges may lead some farmers to sell their land for non-agricultural uses, potentially affecting the rural landscape.
- **Urbanization and Development:** In some cases, rural areas may experience suburbanization or the expansion of nearby urban centers. This can result in residential and commercial development encroaching on agricultural land. However, the extent of this development depends on local zoning and land use regulations.
- **Infrastructure Development:** The construction of new transportation infrastructure, such as highways or railroads, can influence land use patterns. Improved infrastructure may make it easier to transport agricultural products to markets or to access rural areas for development.

- **Government Policies:** Government policies, including agricultural subsidies, land use regulations, and conservation programs, can impact the way rural and agricultural land is used. For example, conservation programs may encourage farmers to preserve land for wildlife habitat rather than development.
- **Local Planning and Zoning:** Local governments play a key role in land use planning and zoning regulations. These policies can determine whether agricultural land can be converted to non-agricultural uses, such as residential or commercial development. Some areas may have strict zoning that preserves agricultural character, while others may allow more flexibility.
- **Population Trends:** Demographic trends, including population growth or decline, can influence the demand for land in rural areas. If there is an influx of new residents seeking a rural lifestyle, it can drive demand for residential development in formerly agricultural areas.

The majority of lands with Rio Arriba County are owned and administered by federal government agencies. The following map details land ownership throughout the county:

Map 12: Rio Arriba County Land Ownership



Source: Rio Arriba County

Based on the available data, it is likely that Rio Arriba County and all participating jurisdictions will retain their mostly rural character during the life of this plan.

3.14 Infrastructure Development

Infrastructure repair can have a significant impact on regional development, both positive and negative. The specific effects depend on the scale of the repair projects, the quality of the infrastructure, and the overall economic and social context of the region, and may include:

- **Improved Connectivity:** Repairing and upgrading infrastructure, such as roads, bridges, and ports, can enhance connectivity within and between regions. This improved connectivity can reduce transportation costs, facilitate the movement of goods and people, and attract businesses and investments to the region.
- **Economic Growth:** Functional infrastructure supports economic activities. When infrastructure is repaired, it can create jobs directly in the construction and maintenance sectors. Additionally, it can indirectly stimulate economic growth by providing a reliable foundation for businesses to operate and expand, leading to increased production and trade.
- **Enhanced Productivity:** Well-maintained infrastructure can increase productivity by reducing downtime and transportation delays. This, in turn, can make regional industries more competitive and efficient.
- **Attracting Investment:** Regions with modern and well-maintained infrastructure are often more attractive to investors. Businesses are more likely to invest in regions with reliable transportation, utilities, and communication networks, as it reduces operational risks and costs.
- **Quality of Life:** Infrastructure repair can enhance the quality of life for residents by providing access to essential services such as clean water, sanitation, healthcare, and education. This can contribute to improved human development indicators and overall well-being.
- **Resilience and Disaster Mitigation:** Infrastructure repair can include upgrades to make infrastructure more resilient to natural disasters and climate change impacts. This can help protect communities and assets and reduce the long-term costs of recovery and reconstruction.
- **Social Equity:** Infrastructure repair can address disparities in access to essential services. It can benefit marginalized communities by providing them with equal access to transportation, utilities, and public facilities.

However, it is important to note that there can be negative impacts as well, including:

- **Disruption During Construction:** Repair projects can disrupt communities and businesses during the construction phase, leading to short-term challenges.
- **Costs and Budget Constraints:** Large-scale infrastructure repair projects can be costly, and they may strain regional budgets or lead to increased taxes or debt.
- **Environmental Concerns:** If not done carefully, infrastructure repair projects can have adverse environmental impacts, such as habitat disruption or water pollution.

Recent significant state, county, and local infrastructure projects within Rio Arriba County include:

- The Ohkay Owingeh, through the USDA Water and Waste Disposal Loan and Grant Program, is receiving a \$610,000 loan and a \$1,600,000 grant to build a wastewater treatment plant on Pueblo lands in Rio Arriba County. This project will help expand water treatment from 235,000 to 350,000 gallons per day and extend services to Pueblo residents who are not currently connected. These improvements will benefit 1,143 residents.
- Rio Arriba County is currently constructing a \$14,820,000 Skilled Nursing Facility & Rehabilitation Hospital.
- The Jicarilla Apache Nation has broken ground on a 140-megawatt solar energy project with another 50 megawatts in battery storage. The Jicarilla Apache Nation is leasing its land to National Renewable Solutions, an independent power producer that acts as the owner, developer and operator of the solar project. The company will then sell the energy to the wholesale power provider Guzman Energy.

Road maintenance projects play a critical role in hazard mitigation by improving the resilience and functionality of transportation infrastructure. Consistent repair and maintenance can help mitigate hazards by:

- **Reduced Flooding Risk:** Regular maintenance, such as cleaning and repairing drainage systems, helps prevent flooding on roadways. Properly maintained culverts, ditches, and stormwater systems ensure that water can flow away from roads, reducing the risk of water damage and road erosion.
- **Strengthening Infrastructure:** Road maintenance projects often include reinforcing bridges, overpasses, and retaining walls to withstand seismic activity, heavy rains, and other hazards.
- **Slope Stabilization:** Road maintenance projects often include measures to stabilize slopes and prevent landslides that can block roads and isolate communities. This includes planting vegetation, installing retaining walls, and improving drainage.
- **Erosion Control:** Implementing erosion control measures such as riprap, geotextiles, and retaining structures helps protect roadways from erosion caused by heavy rains and flooding.
- **Resilient Design:** Maintenance projects can incorporate resilient design features that account for climate change impacts, such as increased precipitation, higher temperatures, and more frequent extreme weather events. This includes elevating roadways, improving drainage systems, and using materials that can withstand changing conditions.
- **Monitoring and Adaptation:** Ongoing maintenance allows for continuous monitoring and adaptation of road infrastructure to changing environmental conditions, ensuring long-term resilience.

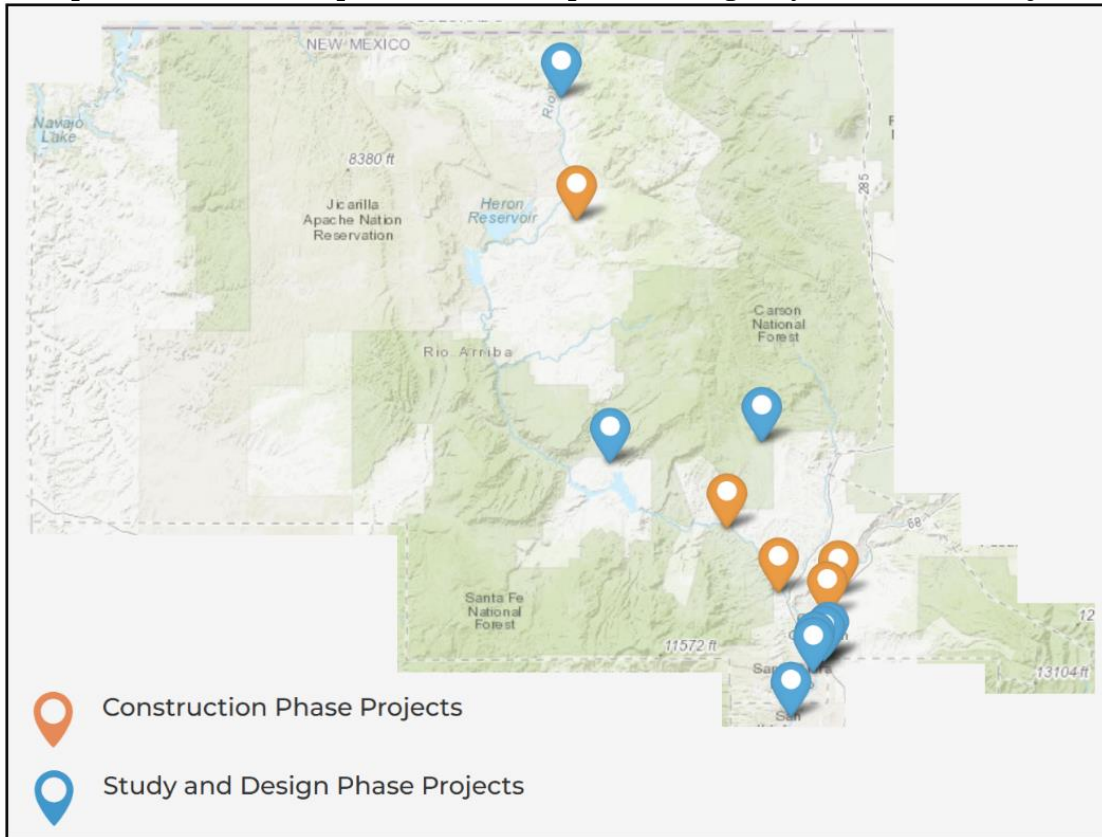
The New Mexico Department of Transportation manages approximately 1,400 miles of highways in Rio Arriba County. The following list, and associated map, indicate current and future New Mexico Department of Transportation maintenance projects:

- **Bridge Preservation for US 84 Bridge No. 3640 (Construction Phase):** Work, totaling \$1,156,618.00 will entail bridge preservation for US 84 Bridge No. 3640 (milepost 207.5 to 208.5).
- **NM 162/NM 531 Pedestrian and Intersection Improvements in Tierra Amarilla (Construction Phase):** This \$1,426,140.00 project involves intersection and pedestrian improvements along NM 162 and NM 531 in Tierra Amarilla, Rio Arriba County.
- **US 84 Rio del Oso Bridge Preservation Project (Construction Phase):** Rio del Oso Bridge #6481 on US 84 will undergo \$15,663,813.73 in preventative maintenance including mill and overlay. The roadway will be widened to provide a left-turn lane. Permanent signing and striping will be installed along with a new guardrail and fencing. Channel grading will take place. Driving lanes will be reduced to one direction with a signal during certain times of construction.
- **NM 68 Road and Bridge Improvements Project from Alcalde (Milepost 6.86) to Velarde (Milepost 12.70) (Construction Phase):** This \$30,767,771.20 project is being conducted to reconstruct the NM 68 roadway corridor in Ohkay Owingeh from milepost 4.124 to 6.863 and north of Alcalde between milepost 10.116 to 12.713 near Velarde Elementary School in Rio Arriba County, New Mexico. The project is needed to address safety concerns; design deficiencies to roadway, bridge, and drainage elements; pavement structure failure, and settlement due to collapsible soils. The purpose of the project is to improve the roadway condition and create safe turning movements. The project involves roadway and bridge construction, drainage improvements, vertical grade and super elevation improvements, access control, signing and striping including raising the grade of existing driveway tie-ins; closure of median crossovers; cleaning of drainage structures; installation of rip rap and energy dissipaters at select drainage structures; replacement of Bridge 6759 (northbound spanning Canada de Ancha) and Bridge 6760 (northbound spanning Rio de Truchas), preventative maintenance to six other bridges; guardrail installations; and spot right-of-way fence replacements.
- **NM 68 Roadway Reconstruction and Bridge Rehabilitation (Construction Phase):** This \$15,663,813.73 project is being conducted to reconstruct the NM 68 roadway corridor north of Alcalde between milepost 6.9 to 10.1. The project is needed to address safety concerns; design deficiencies to roadway, bridge, and drainage elements; pavement structure failure, and settlement due to collapsible soils. The purpose of the project is to improve the roadway condition and create safe turning movements.
- **NM 17-US 64 Alignment Study in Chama (Study and Design):** The objective of the study is to analyze existing conditions, verify the need for improvements, and evaluate feasible alternatives that provide solutions

to identified problems. Ultimately, the study will assist with defining future design and construction goals within the Village of Chama.

- **NM 30 Improvements Project, Phase 2 (Study and Design):** The purpose of the proposed project is to provide physical, operational, and safety improvements to help ensure that travel on this segment of NM 30 is safe and efficient and meets the needs of the current and future users. NM 30 has poor pavement conditions including cracking and rutting, increasing traffic volumes create traffic congestion and unsafe driving conditions, and this facility lacks multimodal facilities.
- **NM 30 Improvements Project, Phase 3 (Study and Design):** The purpose of the proposed project is to provide physical, operational, and safety improvements to help ensure that travel on this segment of NM 30 is safe and efficient and meets the needs of the current and future users. NM 30 has poor pavement conditions including cracking and rutting, increasing traffic volumes create traffic congestion and unsafe driving conditions, and this facility lacks multimodal facilities.
- **NM 554 El Rito Creek Bridge Replacement, Mileposts 12.3 to 12.5 (Study and Design):** The design in development will include bridge replacement along the same alignment with new guardrail, approaches, signing, and striping.
- **NM 583 (McCurdy Road) Alignment Study (Study and Design):** An Alignment Study is underway for NM 583 (South McCurdy Road) in the City of Espanola within Santa Fe and Rio Arriba counties, and is focused on documenting existing conditions and developing potential alternatives for roadway improvements.
- **Phase 1 - NM 68, US 84/285 Milepost 0.0 to 1.4 (Study and Design):** The project will improve road and bridge conditions, sidewalks, curb ramps, access management, and ADA compliance.
- **Phase 3-US 64 Road Reconstruction and Bridge Replacement (Study and Design):** Proposed improvements will include road reconstruction, widening of shoulders, replacement of the bridge at Shiprock Wash, drainage structure improvements, scour protection, and construction of roadside barriers.
- **US 84 Bridge Replacement Project (Study and Design):** This project aims to replace the bridge without the need for shutting down the bridge and by maintaining two-way traffic on a temporary detour bridge while constructing a new wider single-span bridge on the same alignment as the existing US 84 three-span bridge. No new right-of-way acquisition is anticipated.
- **US 84/285 and Paseo de Oñate Intersection Improvements (Study and Design):** The intent of the project is to realign the intersection of US 84/285 and Paseo de Oñate to include signalization, lighting, drainage, curb and gutter, sidewalk, signing, and striping improvements.

Map 13: New Mexico Department of Transportation Highway Maintenance Projects



Source: New Mexico Department of Transportation

Based on the available data, it is likely that Rio Arriba County and all participating jurisdictions will retain a mostly rural character during the life of this plan. Additionally, no near future development changes are anticipated to increase jurisdictional vulnerability to identified hazards. Rather, the noted demographic decrease is expected to potentially reduce across the board vulnerability to identified hazards.

3.15 Agricultural Data

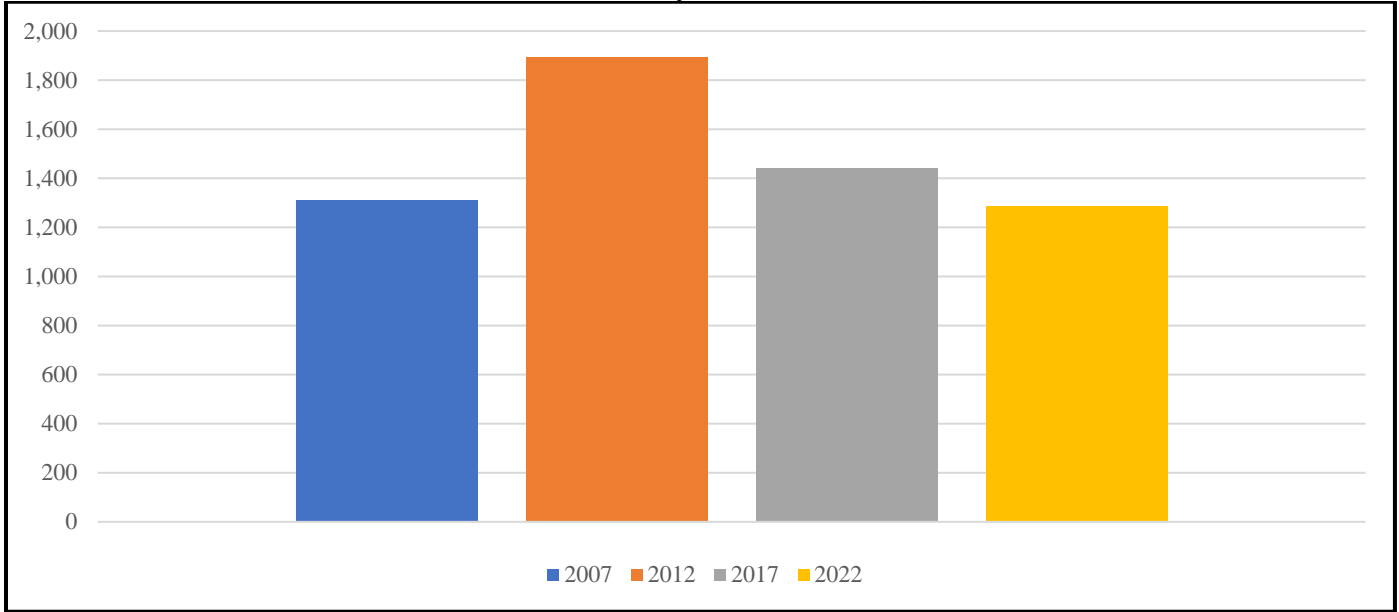
Agriculture forms a large part of both the economic and social fabric of Rio Arriba County. USDA National Agricultural Statistics Service data from 2007, 2012, 2017, and 2022 (the latest available data) was used to develop an understanding of the agricultural footprint within the county, as detailed in the following table and charts:

Table 15: Rio Arriba County Regional Agricultural Data

Year	2007	2012	2017	2022
Number of Farms	1,312	1,892	1,439	1,285
Total Farm Acreage	1,460,186	1,432,897	1,362,062	1,346,191
Market Value of Products Sold	\$12,763,000	\$18,979,000	\$14,637,000	\$23,095,000
Value of Machinery and Equipment	\$60,712,800	\$81,872,000	\$74,145,000	\$83,604,000
Value of Lands and Buildings	\$687,747,606	\$548,193,000	\$812,334,000	\$1,769,725,000

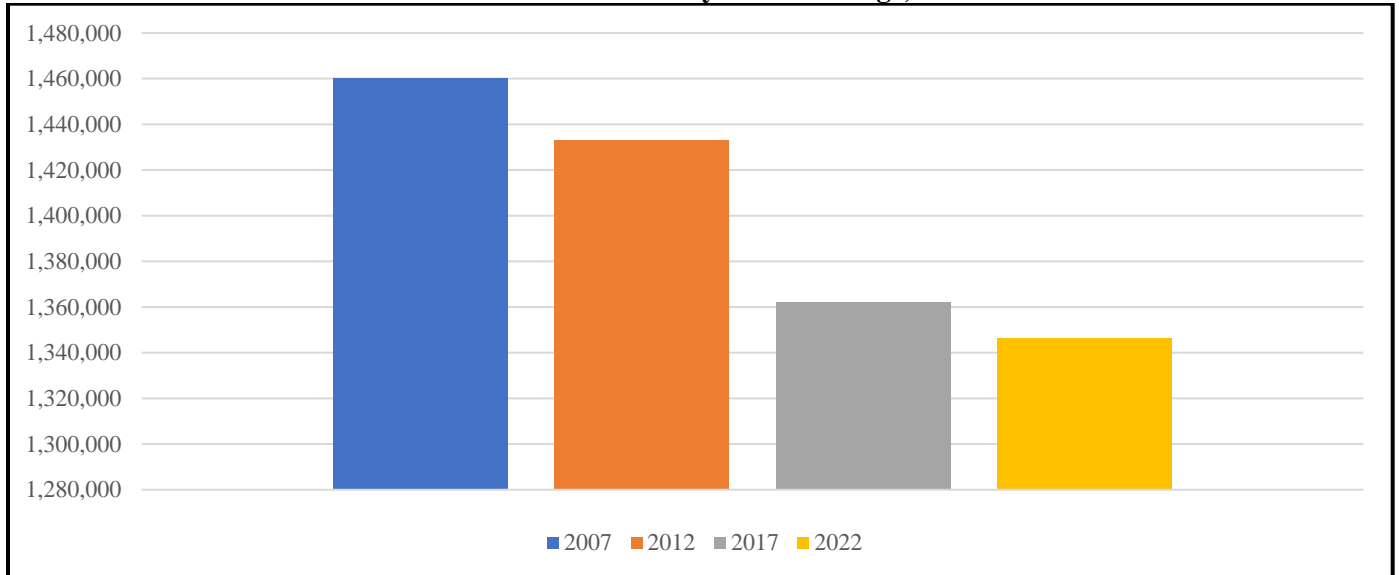
Source: USDA National Agricultural Statistics Service

Chart 9: Rio Arriba County Number of Farms, 2007-2022



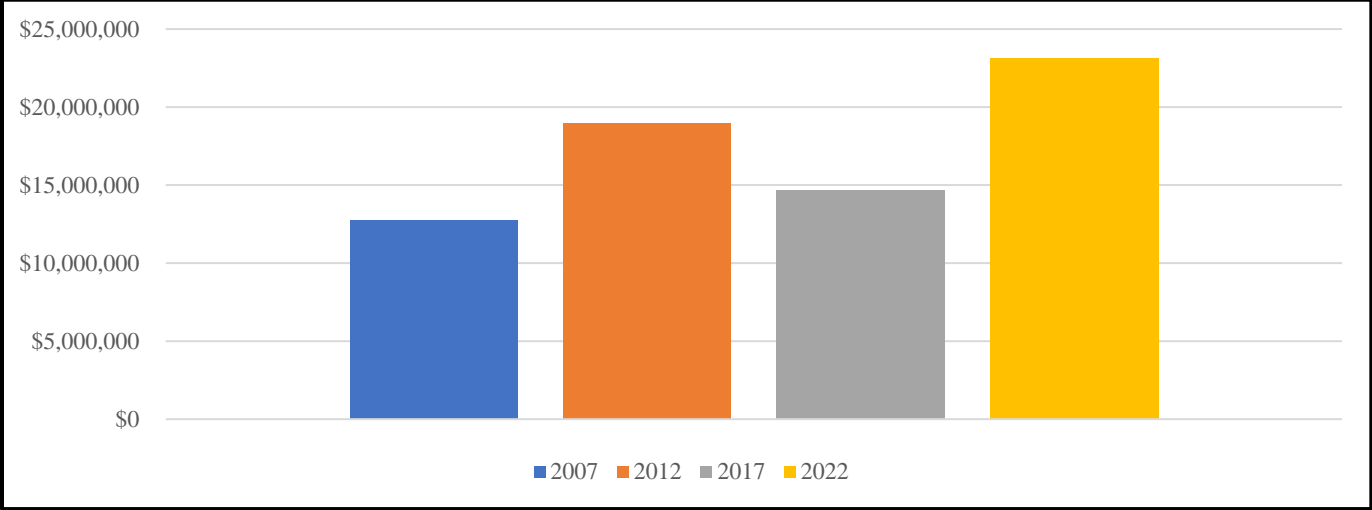
Source: USDA National Agricultural Statistics Service

Chart 10: Rio Arriba County Farm Acreage, 2007-2022



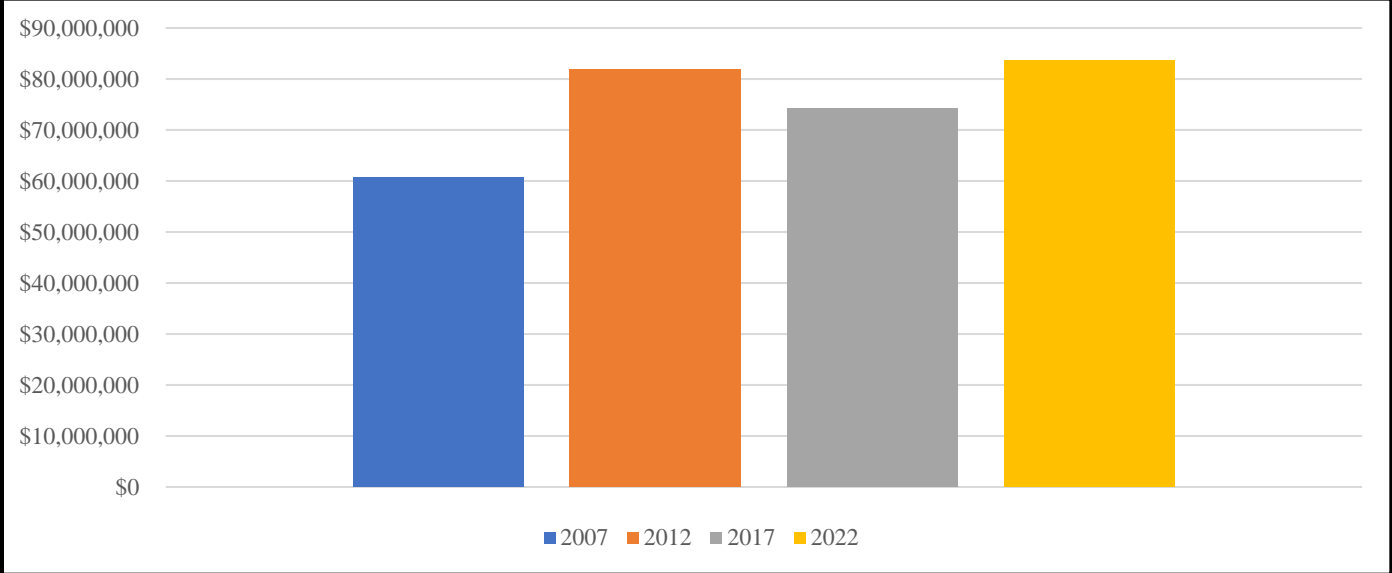
Source: USDA National Agricultural Statistics Service

Chart 11: Rio Arriba County Market Value of Products Sold, 2007-2022



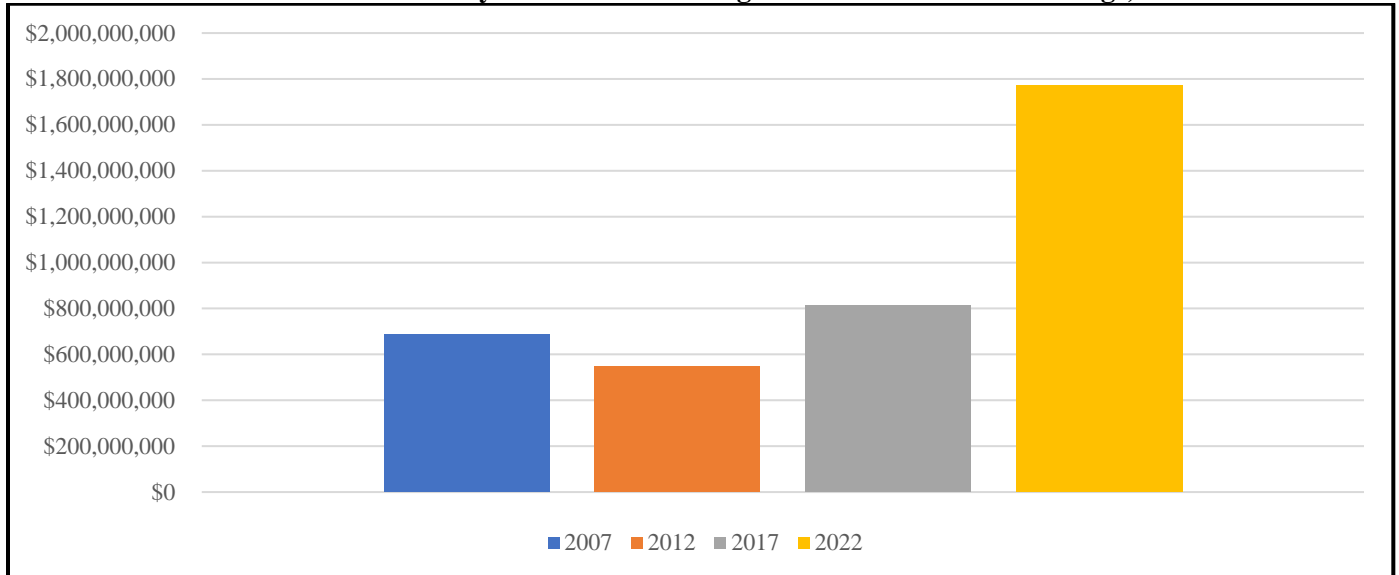
Source: USDA National Agricultural Statistics Service

Chart 12: Rio Arriba County Market Value of Agricultural Machinery and Equipment, 2007-2022



Source: USDA National Agricultural Statistics Service

Chart 13: Rio Arriba County Market Value of Agricultural Land and Buildings, 2007-2022



Source: USDA National Agricultural Statistics Service

3.16 Regional Climate

Rio Arriba County experiences a varied climate due to its diverse geography, which includes mountains, valleys, and high desert plains. General climate characteristics include:

- **Temperature:** Summers are generally warm to hot, with daytime highs typically ranging from the mid-80s to low 90s°F (29-34°C). Winters can be cold, particularly in the higher elevations, with daytime highs ranging from the mid-30s to mid-50s°F (2-13°C). Nighttime temperatures can drop significantly, often below freezing.
- **Precipitation:** The county receives most of its precipitation during the summer months (July to September) due to the North American Monsoon. These summer thunderstorms can be intense but are usually short-lived. Annual precipitation varies widely depending on the location within the county, with mountainous areas receiving more moisture (up to 20 inches or more per year) compared to lower elevations and desert areas (which may receive less than 10 inches per year).
- **Snowfall:** Snowfall is common in the winter, especially in the higher elevations. The amount of snowfall can vary greatly, with mountainous regions receiving significant accumulations that contribute to snowpack and water resources.
- **Wind:** Windy conditions are common, particularly in the spring. These winds can lead to increased fire danger during dry periods.

3.17 Potential Impacts of Climate Change

Public Comment: Concerned about climate change and the related impacts

For hazards related to weather patterns, climate change may cause significant changes in patterns and event frequency. There is a scientific consensus that climate change is occurring, and recent climate modeling results indicate that extreme weather events may become more common. Rising average temperatures produce a more variable climate system which may result in an increase in the frequency and severity of some extreme weather events, including:

- Longer and more intense heat waves
- An increased risk of wildfires
- Higher wind speeds
- Greater rainfall intensity, but less rainfall frequency

Data from the NOAA NCEI New Mexico 2022 State Climate Summary indicates the following concerning the climate change in the state:

- Temperatures have risen approximately 2° Fahrenheit since the beginning of the 20th century.
- The last decade has been the warmest on record for the state, with increasing trends in both extremely hot days and warm nights.
- Over the past several decades, much of the state has seen increases in the number of extremely hot days.
- Although projections of annual precipitation are uncertain, precipitation in spring, which is already the dry season in New Mexico, is projected to decrease across most of the state.
- New Mexico has not experienced an upward trend in the frequency of extreme precipitation events.
- The intensity of future droughts is projected to increase.
- Drought will further challenge limited agricultural resources.
- The frequency and severity of wildfires and dust storms are projected to increase.

Section 4 –Capability Assessment

4.1 Introduction

This capability overview for Rio Arriba County, the Ohkay Owingeh, and participating jurisdictions documents programs, policies, and funding mechanisms for participating jurisdictions. All listed capabilities documented in the previous LHMP were reviewed for relevance and updated to reflect the current environment, as necessary. Additionally, any programs, policies, or funding mechanisms that are no longer applicable, are outdated, or are no longer in existence have been removed. As part of this process, updated jurisdictional capability profiles were sent for review and, if necessary, further revision.

This section of the plan discusses the current capacity of regional communities to mitigate the effects of identified hazards. A capability assessment is conducted to determine the ability of a jurisdiction to execute a comprehensive mitigation strategy, and to identify potential opportunities for establishing or enhancing specific mitigation policies, programs or projects.

A capability assessment helps to determine which mitigation actions are practical based on a jurisdiction’s fiscal, staffing and political resources, and consists of:

- An inventory of relevant plans, ordinances, or programs already in place
- An analysis capacity to carry them out.

A thoughtful review of jurisdictional capabilities will assist in determining gaps that could limit current or proposed mitigation activities, or potentially aggravate a jurisdiction’s vulnerability to an identified hazard. Additionally, a capability assessment can detail current successful mitigation actions that should continue to receive support.

4.2 Administrative and Technical Capabilities

The administrative and technical functions of Rio Arriba County and participating jurisdictions are critical in the effective implementation of hazard mitigation strategies. These functions ensure that the jurisdiction is prepared to reduce risks associated with natural and human-made hazards and can efficiently identify, integrate, and manage mitigation projects.

Rio Arriba County has a dedicated staff across multiple departments for hazard mitigation roles including planning, engineering, and mapping. Additionally, the county has numerous communication channels available, including websites and social media platforms, and a variety of trained Public Information Officers and general staff to disseminate hazard mitigation information to all stakeholders and the public. The staffing capabilities of participating jurisdictions vary, with many having small, but dedicated teams.

The following table details Rio Arriba County and participating jurisdiction departments and positions and their roles in supporting hazard mitigation planning:

Table 16: Rio Arriba County and Participating Jurisdictions Departments Supporting Mitigation Planning

Department or Position	Hazard Mitigation Roles
Governing Board or Chief Executive	<ul style="list-style-type: none">• Provides adoption resolution for LHMP.• Approves ordinances and bylaws and facilitates capital improvements budget.
Building Department	<ul style="list-style-type: none">• Enforces building codes that enhance structural resilience to hazards.• Conducts inspections and issues permits ensuring compliance.
Emergency Management Department*	<ul style="list-style-type: none">• Develops, implements, and updates the LHMP.• coordinates between various departments, agencies, and external stakeholders to ensure a cohesive approach to hazard mitigation.• Provides public education on matters concerning hazard mitigation.• Coordinates hazard grant application process.

Table 16: Rio Arriba County and Participating Jurisdictions Departments Supporting Mitigation Planning

Department or Position	Hazard Mitigation Roles
	<ul style="list-style-type: none"> Involving local businesses, non-profits, and residents in the planning process to foster a collaborative approach to mitigation. Supports the planning and implementation of mitigation projects.
Finance Department	<ul style="list-style-type: none"> Allocates funding for hazard mitigation projects. Manages grants and other financial resources to support mitigation efforts.
Fire Department	<ul style="list-style-type: none"> Wildfire mitigation through controlled burns and fuel management. Outreach programs to educate the public on fire safety, such as how to prevent home fires, create defensible spaces around properties. Community planning to create defensible spaces and ensure buildings are more fire-resistant
Geographic Information System (GIS)	<ul style="list-style-type: none"> Provides critical data and mapping services for hazard identification and risk assessments. Utilizes advanced modeling techniques to predict the impact of various hazards on the community. Supports the planning and implementation of mitigation projects.
Health Department	<ul style="list-style-type: none"> Addresses public health risks associated with identified hazards. Plans for emergency medical response and disease control measures. Monitors environmental hazards (e.g., water contamination, hazardous materials).
Parks Department	<ul style="list-style-type: none"> Manage open space and wetlands for flood control. Manage vegetation in parks to reduce fire hazards. Provision of green spaces to help mitigate the urban heat island effect by cooling surrounding areas through shade and evapotranspiration
Planning Department	<ul style="list-style-type: none"> Enforces zoning and land-use policies to minimize hazard risks. Integrates hazard mitigation into comprehensive and capital improvement plans.
Public Works Department	<ul style="list-style-type: none"> Manages infrastructure resilience projects (e.g., road improvements, drainage systems).

Note: * Role may be taken by local fire or police department, and not dedicated emergency management department

The following table details Ohkay Owingeh divisions and their roles in supporting hazard mitigation planning:

Table 17: Ohkay Owingeh Departments and Positions Supporting Mitigation Planning

Division	Hazard Mitigation Roles
Ohkay Owingeh Planning Division	<ul style="list-style-type: none"> Enforces zoning and land-use policies to minimize hazard risks. Integrates hazard mitigation into comprehensive and capital improvement plans. Enforces building codes that enhance structural resilience to hazards. Conducts inspections and issues permits ensuring compliance.
Ohkay Owingeh Public Works Division	<ul style="list-style-type: none"> Manages infrastructure resilience projects (e.g., road improvements, drainage systems).
Ohkay Owingeh Health and Human Services Division	<ul style="list-style-type: none"> Addresses public health risks associated with identified hazards. Plans for emergency medical response and disease control measures. Monitors environmental hazards (e.g., water contamination, hazardous materials).
Ohkay Owingeh Finance and Accounting Division	<ul style="list-style-type: none"> Allocates funding for hazard mitigation projects. Manages grants and other financial resources to support mitigation efforts.

Table 17: Ohkay Owingeh Departments and Positions Supporting Mitigation Planning

Division	Hazard Mitigation Roles
Ohkay Owingeh Cultural Preservation Division	<ul style="list-style-type: none"> Provides public education on matters concerning cultural resources and preservation. Manages cultural and sacred site resilience projects.
Ohkay Owingeh Tribal Council	<ul style="list-style-type: none"> Provides adoption resolution for LHMP. Approves ordinances and bylaws and oversees capital budget expenditures.

The following table indicates if a participating jurisdiction has the above noted departments:

Table 18: Participating Jurisdiction Departments

Jurisdiction	Board or Exec	Building	Emergency Management	Financial	Fire	GIS	Health	Parks	Planning	Public Works
Rio Arriba County	x	x	x	x			x	x	x	x
Chama	x	x	x	x	x			x	x	x
Espanola	x	x	x	x	x			x	x	x
Ohkay Owingeh	x	x	x	x	x			x	x	x

Note: * Role may be taken by Rio Arriba County

4.3 Regulation of Development

The regulation of development plays a crucial role in helping a community become more resilient in the face of various hazards. Effective regulation of development contributes to community resilience through:

- **Risk Reduction:** Regulations guide land use and construction practices, ensuring that they provide strong protection against hazards.
- **Public Safety:** Building codes and land-use regulations establish minimum safety standards for construction, including structural integrity, fire resistance, and the use of resilient materials.
- **Infrastructure Resilience:** Regulations may require infrastructure improvements, such as the construction of resilient roads, bridges, utility systems, and drainage systems. This strengthens a community's ability to withstand hazards, ensures the continued operation of critical services, and aids in recovery.
- **Floodplain Management:** Regulations in flood-prone areas can mandate elevation requirements for new construction, ensuring that structures are built above the base flood elevation. This minimizes flood damage, reduces the need for costly post-disaster repairs, and protects property values.
- **Land Use Planning:** Effective land-use planning helps communities avoid inappropriate development in areas at high risk of hazards.
- **Community Awareness:** Public education and outreach can be incorporated into regulations, requiring communities to inform residents about local hazards, evacuation routes, and preparedness. Informed residents are more likely to take protective measures and respond effectively to disasters.

The following sections provide further detail on building codes, zoning ordinances, and floodplain management.

Building Codes

In New Mexico, the authority for enacting and enforcing building codes lies with New Mexico Construction Industry Division, in conjunction with local planning and zoning departments and the Ohkay Owingeh Planning and Zoning Department. Building codes establish general minimum construction standards and are enforced through authorized local building inspection agencies and inspectors. Building codes provide for:

- **Life Safety:** Building codes include provisions for fire safety, emergency egress, and the use of fire-resistant materials.
- **Accessibility and Life Support:** Building codes incorporate accessibility standards, ensuring that buildings are designed to accommodate all individuals. This is crucial during and after disasters when people with mobility

issues may require assistance. Accessible features also benefit emergency responders and support recovery efforts.

- **Retrofitting Existing Buildings:** Building codes may require the retrofitting of older structures to meet modern safety standards.
- **Public Awareness:** Building codes promote public awareness of hazards and the importance of resilient construction. This can lead to informed decision-making by property owners, builders, and developers, resulting in safer structures.

Key hazard resistant building code provisions found in current building codes include:

- **Structural Design Requirements:** Provides requirements for the structural design of buildings to ensure their resistance to various hazards, including earthquakes, high winds, and snow loads. These requirements are aimed at enhancing the overall structural integrity and safety of buildings.
- **Wind Design Requirements:** Provides specific provisions for wind design, considering the geographical location of the structure. Wind loads are calculated based on factors such as wind speed, exposure, and building height.
- **Seismic Design Requirements:** Incorporates seismic design provisions to address earthquake hazards. The code includes seismic design categories and requirements for the design and construction of buildings in seismic-prone regions.
- **Flood-Resistant Design Requirements:** Includes provisions related to flood-resistant design, particularly in areas prone to flooding. It may specify elevation requirements, construction materials, and other considerations to reduce the risk of flood damage. The vast majority of the regulations required by the NFIP are included within the International Building Code and the International Residential Code.
- **Fire-Resistant Construction Requirements:** Requirements for fire-resistant construction are included to mitigate the risk of fire hazards. This includes specifications for fire-resistant materials, assemblies, and building features.
- **Material and Construction Standard Requirements:** Establishes standards for building materials and construction methods to ensure the durability and safety of structures, considering various hazards.

In Rio Arriba County, and on the Ohkay Owingeh Pueblo, building codes are enforced in accordance with the New Mexico state codes, which include various regulations for construction, electrical work, plumbing, mechanical systems, and energy conservation. These codes are supplemented by local ordinances that address specific issues such as flood damage prevention, signage, and land use. Current Codes enforced include:

- 2021 New Mexico Residential Energy Conservation Code NMAC 14.7.6 (effective 7.30.24)
- 2021 New Mexico Commercial Energy Code NMAC 14.7.9 (effective 7.30.2024)
- 2021 New Mexico Commercial Building Code NMAC 14.7.2
- 2021 New Mexico Residential Building Code NMAC 14.7.3
- 2021 New Mexico Earthen Building Materials Construction Code (Phase III) NMAC 14.7.4
- 2009 New Mexico Non-Load Bearing Baled Straw Construction Building Code (Phase III) NMAC 14.7.5
- 2018 New Mexico Residential Energy Conservation Code NMAC 14.7.6
- 2021 New Mexico Existing Building Code NMAC 14.7.7
- 2021 New Mexico Historic Earthen Buildings NMAC 14.7.8
- 2018 New Mexico Commercial Energy Conservation Code NMAC 14.7.9
- 2021 New Mexico Plumbing Code NMAC 14.8.2
- 2012 New Mexico Swimming Pool, Spa, and Hot Tub Code NMAC 14.8.3
- 2021 New Mexico Mechanical Code NMAC 14.9.2
- Boilers NMAC 14.9.4
- Medical Gas Installation and Certification NMAC 14.9.5
- 2012 New Mexico Solar Energy Code NMAC 14.9.6

- 2020 New Mexico Electrical Code NMAC 14.10.4
- 2012 New Mexico Electrical Safety Code NMAC 14.10.5

In general, Rio Arriba County, the Ohkay Owingeh, and all participating jurisdictions require building permits for the following activities:

- Construction
- Manufactured home placement
- New Utility service/meter relocation/service upgrade
- Grading-Solar panels
- Accessory structures
- Additions
- Roofs
- Wells
- Demolition

As part of this planning effort, personnel charged with regulating or overseeing development were given the opportunity to review and comment of the elements of this plan. The following personnel were identified:

Table 19: Rio Arriba County Building or Development Stakeholders

Jurisdiction	Name	Title
Rio Arriba County	Gabriel Boyle	Planning and Zoning Director
Chama	Anna Pobar	Planning and Zoning Coordinator
Espanola	Ernest Martinez	Deputy Planning Director
Ohkay Owingeh	Christy Vanburen	Planning Manager

Zoning Ordinances

Zoning ordinances in Rio Arriba County govern land use, development, and building requirements and are overseen by the Rio Arriba County, Chama, Espanola, and Ohkay Owingeh Planning and Zoning Departments. Zoning ordinances work by dividing the land into different zoning districts and establishing rules and guidelines for land use, building placement, density, and setback within the zoning districts. In general, zoning ordinances establish:

- **Zoning districts:** Areas designated for specific types of land use, such as residential, commercial, industrial, agricultural, mixed-use, or special districts.
- **Land usage within a zoning district:** Specifications as to which activities, buildings, and operations are permitted in each zoning district.
- **Enforcement:** Zoning ordinances are enforced by the local building department or zoning enforcement officers.

Zoning is the traditional, and most common, tool available to local jurisdictions to control the use of land. Zoning is used to promote health, safety, and the general welfare of the community. Zoning is used to dictate the type of land use and to set minimum specifications for use such as lot size, building height and setbacks, and density of population.

Zoning ordinances play a significant role in enhancing hazard resilience for communities and can help reduce vulnerability to various natural and man-made hazards by regulating land use and development practices. In Rio Arriba County, locally instituted and enforced zoning ordinances provide for:

- **Land Use Planning:** Zoning ordinances designate land use zones within a community, ensuring that certain areas are reserved for particular uses. This can prevent the construction of critical infrastructure, homes, or businesses in high-risk zones, such as floodplains or wildfire-prone areas.

- **Setback Requirements:** Zoning ordinances often mandate specific setbacks, which are distances between structures and property lines or natural features. These setbacks can help prevent buildings from being too close to potential hazards, potentially reducing the risk of damage.
- **Building Height and Design Standards:** Zoning codes can establish building height limits to reduce exposure to certain hazards. Design standards, including materials and construction methods, can be specified to make structures more resilient.
- **Floodplain Management:** Many zoning ordinances incorporate floodplain regulations, which dictate where and how buildings can be constructed within flood-prone areas. These regulations may require buildings to be elevated, use flood-resistant materials, or include openings to allow floodwaters to pass through.
- **Wildfire Mitigation Zones:** In regions susceptible to wildfires, zoning ordinances can establish wildfire mitigation zones with specific requirements for defensible space, fire-resistant landscaping, and building materials to reduce the risk of wildfires spreading to structures.

Properly applied, zoning restriction is one of the most effective hazard mitigation tools available.

Table 20: Rio Arriba County Zoning Stakeholders

Jurisdiction	Name	Title
Rio Arriba County	Gabriel Boyle	Planning and Zoning Director
Chama	Anna Pobar	Planning and Zoning Coordinator
Espanola	Ernest Martinez	Deputy Planning Director
Ohkay Owingeh	Christy Vanburen	Planning Manager

Floodplain Management Ordinances

Floodplain ordinances and management are one of the most effective hazard mitigation tools available against flooding. Local floodplain ordinances, required for NFIP participants, are often used to prevent inappropriate development in floodplains and to reduce flood hazards. In general, they allow the jurisdiction to:

- Minimize the extent of floods by preventing obstructions that inhibit water flow and increase flood height and damage.
- Prevent and minimize loss of life, injuries, and property damage in flood hazard areas.
- Promote the public health, safety and welfare of citizens in flood hazard areas.
- Manage planned growth.
- Grant permits for use in development within special flood hazard areas that are consistent with the community ordinance and the NFIP under 44 CFR 60.3.

The NFIP floodplain management regulations work alongside local building codes by providing specific flood-related requirements that must be met in addition to general building code standards. In NFIP communities, when constructing or substantially improving a structure in a Special Flood Hazard Area (SFHA), the structure must be elevated to or above the Base Flood Elevation (BFE), which is a requirement imposed by the NFIP's regulations.

Code and Ordinance Summary

The following table indicates the status of the above enumerated codes and ordinances for participating jurisdictions:

Table 21: Jurisdictional Codes and Ordinances

Jurisdiction	Building Code	Zoning Ordinance	Floodplain Ordinance
Rio Arriba County	x	x	x
Chama	x	x	x
Espanola	x	x	x
Ohkay Owingeh	x	x	

Note: Blank indicates no code or ordinance

4.4 Jurisdictional Plans

Planning plays a critical role in hazard mitigation by helping communities identify, assess, and reduce risks associated with natural and man-made hazards. Effective planning involves a proactive, strategic, and comprehensive approach to minimize the impact of disasters and enhance community resilience. Jurisdictions were asked if they had completed the following plans:

- **Capital Improvement Plan:** Allocates funding for infrastructure projects, including those that enhance resilience, such as stormwater management systems and seismic retrofits.
- **Community Wildfire Protection Plan:** Focused on reducing wildfire risks, this plan involves community input and includes strategies for fuel reduction, public education, and emergency response improvements.
- **Comprehensive Plan:** A comprehensive plan establishes the overall vision for a jurisdiction and serves as a guide to decision making, and generally contains information on demographics, land use, transportation, and facilities. As a comprehensive plan is broad in scope the integration of hazard mitigation measures can enhance the likelihood of achieving risk reduction goals.
- **Emergency Operations Plan:** An emergency operations plan outlines the responsibility and means and methods by which resources are deployed during and following an emergency or disaster. In Rio Arriba County, the overarching county provides emergency operation planning for jurisdictions within its borders.
- **Floodplain Management Plan:** This plan aims to manage flood risks through zoning, building codes, and public education, often in coordination with FEMA's NFIP.
- **Land Use and Zoning Plan:** These plans regulate development to minimize exposure to hazards, such as restricting construction in flood-prone or wildfire-prone areas.

The following table details the status of these plan types for Rio Arriba County:

Table 22: Rio Arriba County Plans

Plan	Plan Name	Maintained by
Capital Improvement Plan	Rio Arriba Comprehensive Plan	Rio Arriba County Planning Department
Community Wildfire Protection Plan	Community Wildfire Protection Plan	RACOEM
Comprehensive Plan	Rio Arriba Comprehensive Plan	Rio Arriba County Planning Department
Emergency Operations Plan	Rio Arriba County Emergency Operations Plan	RACOEM
Floodplain Management Plan	Rio Arriba Comprehensive Plan	Rio Arriba County Planning Department
Land Use Plan	Land and Resource Use Plan and Policy	East Rio Arriba Soil and Water Conservation District

The following table details the status of these plan types for the Ohkay Owingeh:

Table 23: Ohkay Owingeh Plans

Plan	Plan Name	Maintained by
Capital Improvement Plan	Capital Projects	Ohkay Owingeh Planning Department
Community Wildfire Protection Plan	Community Wildfire Protection Plan	RACOEM
Comprehensive Plan	Capital Projects	Ohkay Owingeh Planning Department
Emergency Operations Plan	Rio Arriba County Emergency Operations Plan	RACOEM
Floodplain Management Plan	Rio Arriba Comprehensive Plan	Rio Arriba County Planning Department
Land Use Plan	Ohkay Owingeh Land Use Master Plan	Ohkay Owingeh Planning Department

The following table indicates the status of the above enumerated plans for participating jurisdictions. Please note that some of these are umbrella plans from Rio Arriba County providing coverage to the community or tribe:

Table 24: Jurisdictional Plans

Jurisdiction	Capital Improve	Climate Action	Community Wildfire Protection*	Comprehensive	Emergency Operations*	Floodplain Management	Land Use and Zoning
Rio Arriba County	x		x	x	x	x	x
Chama	x		x	x	x	x	
Espanola	x		x	x	x	x	
Ohkay Owingeh	x		x	x	x	x	

Note: Blank indicates no plan

Note: * May be under county plan

4.5 Financial Capabilities

Rio Arriba County and all participating jurisdictions can raise revenue by through the application of a tax, an assessment, or a fee, each approved by a statutory authority. The differences between a tax, assessment, and fee are primarily related to their purpose and how they are imposed:

- **Tax:** A mandatory financial charge imposed by a government on individuals or entities to generate revenue for public services, such as schools, roads, and public safety. Taxes are broad and general in nature.
- **Assessment:** A charge levied on property owners to fund specific local improvements that benefit their property, like road paving or sewer systems. It is usually proportional to the benefit received.
- **Fee:** A charge for a specific service provided by the government, such as a building permit, park entry, or utility connection. Fees are usually voluntary and paid directly by the user of the service.

Tribal governments are sovereign entities with the authority to govern themselves, which includes the power to levy taxes, assessment, and fees within their jurisdiction.

Additionally, Rio Arriba County and all participating jurisdictions can borrow money in a number of different ways, generally used as a means of financing large projects such as infrastructure and buildings. Major methods include:

- **General Obligation Bonds:** General obligation bonds have been the traditional form of financing for capital projects such as land acquisition, park development, and transportation projects that are owned and operated by the county. In general, repayment is guaranteed by both tax revenue and operating revenue.
- **Revenue Bonds:** Generally used to finance water and wastewater projects, airports, and stormwater systems. Payment for debt service on revenue bonds comes from user fees generated by the capital facility that is being built.
- **Local Improvement District Bonds:** When a capital project is going to primarily benefit a subset of the population, a Local Improvement District can be formed. Local Improvement Districts are commonly used for projects such as street improvements, water and sewer systems, and the burying of power lines. Bond payment is through an assessment to property owners in the improvement district.

Concerning hazard mitigation, Rio Arriba County and all participating jurisdictions have numerous avenues to fund potential projects, including:

- **Grants:** Participating jurisdictions can apply for state and federal grants for hazard mitigation projects through myriad programs.
- **Bond Issuance:** Participating jurisdictions can issue bonds to finance large-scale mitigation projects, such as infrastructure upgrades.

- **Public-Private Partnerships:** Participating jurisdictions can collaborate with private entities to fund and implement mitigation measures.
- **Reserves and General Funds:** Participating jurisdictions may allocate funds from their general budget or reserves for mitigation activities.

Participating Stakeholder Financial Capability Summary

The following table indicates the status of the above enumerated financial capabilities for participating jurisdictions:

Table 25: Participating Jurisdiction Financial Capabilities

Jurisdiction	Tax	Assessment	Fee	Grant Application	Public-Private Partnership	Reserves and General Funds
Rio Arriba County	x	x	x	x	x	x
Chama	x	x	x	x	x	x
Espanola	x	x	x	x	x	x
Ohkay Owingeh	x	x	x	x	x	x

4.6 Community-Based Classifications

Rio Arriba County currently participates in the following community-based classifications, which attest to the continued investment in community resilience.

Public Protection Classification

An Insurance Services Office (ISO) fire rating, officially known as the Public Protection Classification (PPC) rating, is a score given to evaluate the fire protection capabilities of a community. This rating assesses how well-equipped a local fire department is to respond to fires, which can impact insurance premiums for homeowners and businesses within that community. Key Components of the ISO Fire Rating include:

- **Emergency Communications:** This evaluates the community's emergency call center and dispatch system. The speed and efficiency of handling emergency calls are critical factors.
- **Fire Department:** The number, training, and equipment of the firefighters are assessed. This includes the department's ability to handle fires, the number of engines, and the availability of water supply.
- **Water Supply:** The availability and reliability of water sources, such as hydrants and water mains, are evaluated. This also includes the volume of water available for firefighting.
- **Community Risk Reduction:** This includes fire prevention efforts, public fire safety education, and building code enforcement. Effective risk reduction programs can positively impact the ISO rating.

The ISO rating is given on a scale from 1 to 10, with a Class 1 rating representing the best public protection and superior fire protection services and a Class 10 rating indicating that the community's fire protection does not meet ISO's minimum standards. A better (lower) ISO rating can lead to lower insurance premiums for property owners because it indicates a lower risk of fire damage. The following table details ISO ratings for program participants:

Table 26: Rio Arriba ISO Ratings

Name	ISO Rating
Abiquiu Fire District	9
Canjilon Fire District	10
Chamita Fire District	6
Coyote Fire District	10
Dixon Fire District	9
Dulce Fire District	8
El Rito Fire District	9
Laguna Vista Fire District	9
La Mesilla Fire District	9

Table 26: Rio Arriba ISO Ratings

Name	ISO Rating
Ojo Sarco Fire District	10
Tierra Amarilla Fire District	9
Truchas Fire District	10
Vallecitos Fire District	10
City of Chama	7
City of Espanola	7

Source: Insurance Services Office

Firewise USA Program

The Firewise USA program is a national initiative designed to help communities at risk from wildfires take proactive steps to reduce their vulnerability. Managed by the National Fire Protection Association (NFPA), the program encourages local solutions for wildfire safety by involving homeowners, community leaders, and other stakeholders in reducing fire risks. Key Elements of the program include:

- **Community Engagement:** The program focuses on encouraging communities to work together to develop and implement plans that reduce the risk of wildfire damage. This includes organizing community events, educational workshops, and fire preparedness activities.
- **Risk Assessment:** The program helps communities assess their wildfire risk by identifying vulnerable areas, such as overgrown vegetation or homes with flammable roofing materials. Communities then create a plan to address these risks.
- **Mitigation Actions:** The program encourages property owners to take specific actions to make their homes and surroundings more fire-resistant. These actions might include clearing brush and dead trees, using fire-resistant building materials, and creating defensible space around homes.
- **Education and Resources:** The program provides educational materials and resources to help communities understand wildfire risks and the steps they can take to mitigate them. This includes guidelines for homeowners, tips for creating fire-resistant landscapes, and strategies for community preparedness.
- **Community Cohesion:** The program fosters a sense of shared responsibility and cooperation among community members, which can enhance overall preparedness and resilience.
- **Potential Insurance Discounts:** Some insurance companies offer discounts to homeowners in recognized Firewise communities, reflecting the reduced risk of wildfire damage.

The following are current Firewise USA program participants:

Table 27: Firewise USA Members

Name	Recognition Date
Dixon Volunteer Fire Department	06/23/2023
Brazos Canyon Fire District	09/29/2017

Source: Firewise USA

StormReady Community

The StormReady program is a community preparedness initiative developed by the NWS to enhance the ability to prepare for and respond to severe weather events. The goal of StormReady is to help communities develop comprehensive weather safety plans that save lives and protect property. Key Components of the program include:

- **Establishing Warning Systems:** Communities must have multiple ways to receive severe weather warnings and alert the public. This can include NOAA Weather Radios, emergency alert systems, and local broadcast media.
- **Emergency Operations Center:** A designated location where emergency managers and public officials can monitor weather conditions and coordinate responses.

- **Public Education Programs:** Communities in this program must promote weather safety and preparedness through public outreach, including safety fairs, school programs, and distributing weather information materials.
- **Training:** Community leaders and emergency managers undergo training on how to prepare for, respond to, and recover from severe weather.
- **Advanced Monitoring Systems:** Communities are required to monitor local weather conditions in real-time, often using local spotters, weather stations, and other technology to keep track of changing weather patterns.
- **Formal Emergency Plans:** Communities must develop and maintain formal plans for responding to various types of severe weather, including hurricanes, tornadoes, floods, and winter storms. These plans should detail evacuation routes, shelter locations, and post-disaster recovery strategies.
- **Collaboration with the NWS:** Communities work closely with their local NWS office to ensure they have the latest information and resources for weather preparedness and response.
- **Potential Insurance Benefits:** Some insurance providers may offer benefits or discounts to communities that are StormReady certified, reflecting the reduced risk of weather-related damage.

Neither Rio Arriba County nor any participating jurisdictions are StormReady communities.

4.7 Special Districts Mitigation Capabilities

Special districts, which are independent government units created for specific purposes, have several mitigation capabilities:

- **Infrastructure Development and Maintenance:** They can build and maintain infrastructure like levees, drainage systems, or firebreaks to reduce the impact of natural hazards.
- **Emergency Services:** Some districts manage fire protection, flood control, or emergency medical services, which are critical in disaster response and mitigation.
- **Land Use and Zoning:** They can enforce zoning regulations that limit development in high-risk areas.
- **Public Education and Outreach:** Special districts often provide information and resources to help communities prepare for and respond to hazards.
- **Collaboration:** They often work with local, state, and federal agencies to coordinate mitigation efforts and share resources.

Fire districts mitigation capabilities include:

- **Fire Prevention Programs:** They conduct inspections, enforce fire codes, and promote fire-safe practices within communities.
- **Hazardous Fuels Management:** Fire districts manage vegetation to reduce fuel loads, including controlled burns and clearing brush, to prevent the spread of wildfires.
- **Emergency Response Planning:** They develop and implement response plans for wildfires, floods, and other emergencies, ensuring quick and effective action.
- **Public Education:** Fire districts educate residents on fire safety, evacuation procedures, and emergency preparedness.
- **Infrastructure Protection:** They work to protect critical infrastructure and buildings by ensuring compliance with building codes and fire-resistant construction practices.
- These capabilities allow special districts to play a crucial role in reducing risks and enhancing community resilience against natural hazards.

School districts mitigation capabilities include:

- **Building Safety:** They enforce building codes and design schools to withstand hazards like earthquakes, floods, and tornadoes.
- **Emergency Preparedness Plans:** School districts develop and regularly update emergency response plans, including evacuation routes, shelter-in-place procedures, and communication strategies.
- **Drills and Training:** They conduct regular safety drills and provide training for students, teachers, and staff on how to respond during emergencies.
- **Community Coordination:** School districts collaborate with local emergency services, law enforcement, and public health agencies to ensure a coordinated response to hazards.
- **Resilience Education:** They integrate disaster preparedness into the curriculum, teaching students about hazard awareness and safety practices.

Soil and water conservation districts have mitigation capabilities include:

- **Flood Control:** They manage reservoirs, levees, and drainage systems to prevent or reduce flooding.
- **Water Supply Management:** Water districts ensure the stability and reliability of water supplies during droughts or emergencies by implementing conservation measures and diversifying water sources.
- **Infrastructure Resilience:** They maintain and upgrade water infrastructure to withstand hazards.
- **Emergency Response:** Water districts develop and implement emergency response plans to quickly address disruptions in water services due to natural hazards.
- **Public Education:** They educate the community on soil and water conservation, hazard preparedness, and response strategies.

Watershed districts have several mitigation capabilities to manage and protect water resources:

- **Flood Control:** They design and maintain infrastructure like dams, levees, and retention basins to control flooding and manage stormwater.
- **Water Quality Management:** Watershed districts implement practices to reduce pollution, manage runoff, and protect drinking water sources.
- **Erosion Control:** They work to prevent soil erosion by implementing land management practices and restoring natural vegetation along waterways.
- **Public Education:** Watershed districts educate the community on water conservation, pollution prevention, and the importance of maintaining healthy watersheds.
- **Habitat Restoration:** They engage in efforts to restore wetlands, rivers, and other ecosystems to enhance biodiversity and natural resilience to hazards.

The above enumerated capabilities allow special districts to play a crucial role in reducing risks and enhancing community resilience against natural hazards.

The following table list relevant special districts within Rio Arriba County:

Table 28: Rio Arriba County Special Districts

District Type	Special District Name
Fire District	Abiquiu
Fire District	Agua Sana
Fire District	Brazos Canyon
Fire District	Canjilon
Fire District	Chamita
Fire District	Coyote
Fire District	Dixon
Fire District	Dulce

Table 28: Rio Arriba County Special Districts

District Type	Special District Name
Fire District	El Rito
Fire District	Laguna Vista
Fire District	La Mesilla
Fire District	Lindrith/Llaves
Fire District	Ojo Sarco
Fire District	Rio Grande Fire District
Fire District	Tierra Amarilla
Fire District	Truchas
Fire District	Vallecitos
School District	Chama Valley Independent School District
School District	Dulce Independent Schools
School District	Espanola Public Schools
School District	Jemez Mountain Public Schools
School District	Mesa Vista Consolidated Schools
Soil and Water Conservation District	East Rio Arriba Soil and Water Conservation District
Watershed District	Upper Rio Grande Watershed District

4.8 Jurisdictional Compliance with NFIP

Rio Arriba County NFIP participating communities are committed to continued involvement and compliance. To help facilitate compliance, NFIP participating communities:

- Meet the minimum standards set forth in the program.
- Adopted floodplain regulations through local ordinance.
- Enforce floodplain ordinances through building restrictions.
- Regulate new construction in Special Flood Hazard Areas as outlined in their floodplain ordinance.
- Utilize FEMA DFIRMs, where available.
- Monitor floodplain activities.

A community's NFIP coordinator plays a crucial role in managing and implementing floodplain management activities to reduce flood risk. Their responsibilities typically include:

- **Administering Floodplain Regulations:** Ensuring the community complies with NFIP standards by enforcing local ordinances and building codes in designated flood-prone areas.
- **Assisting Property Owners:** Providing guidance on flood insurance requirements, helping residents understand their flood risk, and facilitating access to NFIP insurance.
- **Maintaining Flood Maps:** Keeping and updating FIRMs to reflect current flood risks and communicating changes to stakeholders.
- **Coordinating Flood Risk Reduction Efforts:** Collaborating with federal, state, and local agencies to implement flood mitigation strategies and projects.
- **Community Outreach:** Educating the public about flood hazards, mitigation measures, and the importance of flood insurance coverage.

By fulfilling these duties, NFIP coordinators help reduce flood damage and promote community resilience. The following represent NFIP coordinators for each participating community within Rio Arriba County:

Table 29: Rio Arriba County Jurisdictional NFIP Coordinators

Jurisdiction	NFIP Coordinator	Title
Rio Arriba County	Gabriel Boyle	Planning and Zoning Director
Chama	Anna Pobar	Planning and Zoning Coordinator
Espanola	Ernest Martinez	Deputy Planning Director

Table 29: Rio Arriba County Jurisdictional NFIP Coordinators

Jurisdiction	NFIP Coordinator	Title
Ohkay Owingeh	Do not participate	Do not participate

Participation in the NFIP is based on an agreement between the municipality and the federal government. If a municipality agrees to adopt and enforce a floodplain ordinance designed to reduce future flood risks, all citizens in the participating municipality can purchase flood insurance.

As part of NFIP participation, communities must:

- Use current NFIP flood maps in adopting floodplain management regulations.
- Require permits for all development in SFHAs
- Ensure that development does not increase the flood hazard on other properties.
- Meet current elevation standards. Ensuring the lowest occupied floor is elevated to or above the base flood elevation indicated on the NFIP flood map.

A jurisdiction might choose not to participate in the NFIP for several reasons, despite the program's benefits in managing flood risks and providing insurance options. Participating in the NFIP requires adopting and enforcing floodplain management regulations, maintaining records, and updating flood maps. Smaller jurisdictions, or those with limited resources, might find this administrative effort overwhelming. Some jurisdictions perceive their flood risk as minimal or nonexistent, especially if there are no SFHAs within their jurisdiction. Finally, implementing flood mitigation measures, such as updating infrastructure or adhering to NFIP standards, can be expensive. Jurisdictions with constrained budgets may prioritize other needs over NFIP participation.

While most floodplain requirements have been incorporated into the current Building Codes, some additional provisions and regulations may be required by a community. Communities participating in the NFIP are required to adopt, enforce and maintain a local floodplain ordinance as a stipulation of compliance with the program. The purpose of this ordinance is to ensure public safety, minimize impact to persons and property from flooding, protect watercourses from encroachment, and maintain the capability of floodplains to retain and carry off floodwaters. The local floodplain administrator is typically the municipal official responsible for overseeing the enforcement and update of the document.

Each participating jurisdiction in the NFIP has their own NFIP Coordinator to ensure base flood elevation certificates are completed for all new construction in the planning area, ensure any development in a flood plain is accompanied by a Flood Hazard Development Certificate, and further develops the NFIP program in the planning area to mitigate flood risk to its population. Both certificates are required prior to construction and to be completed by a licensed surveyor. The Village of Chama does not have any additional, codified requirements or ordinances beyond the minimum required by the NFIP. In addition to the NFIP requirement, Rio Arriba County has adopted the Flood Damage Prevention Ordinance 2011-004 while the City of Española has adopted the Floodplain Development Ordinance 2012-10.

Rio Arriba County jurisdictional floodplain ordinances are typically enforced by law enforcement departments and/or code enforcement offices. For all Rio Arriba County NFIP participating communities the enforcement process works as follows:

- **Identification of Violations:** Violations are often identified through various means, such as citizen complaints, routine inspections, or observations by enforcement officers.
- **Notification:** Once a violation is identified, the responsible party is typically notified of the violation. This notification may come in the form of a written citation, warning letter, or verbal communication depending on the severity of the violation and local procedures.
- **Correction Notice:** In many cases, the responsible party is given a certain amount of time to correct the violation. They may be required to remedy the situation, obtain necessary permits, or comply with specific regulations.
- **Follow-up Inspections:** After the designated correction period, enforcement officers may conduct follow-up inspections to ensure that the violation has been addressed satisfactorily.

- **Penalties and Fines:** If the responsible party fails to comply with the ordinance or correct the violation within the specified timeframe, they may face penalties or fines. These penalties can vary depending on the nature and severity of the violation and may escalate for repeated offenses.
- **Legal Action:** In cases of persistent non-compliance or serious violations, local authorities may initiate legal proceedings against the responsible party. This can involve court appearances, injunctions, or other legal measures to compel compliance.

Additionally, FEMA has specific requirements NFIP communities must follow both before (pre-disaster) and after (post-disaster) a flood event. These requirements are designed to mitigate flood risks, promote sustainable development, and ensure eligibility for federal disaster assistance and flood insurance benefits. The following figure represents both pre- and post-disaster NFIP community requirements:

Figure 7: Pre- and Post-Disaster Community NFIP requirements



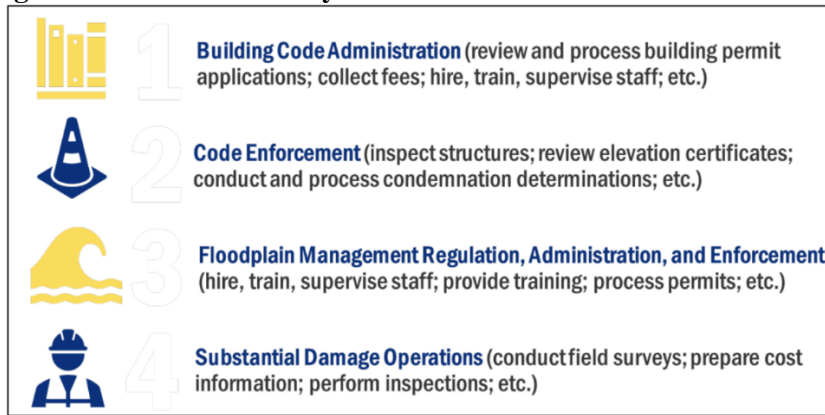
Source: FEMA

When structures located in the SFHAs are substantially modified (more than 50% damaged or improved) they are required to be brought into compliance with current NFIP standards and local building codes. In cases of repairs being conducted as a result of damage, jurisdictional NFIP Coordinators are responsible for substantial damage and improvement determinations. These determinations are required for compliance in the NFIP and must be completed before residents begin repairs or permits are issued.

However, the May 2020 Report to Congressional Committees on the National Flood Insurance Program by the United States Government Accountability indicates “FEMA generally does not collect or analyze the results of these assessments, limiting its ability to ensure the process operates as intended. Furthermore, FEMA has not clarified how communities can access NFIP claims data. Such data would help communities target substantial damage assessments after a flood.” This has been found to be true in Rio Arriba County, with submitted information and data underutilized and some FEMA available data unshared and/or unadvertised.

Section 1206 of the Disaster Recovery Reform Act of 2018 authorizes the FEMA to provide communities with the resources to administer and enforce building code and floodplain management ordinances following a major disaster declaration through FEMA’s Public Assistance Program. To be eligible for reimbursement under the Public Assistance Program, including for the Disaster Recovery Reform Act of 2018 Section 1206, communities must be designated for Public Assistance permanent work under a major disaster declaration and be legally responsible to administer and enforce building codes or floodplain management regulations. Communities must also be in good standing with the NFIP. Available assistance includes:

Figure 8: Disaster Recovery Reform Act of 2018 Available Assistance



Source: FEMA

It is worth noting that this assistance is available for a variety of hazards occurrence types, not just flooding.

Key to achieving across the board reduction in flood damages is a robust community assistance, education, and awareness program. As such, NFIP participating jurisdictions will continue to develop both electronic (including social media) and in person outreach activities.

4.9 Challenges and Opportunities for Capability Improvement

As always, challenges exist for all participating jurisdictions due to the day-to-day demands of the working environment including staffing issues, budget restrictions, and staffing turnover. These issues can, and do, impact the utilization and incorporation of the LHMP and the completion of identified hazard mitigation projects.

As part of this planning process, the MPC worked to identify gaps and deficiencies identified in the completion of this LHMP. Resulting from this assessment is a series of problem statements, concise descriptions of issues or challenges that need to be addressed. These problem statements were determined to be applicable to all participating jurisdictions:

- Continued climate change is driving an increased incidence of major hazard occurrences, stressing the response, recovery, and mitigation capabilities of even the most prepared jurisdiction.
- Available funding for the completion of hazard mitigation projects is at a premium, with all participating jurisdiction seeing minimal room in the budget for any required project match.
- The difficulties in applying for and managing hazard mitigation grants is a challenge for both all participating jurisdictions
- Staffing at all levels is stretched thin, with many personnel wearing multiple hats, compromising mitigation capabilities.

Improving capabilities can lead to enhanced performance, increased efficiency, and better outcomes in hazard mitigation planning and implementation. The following identify recommended improvements for all jurisdictions, with some recommendations being applicable to all jurisdictions, and other being specific to identified jurisdictions:

- Continued instruction should be solicited from NMDHSEM and FEMA Region VI on grant application and grant management strategies to reflect changing requirements.
- All participating jurisdictions should conduct more extensive educational outreach to all communities, especially vulnerable and underserved communities, on mitigation actions and methodologies
- Participating jurisdictions not in the NFIP should apply for membership
- Participating NFIP communities should apply for membership in the CRS to allow citizens to receive discounts off their federally backed flood insurance policies.
- Participating jurisdictions who are not current participants should apply for membership in the Firewise USA program.

- Participating jurisdictions who are not current participants should apply for membership in the StormReady program.
- Rio Arriba County and participating jurisdictions should continue to explore and engage in public-private emergency planning partnerships to further increase hazard resiliency through the infusion of additional funding and expertise to help complete mitigation projects.
- Participating jurisdictions that do not have climate studies and plans should conduct them.
- Participating jurisdictions that do not have wildfire specific codes or ordinances should draft and adopt them.

Table 30: Participating Jurisdiction Opportunities for Improvement

	Rio Arriba County	Chama	Espanola	Ohkay Owingeh	Rio Arriba School District
Grant Education	x	x	x	x	x
Community Outreach	x	x	x	x	x
NFIP Application				x	
CRS Application	x	x	x	x	
Firewise Application	x	x	x	x	
StormReady Application	x	x	x	x	
Climate Plan	x	x	x	x	
Wildfire Ordinance	x	x	x	x	

To help overcome many of these identified challenges, participating jurisdictions will work collaboratively using the following strategies, as appropriate:

- **Innovation and Adaptation:** Foster a culture of innovation and adaptability. Encourage employees to think creatively, embrace change, and explore new ways of doing things to overcome challenges.
- **Training and Development:** Invest in training and development to enhance skills and knowledge.
- **Communication Improvement:** Enhance communications and provide clear and transparent communication when sharing information, aligning teams, and addressing concerns.
- **Collaboration and Teamwork:** Encourage collaboration and teamwork which allows for the pooling of diverse skills and perspectives, leading to more effective problem-solving (the MPC is a good example of effective use of this strategy).
- **Technology Adoption:** Embrace technology to streamline operations and enhance productivity.
- **Agile Project Management:** Implement agile project management methodologies to enhance flexibility and responsiveness to changing conditions. Agile approaches allow teams to adapt quickly to challenges.

As appropriate, these strategies will be tailored for specific circumstances, with a combination of these strategies often being more effective than relying on a single approach.

Section 5 – Hazard Identification and Risk Assessment

5.1 Introduction

The goal of this hazard mitigation is to reduce the future impacts of hazards, including deaths and injuries, property damage, and disruption to local and county economies, and to further reduce the amount of public and private funds spent to assist recovery. To complete this goal, hazard mitigation decision-making in this plan has been based on a robust risk assessment, completed to identify natural, human caused, and technological hazards that represent a risk to Rio Arriba County. The following provide a definition of the risk assessment terms used during this assessment:

- **Hazard:** An act or phenomenon that has the potential to produce harm or other undesirable consequences to a person or thing.
- **Exposure:** The people, property, systems, or functions that could be lost to a hazard. Generally, exposure includes what lies in the area the hazard could affect.
- **Vulnerability:** Vulnerability is susceptibility to physical injury, harm, damage, or economic loss. It depends on an asset's construction, contents, and economic value of its functions.
- **Risk:** A function of hazard, vulnerability, and exposure. It refers to the likelihood of an event resulting in an adverse condition that causes injury or damage.

In order to accomplish this assessment, all relevant natural, human caused, and technological hazards, potential vulnerabilities, and exposures were identified. As potential hazards, vulnerabilities, and exposure are identified Rio Arriba County can continue to develop a strategy to identify and prioritize mitigation action to defend against these potential risks.

5.2 Declared Federal Disasters

The Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. §§ 5121-5206) provides for the Federal support of State and local governments and their citizens when impacted by an overwhelming disaster. The Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended, establishes the process for requesting a Presidential disaster declaration and defines the type of assistance available.

If it is apparent that a Presidential disaster declaration may be necessary to assist in the recovery of an impacted area, Rio Arriba County and FEMA Region VI will conduct a Preliminary Damage Assessment (PDA). This assessment is used to determine:

- The extent of the event.
- The impact of the event on individuals and public facilities.
- The types of federal assistance that may be needed.

Once the PDA is complete, and if a determination is made that the damages exceed available State of New Mexico resources, the Governor may submit through FEMA Region VI a declaration request to the President.

A major disaster declaration provides a wide range of federal assistance programs for individuals and public infrastructure, including funds for both emergency and permanent work. Not all programs, however, are activated for every disaster. The determination of which programs are authorized is based on the types of assistance specified in the Governor's request and the needs identified during the initial and subsequent PDAs. FEMA disaster assistance programs may include:

- Individual Assistance
- Public Assistance
- Hazard Mitigation

To recognize and encourage mitigation, FEMA considers the extent to which mitigation measures contributed to the reduction of disaster damages. This could be especially significant in those disasters where, because of mitigation, the estimated public assistance damages fell below the per capita indicator.

Historical events of significant magnitude or impact can result in a Presidential Disaster Declaration. The MPC reviewed the historical federal disaster declarations to assist in hazard identification. The following table details Disaster Declarations for Rio Arriba County:

Table 31: Rio Arriba County Presidentially Declared Disasters

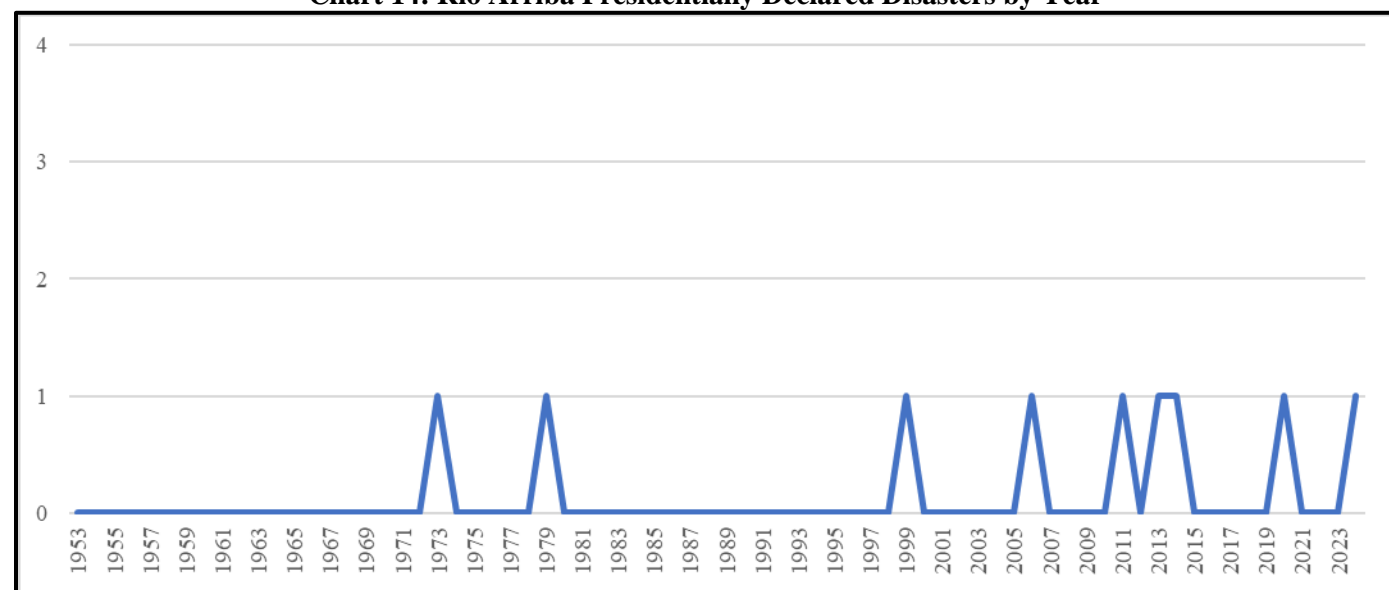
Designation	Declaration Date	Incident Type	Individual Assistance	Public Assistance
DR-4795-NM	06/20/2024	New Mexico South Fork and Salt Fire	\$7,628,322	-
DR-4529-NM	04/05/2020	New Mexico Covid-19 Pandemic	\$386,089,052	\$1,997,307
DR-4197-NM	10/6/2014	Severe Storms, Flooding	\$6,276,380	-
DR-4152-NM	10/29/2013	Severe Storms, Flooding, Mudslides	\$41,827,081	-
DR-1962-NM	03/24/2011	Severe Winter Storm, and Extreme Cold Temperature	\$1,801,838	-
DR-1659-NM	01/30/2006	Severe Storms, Flooding	\$34,407,619	-
DR-1301-NM	09/22/1999	Severe Storms, Flooding	\$1,968,330	-
DR-589-NM	06/23/1979	Severe Storms, Snowmelt, Flooding	-	-
DR-380-NM	05/11/1973	Severe Storms, Snowmelt, Flooding	-	-

Source: FEMA

-: Not reported

The following chart represents Presidentially Declared Disasters in the Rio Arriba County by year, starting in 1955:

Chart 14: Rio Arriba Presidentially Declared Disasters by Year



Source: FEMA

The President can declare an emergency for any occasion or instance when the President determines federal assistance is needed. Emergency Declarations supplement State and local or Indian tribal government efforts in providing emergency services, such as the protection of lives, property, public health, and safety, or to lessen or avert the threat of a catastrophe. The total amount of assistance provided for in a single emergency may not exceed \$5,000,000. The following types of assistance are available under an Emergency Declaration:

- Public Assistance, Categories A (debris removal) and B (emergency protective measures)
- Individual Assistance, the Individuals and Households Program

The MPC reviewed the historical federal emergency declarations to assist in hazard identification. The following table details Emergency Declarations for Rio Arriba County.

Table 32: Rio Arriba County Emergency Declarations

Designation	Declaration Date	Incident Type	Public Assistance
EM-3460-NM	3/13/2020	New Mexico Covid-19 Pandemic	-
EM-3299-NM	9/7/2005	New Mexico Hurricane Katrina Evacuation	\$1,036,862
EM-3154-NM	5/10/2000	New Mexico Fire	-
EM-3460-NM	3/13/2020	New Mexico Covid-19 Pandemic	-

Source: FEMA

The Governor, or the Governor's Authorized Representative, may submit a request for a fire management assistance declaration as required. FEMA will approve declarations for fire management assistance when it is determined that a fire or fire complex on public or private forest land or grassland threatens such destruction as would constitute a major disaster.

The MPC reviewed the historical fire management declarations to assist in hazard identification. The following table details fire management declarations for Rio Arriba County:

Table 33: Rio Arriba Fire Management Declarations

Designation	Declaration Date	Incident Type	Public Assistance
FM-2993-NM	6/26/2011	New Mexico Las Conchas Fire	\$1,651,694
FM-2408-NM	5/23/2002	New Mexico Borrego Fire	\$958,865
FM-1329-NM	5/13/2000	New Mexico Wildfire	\$5,652,344

Source: FEMA

In New Mexico, the governor has the authority to declare a state of emergency or disaster under various state statutes and provisions. This authority allows the governor to activate resources, issue orders, and coordinate responses to protect public safety. The Emergency Management Act (NMSA 1978, Section 12-10-1 to 12-10-10) gives the governor broad authority to declare a state of emergency or disaster when there is an “occurrence or imminent threat” of widespread or severe damage, injury, or loss of life or property due to natural or human-caused disasters. The following represent State of New Mexico disaster declarations from 2019-2024.

Table 34: Governor of New Mexico Rio Arriba Disaster Declarations, 2019 - 2024

Year	Executive Order	Incident Type
2023	2023-060	Drought and Severe Fire Conditions (statewide)
2022	2022-119	Flood
2022	2022-002	Snow
2021	2021-053	Flood
2021	2021-028	Drought and Severe Fire Conditions (statewide)
2020	2020-084	Drought (statewide)
2020	2020-040	Drought and Severe Fire Conditions (statewide)
2019	2019-014	Flood
2019	2019-009	Severe Wind, Tornadoes, Hail, and Power Outages (statewide)
2019	2019-008	Severe Winter Storms (statewide)

Source: NMDHSEM

5.3 Identified Potential Hazards

One of the first steps in developing a hazard assessment is to identify the hazards that have a reasonable risk of occurring. Proper identification allows for appropriate and well-planned action in order to mitigate the extent and cascading impacts of an incident. Furthermore, while not all disaster contingencies can be planned for, applying an all-hazards

approach to the mitigation process does yield greater awareness and better preparedness for unforeseen hazard incidents overall.

Public Comment: *Wildfire and flooding seem to be the most prominent issues affecting Rio Arriba County.*

The MPC met to discuss previously identified hazards and deliberate on any changes or additions to the regional hazard profile. A thorough and comprehensive revision of data for each hazard was completed as part of this plan update. Additionally, this plan has worked, as per FEMA recommendations, to merge similar hazards together with the aim of both simplifying the usage of the plan and reducing duplication of effort.

The MPC confirmed the following natural hazards that may impact the Rio Arriba County:

- Dam Failure
- Drought
- Extreme Heat
- Flood
- Landslide
- Severe Weather
- Severe Winter Weather
- Wildfire

The following table indicates the improvement of worsening of conditions related to the identified hazards in this LHMP since the completion of the 2018 LHMP:

Table 35: Natural Hazard Change in Conditions

Natural Hazard	Change in Conditions	Notes
Dam Failure	Unchanged	The number of extremely high hazard dams in the county has not changed.
Drought	Worsening	Available data indicates that the rate of drought occurrence is increasing.
Extreme Heat	Worsening	Data indicates that the number of high temperature days has been increasing. Continued climate change is expected to exacerbate these conditions.
Flood	Worsening	Data indicates that while rainfall occurrence has lessened, the number of heavy rainfall events have increased. Additionally, increased wildfire and drought occurrences have exacerbated conditions related to flash flood events.
Landslide	Worsening	Increased wildfire and drought occurrences have exacerbated conditions related to flash flood events.
Severe Weather	Worsening	Data indicates that incidences of severe weather are likely to increase due to changes in climate.
Severe Winter Weather	Improving	Data indicates that incidences of severe winter weather are likely to increase change to changes in climate.
Wildfire	Worsening	Increased extreme heat and drought occurrences have exacerbated conditions related to wildfire events.

The following table indicates the increase or decrease in vulnerabilities to the identified hazards in this LHMP since the completion of the 2018 LHMP:

Table 36: Natural Hazard Change in Vulnerability

Natural Hazard	Change in Vulnerability	Notes
Dam Failure	Decreasing	The number of citizens and property exposed to a dam failure event has decreased due to decreasing population sin potentially impacted jurisdictions.
Drought	Increasing	A continued decline in population will decrease the human vulnerability to drought. However, aging water infrastructure and a slight increase in agricultural land will tend to increase the overall vulnerability.
Extreme Heat	Increasing	A continued increase in both the age of residences and an aging infrastructure will increase vulnerability.
Flood	Increasing	A continued decline in population and a static level of housing will decrease vulnerability. However, the expanded extent of flash flood events, due largely to wildfire scars, in areas previously not determined as susceptible will increase vulnerability.
Landslide	Increasing	A continued decline in population and a static level of housing will decrease vulnerability. However, the expanded extent of potential landslide areas, due largely to wildfire scars will increase vulnerability.
Severe Weather	Unchanged	A continued decline in population and a static level of housing will decrease vulnerability.
Severe Winter Weather	Unchanged	A continued decline in population and a static level of housing will decrease vulnerability.
Wildfire	Increasing	A continued spread of citizens into remote areas of the county will increase potential vulnerability. Current programs to harden exposed structures and educate community members and a decreasing population may eventually decrease future vulnerability.

Based on discussion with the MPC, a lack of identified risk or history, and geographic improbability, numerous FEMA identified hazards such as coastal erosion and hurricane were not included in the scope of this plan. Additionally, the following natural hazards, while recognized as potential hazards, did not warrant full discussion for the enumerated reasons:

- **Earthquake:** Mapping from the USGS indicates an extremely low likelihood for occurrence and damage from an earthquake event.
- **Expansive Soils:** Information from the United States Geological Service (USGS) Swelling Clays Map of the Conterminous United States indicates that the majority of Rio Arriba County has low susceptibility to swelling soils. Additionally, the 2023 State of New Mexico Hazard Mitigation Plan rates it as a low hazard for Rio Arriba County.
- **Tornado:** Data from the NCEI indicates that over the 74-year period from 1950-2024, Rio Arriba County has recorded one tornado rated at F0 (the lowest rating for a tornado) and one tornado rated at EF1 with no minor damage and no deaths or injuries.
- **Volcano:** There have been no geologically recent recorded damaging volcanic events in Rio Arriba County in recent history. Additionally, the 2018 State of New Mexico LHMP indicates Rio Arriba County has no risk to volcanoes.

5.4 Hazard Planning Significance

For the purposes of this plan, hazard planning significance refers to the relevance of the identified hazard to the jurisdictions of Rio Arriba County when calculating risk and vulnerability. In order to help quantify the planning significance for a hazard, data was reviewed on three levels, federal (various data sets), state (State of New Mexico 2023 Hazard Mitigation plan and available state databases and GIS resources), and local (data relevant to occurrence

and vulnerability on a county and local level). This allowed for a comparison between data sets for each hazard type and allowed for a summation at the county level. It is recognized that inconsistencies in methodologies and data make it difficult to make a direct comparison across all data levels. However, as possible, collected data was translated into a unified model that accounted for any variability in data and methodologies. The result of this assessment provides a larger scale snapshot of how Rio Arriba County jurisdictions view risk and allowed for integration of hazard data into the LHMP.

Augmenting state and local data, FEMA's NRI dataset and online tool was used to help determine local community risk for identified natural hazards in this LHMP. This tool is useful in that it helps provide a simple, visual method of understating local level jurisdictional vulnerability. However, like all clearinghouse databases, it is recognized to have some limitations. As such, and as mentioned above, the data was vetted by Rio Arriba County and participating jurisdictions against local and state data and analysis. Where discrepancies exist, they are noted and discussed in the relevant hazard section.

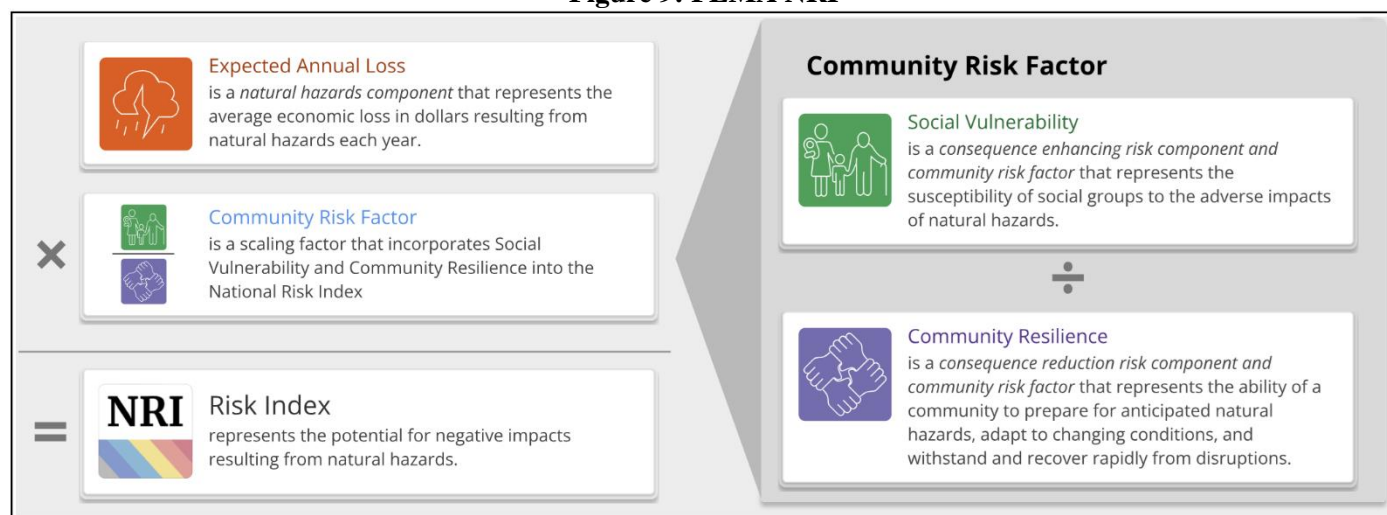
The risk equation behind the Risk Index includes three components, Expected Annual Loss (EAL), social vulnerability (previously discussed), and community resilience (previously discussed). The dataset supporting EAL provides estimates measured in 2022 U.S. dollars. The datasets supporting the social vulnerability and community resilience components have been standardized using a minimum-maximum normalization approach prior to being incorporated into the NRI risk calculation.

As part of the NRI, EAL represents the average economic loss in dollars resulting from a hazard each year. It quantifies loss for relevant consequence types, buildings, people, and agriculture. An EAL score and rating represent a community's relative level of expected losses each year when compared to all other communities at the same level. EAL is calculated using an equation that includes exposure, annualized frequency, and historic loss ratio risk factors. Exposure is a factor that measures the building value, population, and agriculture value potentially exposed to a natural hazard occurrence. Annualized frequency is a factor that measures the expected frequency or probability of a hazard occurrence per year. Historic loss ratio is a factor that measures the percentage of the exposed consequence type value (building, population, or agriculture) expected to be lost due to an occurrence. EAL represents the average economic loss in dollars resulting from natural hazards each year and is proportional to a community's risk.

To calculate Risk Index values, the NRI generates a Community Risk Adjustment to scale EAL values up or down, depending on their community risk factors, increasing with social vulnerability and decreases with community resilience. For a jurisdiction, a higher social vulnerability results in a higher Risk Index value while higher community resilience results in a lower Risk Index value.

Using these three components, Risk Index values are calculated for each jurisdiction (county and Census tract). The calculated Risk Index values form an absolute basis for measuring Risk within the NRI, and they are used to generate Risk Index percentiles and ratings across communities. The risk equation behind the NRI is as follows:

Figure 9: FEMA NRI



Source: FEMA

For both the Risk Index and EAL there is a qualitative rating that describes the nature of a community's score in comparison to all other communities at the same level, ranging from "Very Low" to "Very High." Because all ratings are relative, there are no specific numeric values that determine the rating.

The National Risk Index provides relative Risk Index percentiles and ratings based on data for Expected Annual Loss due to natural hazards, Social Vulnerability, and Community Resilience. Separate percentiles and ratings are also provided for each component: Expected Annual Loss, Social Vulnerability, and Community Resilience. For the Risk Index and Expected Annual Loss, percentiles and ratings can be viewed as a composite score for all hazards or individually for each of the 18 hazard types.

A community's score is represented by its percentile ranking among all other communities at the same level for Risk, Expected Annual Loss, Social Vulnerability and Community Resilience. For example, if a given Census tract's Risk Index percentile for a hazard type is 85.32 then its Risk Index value is greater than 85.32% of all US Census tracts. These scores are then assigned a qualitative rating that describes the community in comparison to all other communities at the same level, ranging from "Very Low" to "Very High." To determine Risk and Expected Annual Loss ratings, a methodology known as k-means clustering or natural breaks is applied to each value. This approach divides all communities into five groups such that the communities within each group are as similar as possible (minimized variance) while the groups are as different as possible (maximized variance). A cubed root transformation is applied to both Risk and Expected Annual Loss values before k-means clustering. Without the transformation, these values are heavily skewed by an extreme range of population and building value densities between urban and rural communities. By applying a cube root transformation, the National Risk Index controls for this characteristic and provides ratings with greater differentiation and usefulness.

The following table summarizes the FEMA NRI for Rio Arriba County and participating jurisdictions for all identified natural hazards:

Table 37: Participating Jurisdiction All Natural Hazard Risk Index

Jurisdiction	Census Tract	Risk Index	National Percentile
Rio Arriba County	All	Relatively Low	63.32
Chama	35039000500	Relatively Moderate	68.70
Espanola	35039940700	Relatively Moderate	75.99
Ohkay Owingeh	35039944100	Relatively Moderate	82.95

Source: FEMA NRI

In order to gain an understanding of vulnerability, the following table details the estimated FEMA EAL data for Rio Arriba County and participating jurisdictions (by census tract):

Table 38: Participating Jurisdiction All Natural Hazard EAL

Jurisdiction	Census Tract	EAL	National Percentile	Building EAL	Population Equivalence EAL (fatalities)	Agricultural EAL	Composite EAL
Rio Arriba County	All	Relatively Low	56.27	\$4,348,938	\$1,935,589 (0.17)	\$378,194	\$6,661,938
Chama	35039000500	Relatively Moderate	60.78	\$438,887	\$151,903 (0.01)	\$64,983	\$655,773
Espanola	35039940700	Relatively Moderate	61.93	\$428,112	244,738\$ (0.02)	\$3,783	\$676,633
Ohkay Owingeh	35039944100	Relatively Moderate	73.58	\$520,515	\$359,940 (0.03)	\$88,901	\$969,356

Source: FEMA NRI

Where appropriate, differences in vulnerability to identified hazards are noted in each individual hazard section.

5.5 Hazard Occurrence and Assessment Data

NOAA's National Centers for Environmental Information (NCEI) Storm Events Database was used as the primary source of information for previous occurrences of storm events. It is worth noting that damage estimates indicated by the NCEI are often artificially low. This underreporting is a result of the way the events are reported to the NCEI, often by the local and/or National Weather Service (NWS) office. When reporting an event, the NWS office does not have access to the actual damage assessment resulting from that event. As such, the report often details a very low amount or zero-dollar amount for damages. Most of the events from NCEI are not associated with a federal emergency or disaster. If the event occurred at the same time as an event that was later determined to be a federal emergency or disaster, it is included with the NCEI data even if it occurred in a county not included in the federal declaration.

Environmental Systems Research Institute ArcGIS v10 was used to determine which critical facilities were located within the boundaries of identified hazards (when applicable, and if data was available). Data was provided by the following agencies:

- Rio Arriba County and participating jurisdictions
- FEMA's National Flood Hazard Layer
- University of Wisconsin–Madison Spatial Analysis for Conservation and Sustainability Silvis Lab
- NOAA

Data was also obtained and utilized using Hazus-MH, Version 2.2 SP1, a program administered by the FEMA used to model losses. Modelling for hazards uses Hazus analysis to estimate losses and projected impacts from historical and annualized hazard events. Hazus default data was used in the analysis, including the 2020 Census and other State and Federal government facility databases. A level I analysis was run in Hazus for flood and earthquake, meaning the default population, building stock, and critical infrastructure data within the program was used to calculate losses and damages. Multiple hazard scenarios were run to estimate losses for the identified hazards. For the earthquake and hurricane hazards, historic event scenarios and probabilistic scenarios were run. Flood losses were analyzed using the 100 return scenarios as well as a probabilistic scenario.

Where appropriate, other utilized modeling types and systems are detailed in the relevant hazard analysis section.

5.6 Jurisdictional Critical Facilities, Assets, and Community Lifelines

Certain facilities and assets, such as infrastructure and community lifelines, have a net positive value on the community as they contribute to the public good by facilitating the basic functions of society. These facilities maintain order, public health, education, and help the economy function. Additionally, there are infrastructure and facilities integral to disaster response and recovery operations. Conversely, some infrastructure and facilities are of extreme importance due to the negative externalities created when they are impacted by a disaster. What fits these definitions will vary slightly from community to community, but the definitions remain as a guideline for identifying critical facilities and infrastructure. Rio Arriba County and the Ohkay Owingeh maintain critical facility details under separate cover for security purposes.

For this LHMP, it is assumed that all critical facilities are at equal risk to non-point hazard occurrence but may have varying risk to point hazard occurrence (dam failure and flood). Data concerning critical facilities potentially impacted by these point hazards, as available, is detailed under the respective hazard section.

Each hazard section provides a discussion on potentially vulnerable community lifelines. Community lifelines enable the continuous operation of critical government and business functions and are essential to human health and safety or economic security.

5.7 Hazard Profiles

Each identified hazard is profiled in the subsequent sections, with the level of detail varying based on available information. Sources of information are cited in the detailed hazard profiles below.

For hazards that have a higher chance of occurrence for specific jurisdictions throughout Rio Arriba County, a discussion is provided as to the differing levels of potential vulnerability. All other hazards have been determined to have an equal chance of occurrence for all participating jurisdictions.

The following hazards are presented in alphabetical order, and not by planning significance, for ease of reference.

5.8 Dam Failure

5.8.1 Hazard Description

A dam is a barrier across flowing water that obstructs, directs, or slows down the flow, often creating a reservoir, lake, or impoundment. Most dams have a section called a spillway or weir, over or through, which water flows, either intermittently or continuously. Dams commonly come in two types, embankment (the most common) and concrete (gravity, buttress, and arch), as well as sizes. They also serve a number of purposes and provide essential benefits, including drinking water, irrigation, hydropower, flood control, and recreation.



Large or small, dams have a powerful presence that is frequently overlooked until a failure occurs. Dams fail in two ways, a controlled spillway release done to prevent full failure, or the partial or complete collapse of the dam itself. In each instance, an overwhelming amount of water, and potentially debris, is released. Dam failures are rare, but when they do occur, they can cause loss of life and immense damage to property, critical infrastructure, and the environment.

Possible reasons for dam failure include but are not limited to:

- Sub-standard construction materials/techniques
- Spillway design error
- Geological instability caused by changes to water levels during filling or poor surveying
- Sliding of a mountain into the reservoir
- Poor maintenance, especially of outlet pipes
- Human, computer, or design error
- Internal erosion, especially in earthen dams
- Earthquakes
- Terrorism

There are three classifications of dam failure, hydraulic, seepage, and structural. The following is an explanation of each of these failure classifications:

- **Hydraulic:** This failure is a result of an uncontrolled flow of water over and around the dam structure as well as the erosive action on the dam and its foundation. The uncontrolled flow causing the failure is often classified as wave action, toe erosion, or gullyng. Earthen dams are particularly susceptible to hydraulic failure because earthen materials erode more quickly than other materials, such as concrete and steel. This type of failure constitutes approximately 40% of all dam failures.
- **Seepage:** Seepage is the velocity of an amount of water controlled to prevent failure. This occurs when the seepage occurs through the structure to its foundation, where it begins to erode within. This type of failure accounts for approximately 4% of all dam failures.
- **Structural:** A failure that involves the rupture of the dam or the foundation by water movement, earthquake, or sabotage. When weak materials construct dams (large, earthen dams) are the primary cause of this failure. Structural failure occurs with approximately 30% of dam failures.

5.8.2 Location and Extent

New Mexico's Dam Safety Program is managed by the Dam Safety Bureau. The Dam Safety Bureau operates the program based on Title 19 Natural Resources and Wildlife, Chapter 25 Administration and Use of Water - General Provisions, Part 12 Dam Design, Construction and Dam Safety. This program is responsible for developing and maintaining an inventory of dams, classifying dams, and ensuring the compliance of all regulated dams. The Dam Safety Bureau uses the following definitions for state regulated dams:

- **Dam:** A man-made barrier constructed across a watercourse or off-channel for the purpose of storage, control or diversion of water.
- **Jurisdictional dam:** A dam 25 feet or greater in height, which impounds more than 15 acre-feet of water or a dam that impounds 50 acre-feet or more of water and is 6 feet or greater in height. For purposes of these regulations, reference to a dam means a jurisdictional dam unless otherwise noted. See figure of jurisdictional dam size.
- **Non-jurisdictional dam:** Any dam not meeting the height and storage requirements of a jurisdictional dam. The state engineer does not regulate the design, construction and operation of a non-jurisdictional dam unless the dam is unsafe and there is a threat to life or property, as determined by the state engineer. Waters impounded by a non-jurisdictional dam may not be exempt from water right permit requirements; therefore a separate state engineer water right permit for the water impounded in the reservoir created by a non-jurisdictional dam may be required. Non-jurisdictional dams shall meet the requirements of 19.26.2.15 NMAC unless otherwise exempt. The structures listed below are considered non-jurisdictional dams:

Dams in the State of New Mexico are ranked by Dam Hazard Classification, which is determined by the potential for infrastructure and property damages downstream if a dam failure were to occur. Current Dam Hazard Classifications are:

Table 39: Dam Hazard Potential Classification

Hazard Potential	Definition
High	Dams where failure or mis-operation will probably cause loss of human life.
Significant	Dams where failure or mis-operation will probably not result in loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but may be located on populated areas with significant infrastructure.
Low	Dams where failure or mis-operation results in no probable loss of life but may result in low economic or environmental losses. Losses would be principally limited to dam owner's property.

The U.S. Army Corps of Engineers National Inventory of Dams (NID) program indicates that there are 37 dams in Rio Arriba County, with 28 high hazard dams. Additionally, the NID provides a condition assessment on each dam. The definition of dam condition assessment are as follows:

- **Satisfactory:** No existing or potential dam safety deficiencies are recognized. Acceptable performance is expected under all loading conditions in accordance with state engineers' rules and regulations for dams or tolerable risk guidelines.
- **Fair:** No existing dam safety deficiencies are recognized for normal loading conditions. Rare or extreme hydrologic and/or seismic incidents may result in a dam safety deficiency. Risk may be in the range to take further action.
- **Poor:** A dam safety deficiency is recognized for loading conditions, which may realistically occur. Remedial action is necessary. A poor condition is used when uncertainties exist as to critical analysis parameters, which identify a potential dam safety deficiency. Further investigations and studies are necessary.
- **Unsatisfactory:** A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution.

Both low and significant hazard dams were determined by the MPC to be of minimal concern. The following table details information concerning the 28 identified high hazard dam within the county:

Table 40: Rio Arriba County High Hazard Dams

NID Number	Name	Owner	Condition Assessment	Emergency Action Plan
NM00001	Abiquiu Dam	USACE - Albuquerque District	Satisfactory	Yes

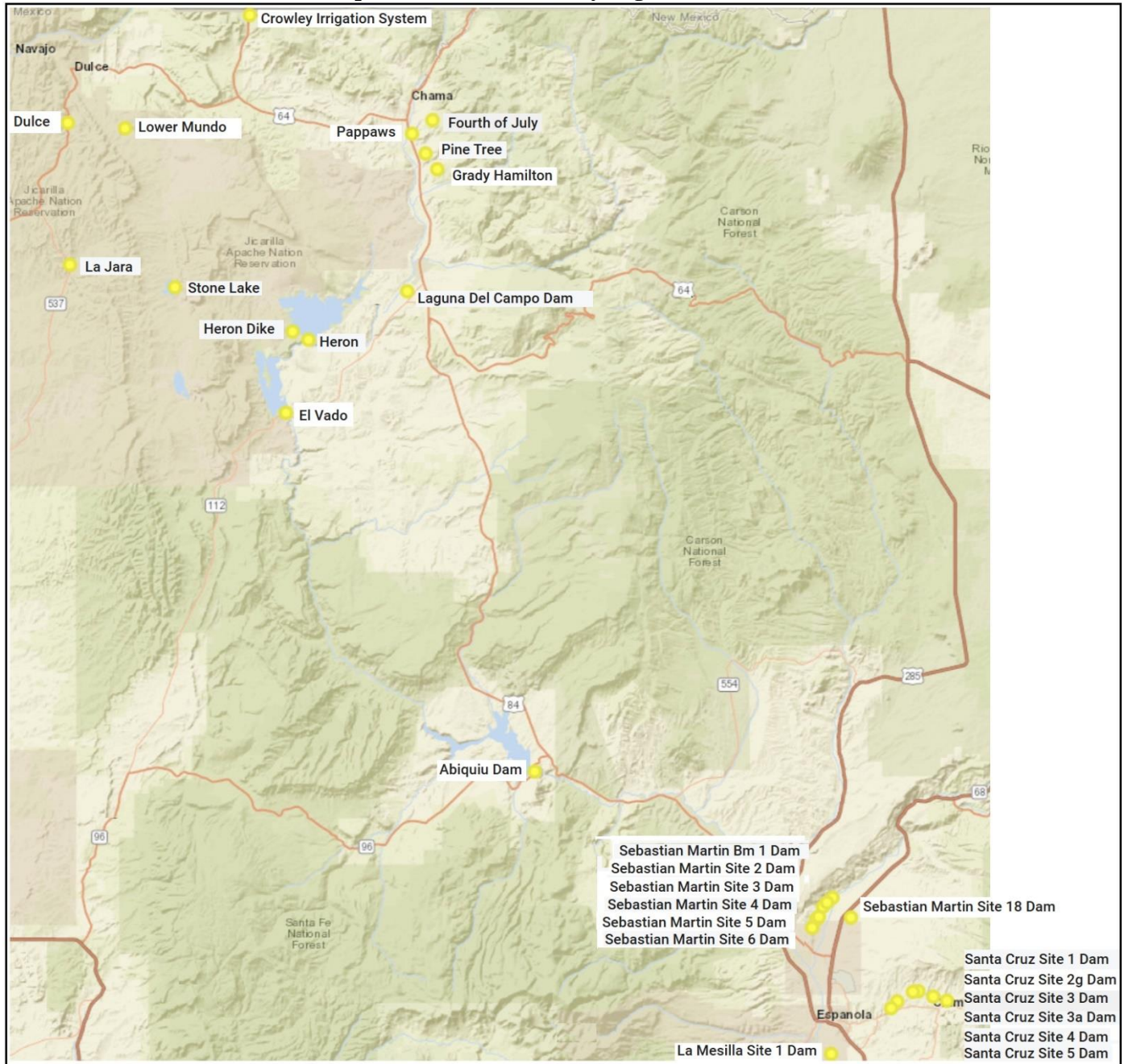
Table 40: Rio Arriba County High Hazard Dams

NID Number	Name	Owner	Condition Assessment	Emergency Action Plan
NM00122	Heron	Reclamation	Not available	Yes
NM10008	El Vado	Reclamation	Not available	Yes
NM00234	Sebastian Martin Site 6 Dam	Upper Rio Grande Watershed District	Poor	No
NM00233	Sebastian Martin Site 5 Dam	Upper Rio Grande Watershed District	Poor	No
NM00441	Sebastian Martin Site 4 Dam	Upper Rio Grande Watershed District	Poor	Yes
NM00261	Santa Cruz Site 2g Dam	Santa Fe-Pojoaque Soil and Water Conservation District	Poor	Yes
NM00438	Sebastian Martin BM 1 Dam	Upper Rio Grande Watershed District	Poor	Yes
NM00440	Sebastian Martin Site 3 Dam	Upper Rio Grande Watershed District	Fair	Yes
NM00262	Santa Cruz Site 4 Dam	Santa Fe-Pojoaque Soil and Water Conservation District	Fair	Yes
NM00190	Lower Mundo	BIA	Not available	Yes
NM00260	Santa Cruz Site 1 Dam	Santa Fe-Pojoaque Soil and Water Conservation District	Poor	Yes
NM00439	Sebastian Martin Site 2 Dam	Upper Rio Grande Watershed District	Fair	Yes
NM00263	Santa Cruz Site 5 Dam	Santa Fe-Pojoaque Soil and Water Conservation District	Poor	Yes
NM00518	Sebastian Martin Site 18 Dam	Upper Rio Grande Watershed District	Poor	Yes
NM00238	Santa Cruz Site 3A Dam	Santa Fe-Pojoaque Soil and Water Conservation District	Poor	Yes
NM00237	Santa Cruz Site 3 Dam	Santa Fe-Pojoaque Soil and Water Conservation District	Fair	Yes
NM00313	Laguna Del Campo Dam	New Mexico Department of Game and Fish	Poor	Yes
NM00235	La Mesilla Site 1 Dam	La Mesilla Community Ditch	Not available	No
NM00244	Stone Lake	BIA	Not available	Yes
NM00186	Dulce	BIA	Not available	Yes
NM00685	Pine Tree	BIA	Not available	Yes
NM00682	Grady Hamilton	BIA	Not available	No
NM00188	La Jara	BIA	Not available	Yes
NM00331	Crowley Irrigation System	Donald Shahan	Poor	No
NM00681	Fourth of July	BIA	Not available	Yes
NM00684	Pappaws	BIA	Not available	Yes
NM00122S001	Heron Dike	Reclamation	Not available	Yes

Source: NID

The following map, from the NID, indicates the location of high hazard dams within Rio Arriba County:

Map 14: Rio Arriba County High Hazard Dams



Source: National Inventory of Dams

Discussions with the MPC and a review of all available data indicated that the dam failure hazard was not a concern for all participating jurisdictions. The following provides a narrative of the level of jurisdictional concern:

- **Rio Arriba County:** Dam failure identified as a community concern as areas of the jurisdiction are in identified failure inundation areas which could impact citizens, buildings, and infrastructure.
- **Chama:** Dam failure is not a hazard of concern within the boundaries of the jurisdiction no areas are in any identified failure inundation areas.
- **Espanola:** Dam failure identified as a community concern as areas of the jurisdiction are in identified failure inundation areas which could impact citizens, buildings, and infrastructure.
- **Ohkay Owingeh:** Dam failure identified as a community concern as areas of the jurisdiction are in identified failure inundation areas which could impact citizens, buildings, and infrastructure.

- **Rio Arriba School District:** Facility mapping has not been conducted to determine if any school facilities are in failure inundation areas.

5.8.3 Previous Occurrences

Data from the National Performance of Dams Program at Stanford University indicates Rio Arriba County has had no reported dam failure incidents.

5.8.4 Probability of Future Incidents

Despite no historical occurrences of dam failure, there remains a significant concern due to the presence of one extremely high hazard dam within the county. The probability of dam failure events is not easily measured, but may be aligned with:

- The probability of future flood events
- Preventative measures taken by dam owners and operators, maintenance and repair
- Frequent condition inspections
- Proper operating procedures

At present, there is no history of a dam failure of any size in Rio Arriba County or its participating jurisdictions. In lieu of any historical events, the next best prediction tool would be based on the structural state of the dam. However, maintenance and structural information on the dams was not available for public use. As such, available historic occurrence data suggests that there is a near zero percent probability of dam failure in a given year. However, it is important to note that the lack of past incidents does not protect against future incidents.

The New Mexico Dam Safety Bureau conducts routine monitoring and inspection of dams within the state on an identified schedule, with priority placed on those dams which pose the greatest potential threat. However, to fully determine the probability of a future event, a full engineering inspection would need to be completed on each dam, something beyond the scope of this plan.

Dams undergoing repair and/or reconstruction are required to be designed to pass at least the 1%-annual-chance rainfall event with one foot of freeboard. The most critical and hazardous dams are required to meet a spillway design standard much higher than passing the runoff from a 1%-annual-chance rainfall event. Although not all the dams have been shown to withstand the 1%-annual-chance rainfall event, most of the dams meet this standard due to original design requirements or recent spillway upgrades.

5.8.5 Projected Changes in Hazard Location, Intensity, Frequency, and Duration

As indicated by NOAA NCEI New Mexico 2022 State Climate Summary, Rio Arriba County is likely to see less available water for both storage and recreation. A warming climate will continue to decrease the snowpack, which has been steadily declining. Combined with the predicted decrease in annual rainfall, it is likely that smaller amounts of water will be available for storage in lakes and reservoirs. Additionally, the changing climate and resultant higher temperatures is likely to increase the rate of water usage while concurrently increasing evaporation from surface waters. As such, it is expected that the amount of water stored behind dams in Rio Arriba County will potentially decrease, lessening the potential impact of this hazard.

However, a potential outcome of changing climate in Rio Arriba County is an increase in extreme precipitation events which may lead to more severe floods and a greater risk of dam failure. Additional projected greater periods of drought conditions and high heat may result in ground cracking, a reduction of soil strength, erosion, and subsidence in earthen dams.

The 2018 National Climate Assessment report indicates that much of the water infrastructure in the United States, including dams, is nearing the end of its planned life expectancy. As indicated in the report:

- “Aging and deteriorating dams and levees also represent an increasing hazard when exposed to extreme or, in some cases, even moderate rainfall. Several recent heavy rainfall events have led to dam, levee, or critical infrastructure failures, including the Oroville emergency spillway in New Mexico in 2017, Missouri River

levees in 2017, 50 dams in South Carolina in October 2015 and 25 more dams in the state in October 2016, and New Orleans levees in 2005 and 2015. The national exposure to this risk has not yet been fully assessed.”

At present there is no comprehensive assessment of the climate-related vulnerability and risks to existing dams. Additionally, there are no common design standards concerning the repair or modification of existing dams nor for the design and construction of new dams operated in the face of changing climate risk.

Land use trends can significantly impact a community's vulnerability to dam failure. The way land is developed and used in proximity to dams can influence the potential consequences of failure, affecting the safety of residents and infrastructure. Development in potential dam failure inundation areas without adequate consideration for flood risk increases vulnerability. Increased urbanization and population density near dams can intensify the consequences of failure. Higher population density means more people and assets are at risk, leading to greater potential for loss of life and property damage. However, Rio Arriba County and participating stakeholder communities are seeing a decrease in population, potentially lowering the vulnerability to a dam failure event.

The location of critical infrastructure, such as hospitals, schools, and emergency services, in close proximity to dams or levees can heighten vulnerability. Infrastructure assets may be at risk of damage or disruption, impacting the community's ability to respond effectively to a failure. However, Rio Arriba County and participating stakeholder communities are not projecting any major infrastructure projects or growth in the number of structures, potentially lowering the vulnerability to a dam failure event.

5.8.6 Vulnerability and Impact Analysis

FEMA NRI

The National Risk Index does not provide rankings for the dam failure hazard.

Extremely High Hazard and High Hazard Dam Failure Inundation Mapping

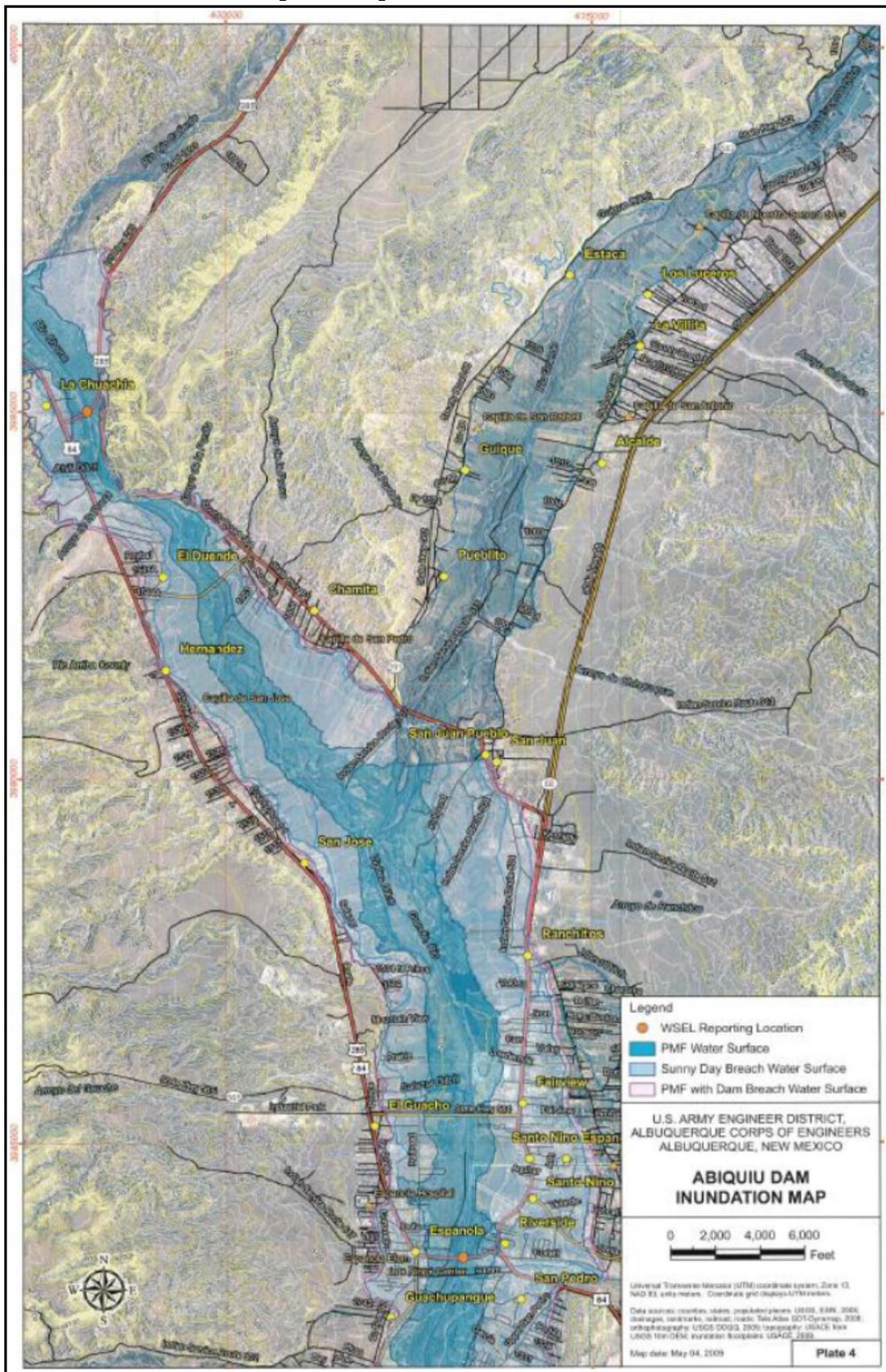
Dams in the State of New Mexico with a high Hazard classification are required to have an Emergency Action Plan. An Emergency Action Plan delineates:

- Incidents that can lead to emergency conditions and failure
- Downstream locations that could be affected by a failure event
- Actions to be taken to minimize property damage, infrastructure loss, and loss of life

In general, the dam owner is responsible for development and maintenance of the Emergency Action Plan.

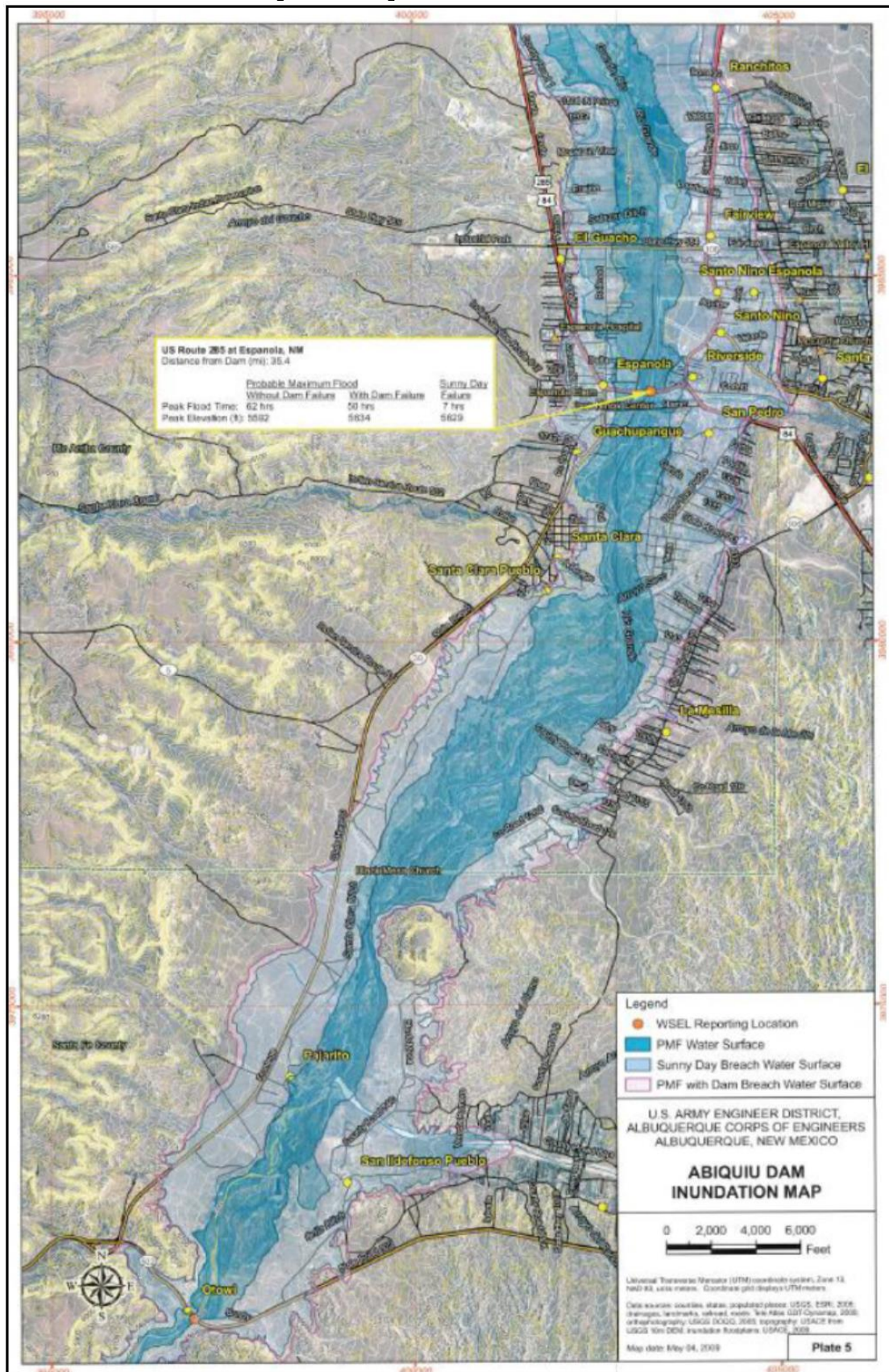
In order to understand the potential risk to Rio Arriba County, efforts were made to review all available Emergency Action Plans for high hazard dams. Please note that inundation mapping only available from the Abiquiu Dam, as follows:

Map 15: Abiquiu Dam Inundation Zone



Source: Rio Arriba County

Map 15a: Abiquiu Dam Inundation Zone

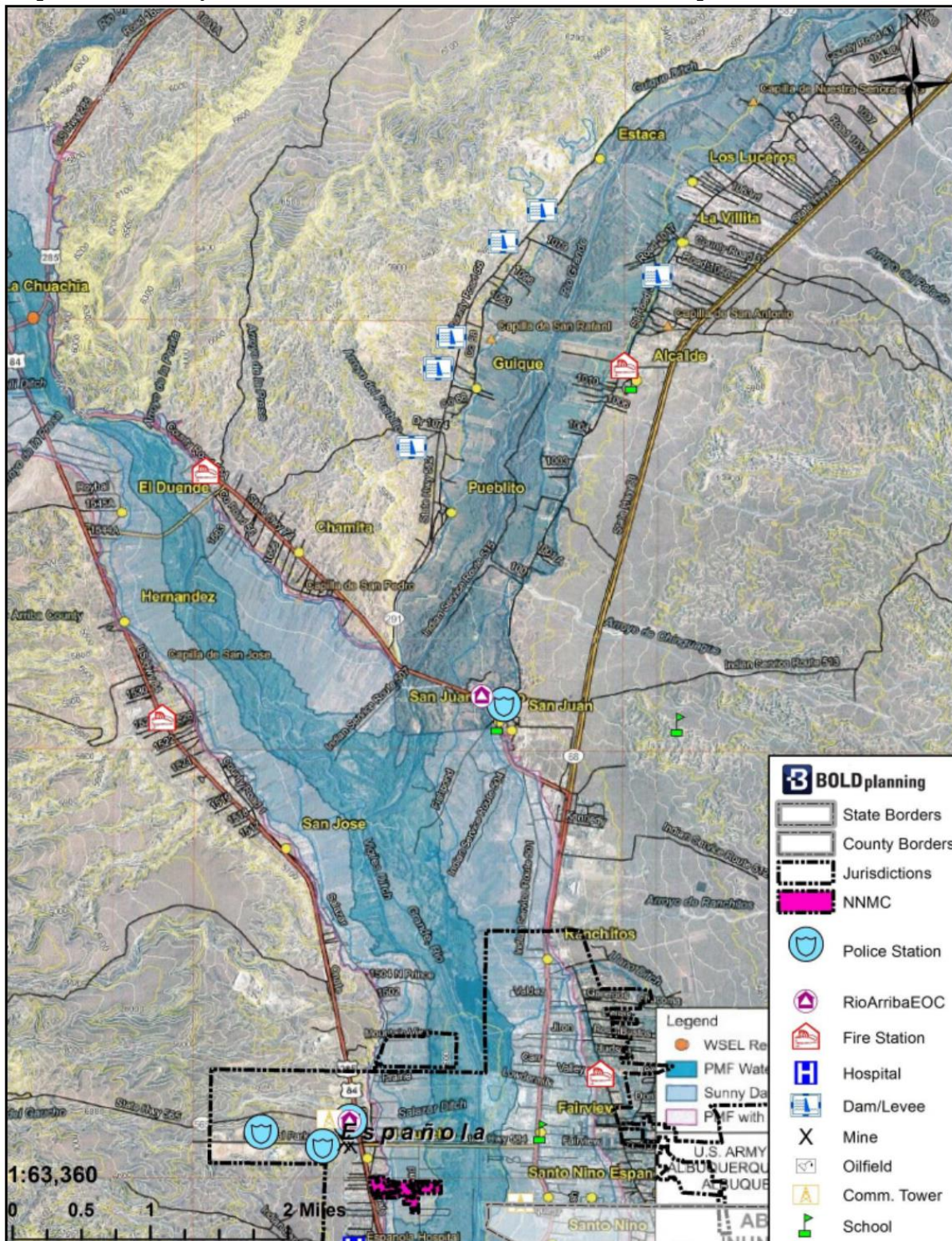


Source: Rio Arriba County

Community Lifelines and Critical Facilities in and Near Inundation Areas

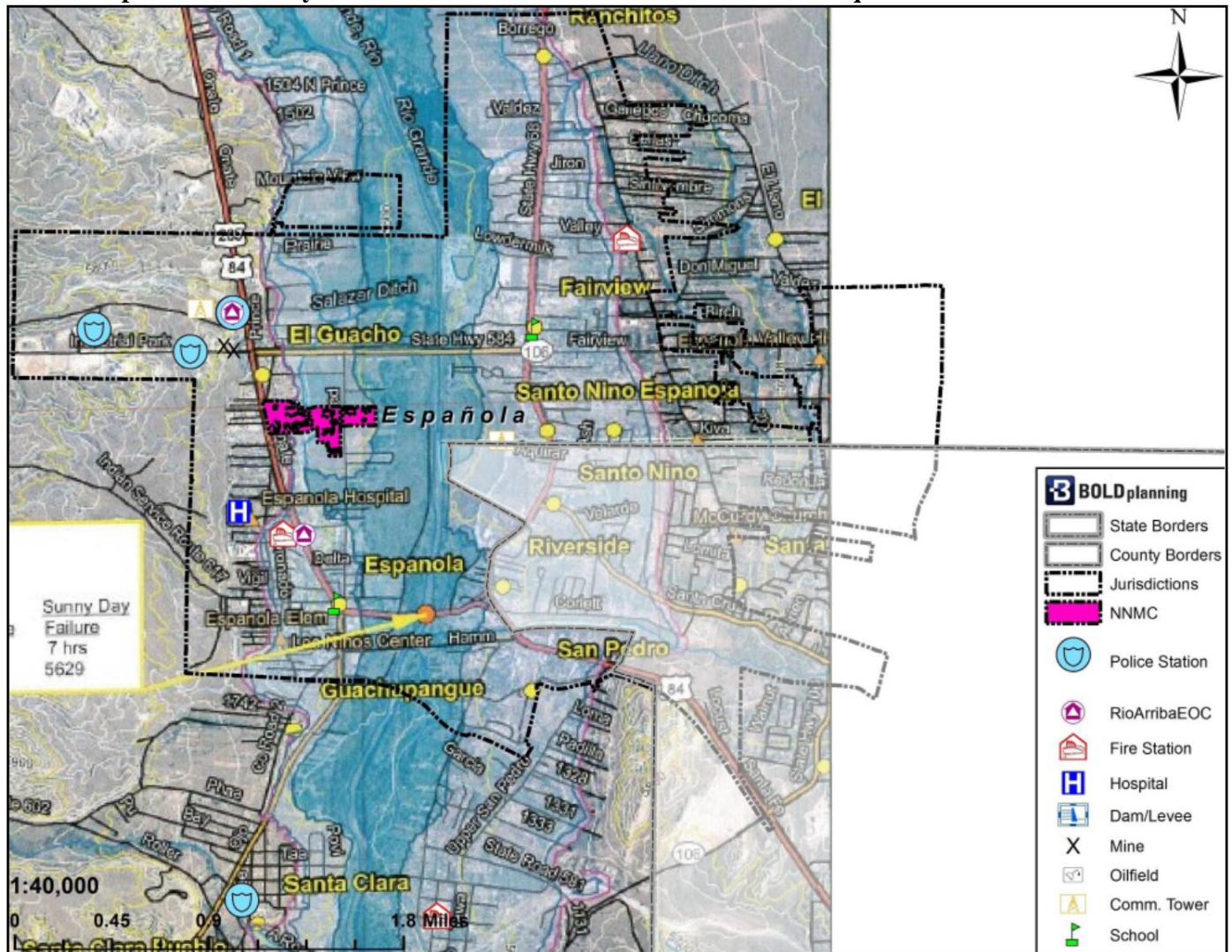
The following maps illustrate community lifelines and critical facilities in and near dam failure inundation areas for Abiquiu Dam. Please note that inundation mapping was not available for the remaining high hazard dams:

Map 16: Community Lifelines and Critical Facilities in and Near Abiquiu Dam Inundation Area



Source: Rio Arriba County and BOLDplanning

Map 17: Community Lifelines and Critical Facilities in and Near Abiquiu Dam Inundation Area



Source: Rio Arriba County and BOLDplanning

Population

A dam failure event can have devastating and wide-ranging impacts on both people and communities. The severity of these impacts depends on the volume of water released and the location of the dam in relation to communities, and may include:

- **Loss of Life:** The sudden release of a large volume of water can result in flooding downstream, leading to drowning and casualties. The loss of life can be particularly high if a dam failure occurs in highly populated areas or when people are unable to evacuate in time.
- **Long Term Displacement:** People living downstream may be forced to evacuate their homes leading to displacement and requiring long-term shelter assistance.
- **Economic Consequences:** Both property damage and the disruption of transportation and utilities could affect local economies.
- **Psychological Trauma:** Survivors of dam failure events may experience psychological trauma, including post-traumatic stress disorder and anxiety.

As of this plan, a complete analysis has not been conducted on the potential impact of a dam failure event on the population of Rio Arriba County, and inundation mapping for the majority of high hazard dams has not been made available or has not been completed. As such, a determination of the potentially impacted population cannot be completed.

However, utilizing data from the U.S. Census Bureau, the Abiquiu Dam Inundation Map, and GIS analysis, an estimate can be made of the potentially impacted population from a failure of Abiquiu Dam of approximately 5,000 people (50% of the population) in Espanola and approximately 1,000 (66% of the population) for the Ohkay Owingeh.

Additionally, the loss of community lifelines can have a direct economic impact on the population. As an overview, the May 2023 FEMA Benefit-Cost Analysis Sustainment and Enhancements Standard Economic Value Methodology Report indicates the following loss values for community lifelines:

Table 41: Economic Impacts of Loss of Service Per Capita Per Day (in 2022 dollars)

Category	Loss
Loss of Electrical Service	\$199
Loss of Wastewater Services	\$66
Loss of Water Services	\$138
Loss of Communications/Information Technology Services	\$141

Source: May 2023 FEMA Benefit-Cost Analysis Sustainment and Enhancements Standard Economic Value Methodology Report

Buildings and Structures

Any structure within an identified inundation zone of a dam failure will be potentially impacted (depending on the severity on the failure incident). Potential impacts may include:

- **Structural Damage:** Facilities located downstream could sustain severe structural damage. Floodwater can inundate buildings, causing structural failures, collapsing walls, and damaging foundations. This can render facilities inoperable or unsafe for use.
- **Equipment and System Damage:** Equipment and systems can be severely damaged or destroyed by floodwater and debris carried by the flood. This can include electrical systems, water and wastewater systems, machinery, data centers, and communication equipment.
- **Long-Term Recovery:** The recovery process could be lengthy and resource intensive. It may involve rebuilding damaged infrastructure, restoring functionality, and implementing measures to prevent future vulnerabilities.

As of this plan, a complete analysis has not been conducted on the potential impact of a dam failure event on the population of Rio Arriba County, and inundation mapping for the majority of high hazard dams has not been made available or has not been completed. As such, a determination of potentially impacted structures cannot be completed. However, utilizing data from the U.S. Census Bureau, the Abiquiu Dam Inundation Map, and GIS analysis, an estimate can be made of the potentially impacted population from a failure of Abiquiu Dam of approximately 2,280 housing units (50%) in Espanola and approximately 280 housing units (60%) housing units for the Ohkay Owingeh. At the U.S. Census Bureau generated average valuation of \$260,800 per housing unit, this equates to \$ 667,648,000.

Governmental

Government operations may be immediately impacted, especially if any facilities are within the inundation area of failure. The extent of the impact depends on multiple factors concerning the extent of the failure, and may include:

- **Emergency Response and Management:** Jurisdictional response agencies may be called upon to respond to a failure event. They must coordinate rescue operations, evacuations, and disaster response efforts to mitigate the immediate risks to human life and property.
- **Public Health and Safety:** Jurisdictional public health agencies would provide support for public health needs during and after a dam failure, including responding to injuries, managing emergency shelters, and addressing potential health risks from contaminants or waterborne diseases.
- **Financial Impact:** A dam failure event can strain state budgets due to the costs associated with emergency response, infrastructure repair, environmental cleanup, and long-term recovery efforts. Local governments may need to allocate additional funds to address these needs.

A review of identified inundation areas for Abiquiu Dam indicates that no government buildings in identified inundation areas.

Transportation and Electrical Infrastructure

The failure of a dam can have significant and wide-ranging impacts on transportation infrastructure, affecting roads, bridges, railways, and other critical components of transportation systems. Potential impacts may include:

- **Flooding and Erosion:** Dam failures can lead to rapid and extensive flooding, causing erosion of roadways and bridge foundations. This can result in the collapse or significant damage to roads and bridges, disrupting transportation routes.
- **Extended Downtime:** The repair of transportation infrastructure, especially major roads and bridges, can take a significant amount of time. During this period, transportation networks may be partially or entirely unavailable.

The following table, utilizing information from the Box Canyon Dam Sunny Day Failure Inundation, Main Dam or Spillway Map, details downstream transportation infrastructure likely to be impacted by a failure:

Table 42: Abiquiu Dam Failure Impacted Infrastructure

Infrastructure Classification	Name
Road or Highway	Highway 285 and bridges
Road or Highway	State Highway 68
Road or Highway	Santa Clara Bridge Road and bridge
Road or Highway	Highway 84 and bridge
Road or Highway	East Fairview Lane and bridge
Road or Highway	Paseo De Onate and bridge
Road or Highway	Po Pay Avenue and bridge

Source: Abiquiu Dam Failure Inundation map

A wide variety of data sources, from the Federal Highway Administration to state and federal Departments of Transportation, can be sourced for construction and repair costs. Average per-mile repair costs for local roads, state highways, and interstates can vary widely depending on factors such as the type of repair (resurfacing, reconstruction, or major rehabilitation), local labor and material costs, geographic conditions, and traffic volumes. The following details a range of repair costs for local, state, and interstate roadway systems:

- **Local Roads**
 - **Resurfacing/Repaving:** Costs generally range between \$20,000 to \$100,000 per mile.
 - **Major Rehabilitation or Reconstruction:** Costs generally range between \$150,000 to \$1 million per mile.
- **State Highways**
 - **Resurfacing/Repaving:** Costs generally range between \$100,000 to \$300,000 per mile.
 - **Major Rehabilitation or Reconstruction:** Costs generally range between \$500,000 to \$2,000,000 per mile.
- **Interstates**
 - **Resurfacing/Repaving:** Costs generally range between \$250,000 to \$1,000,000 per mile.
 - **Major Rehabilitation or Reconstruction:** Costs generally range between \$2,000,000 to \$5,000,00 per mile.

Factors affecting roadway construction and repair costs can include:

- **Extent of Damage:** Minor repairs such as resurfacing are cheaper than full-depth reconstruction.
- **Geography and Terrain:** Roads in mountainous or difficult terrains may cost more due to drainage and foundation issues.

- **Traffic Control and Detours:** Roads with heavy traffic may require expensive detour systems and safety measures, especially for interstates and state highways.
- **Urban vs. Rural:** Repairs in urban areas are typically more expensive due to higher labor costs, complex traffic patterns, and higher land costs.
- **Material Costs:** Prices for materials like asphalt, concrete, and steel can vary significantly based on regional supply chains.
- **Environmental and Regulatory Costs:** Permitting, environmental mitigation, and compliance with federal/state regulations can add to the cost.

Bridges crossing rivers can pose significant concerns during flooding events resulting from a dam failure due to the increased risk of structural failure. Floodwater caused by a dam failure can exert powerful hydraulic forces on bridge structures, with the flow of water, debris, and floating objects impacting the bridge's substructure and foundation. Scouring, the removal of soil or sediment around bridge foundations can increase during a flood event, increasing the risk of failure. Floodwater can also cause the deformation and misalignment of bridge components. As water levels rise and fall, the structural elements may undergo stress and strain, potentially leading to long-term damage and misalignment.

A wide variety of data sources, including the Federal Highway Administration and state and federal Departments of Transportation, can be sourced for bridge construction and repair costs. The average construction and repair costs for bridges vary significantly depending on factors like the size and complexity of the bridge, its location, materials used, and the extent of the repairs or construction required. The following details a range of construction costs for bridges:

- **Small Bridge (local, 2-lane bridge over a small waterway or road):** Costs generally range between \$150 to \$400 per square foot.
- **Medium-Sized Bridge (state highway, spanning larger rivers or railways):** Costs generally range between \$300 to \$600 per square foot.
- **Large Bridge (interstate or urban multi-lane bridge, often requiring complex engineering):** Costs generally range between \$500 to \$1,000+ per square foot.

The following details a range of repair costs for bridges:

- **Minor Repairs (deck resurfacing, guardrail fixes, minor structural repairs):** Costs generally range between \$50,000 to \$500,000.
- **Medium Repairs (replacing sections of the deck, repairing piers or abutments):** Costs generally range between \$500,000 to \$5,000,000.
- **Major Repairs or Rehabilitation (full deck replacement, structural strengthening, or seismic retrofitting):** Costs generally range between \$5,000,000 to \$50,000,000.
- **Emergency Repairs (post-disaster or structural failure):** Costs generally range between \$10,000,000 to \$100,000,000.

Factors affecting bridge construction and repair costs can include:

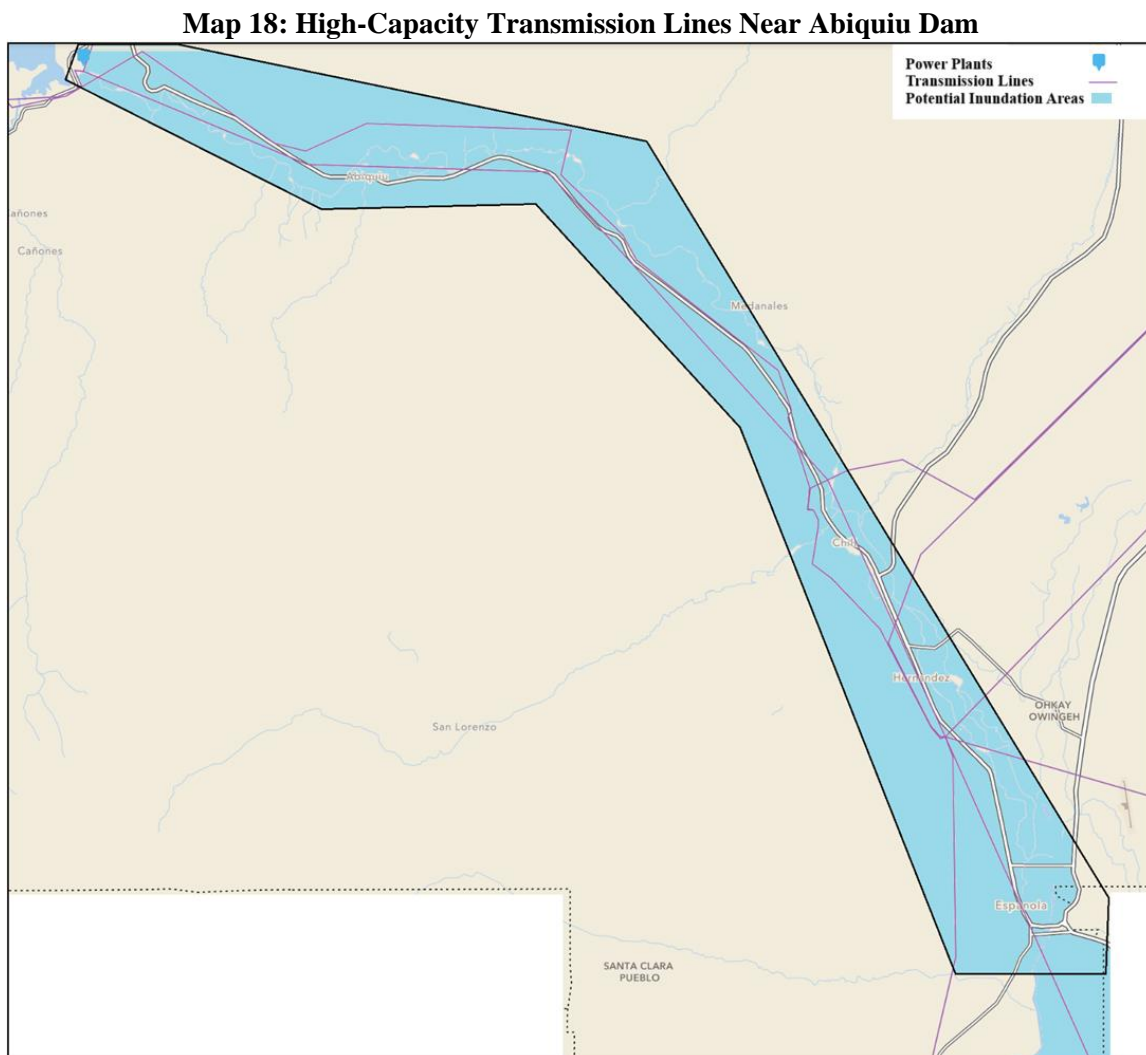
- **Bridge Type and Design:** Suspension, cable-stayed, truss, arch, or simple beam bridges each have different design requirements and associated costs.
- **Location:** Urban areas or difficult terrains (e.g., over water, in mountainous regions) can significantly increase costs due to land acquisition, permitting, and construction challenges.
- **Materials:** The use of steel, concrete, or composite materials impacts the price. Specialized materials (e.g., weathering steel for durability) increase costs.
- **Traffic Management:** Bridges over busy roads or waterways may require costly traffic diversion plans or temporary structures.
- **Environmental and Regulatory Compliance:** Projects near sensitive areas (rivers, wetlands, protected lands) or those requiring special permits may face higher costs.

- **Labor and Regional Costs:** Labor costs, equipment rates, and material availability can vary widely by region.

The failure of a dam can have significant impacts on power utilities, affecting both the generation and distribution of electrical power. Potential consequences may include:

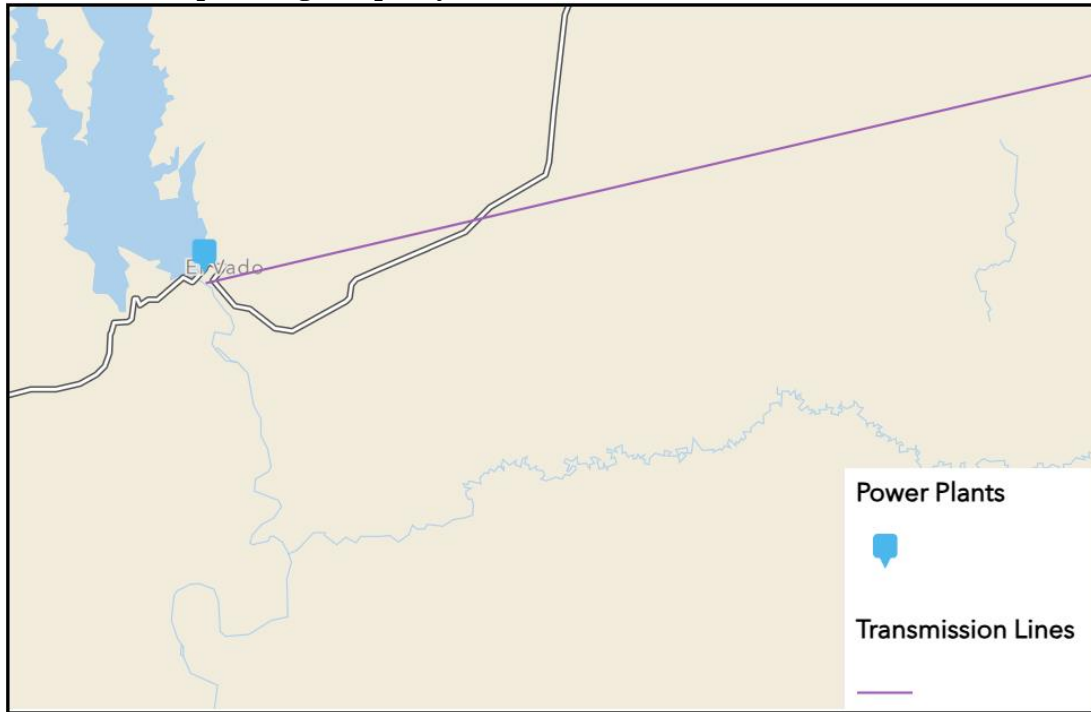
- **Power Line Disruption:** Dam or levee failures can cause flooding and erosion, potentially damaging power lines and transmission towers. This can result in the disruption of electricity transmission from power generation facilities to distribution networks.
- **Substation Impact: Substation Flooding:** Flooding from a dam or levee failure can impact electrical substations, which play a crucial role in transforming and distributing electricity. Substation failures can lead to widespread power outages.
- **Grid Instability:** The sudden loss of a significant power source can lead to voltage and frequency fluctuations. This instability can affect the overall reliability of the power grid.
- **Emergency Shutdowns:** In the event of a dam or levee failure, power utilities may need to implement emergency shutdowns of affected power plants and electrical infrastructure to prevent further damage and ensure the safety of personnel.

The following maps detail the locations of high-capacity transmission lines and power generation facilities near high hazard Abiquiu Dam and El Vado Dam:



Source: FEMA RAPT

Map 19: High-Capacity Transmission Lines Near El Vado Dam



Source: FEMA RAPT

A wide variety of data sources, including the U.S. Energy Information Administration, Federal Energy Regulatory Commission, and the Electric Power Research Institute, can be sourced for construction and repair costs. The repair costs for a hydroelectric plant can vary greatly depending on the type of repair, the size of the plant, and the specific components that require attention. Typical repairs cost are:

- Minor Repairs (Routine Maintenance & Component Replacement): Costs generally range between \$10,000 to \$100,000.
- Moderate Repairs (Replacing Medium-Sized Components): Costs generally range between \$100,000 to \$1 million.
- Major Repairs (Structural or Extensive Mechanical/Electrical Work): Costs generally range between \$1,000,000 to \$50,000,000, depending on the scale.
- Emergency Repairs (After Natural Disasters or Accidents): Costs generally range between \$5,000,000 to \$100,000,000.

For context, after major flooding, the Oroville Dam spillway repairs in Butte County New Mexico cost approximately \$1,100,000,000.

The cost to reconstruct high-capacity (voltage) power transmission lines varies significantly based on several factors, such as the voltage of the line, geographic terrain, regulatory requirements, and environmental considerations. The following present rough cost estimates for construction:

- High-Voltage Alternating Current (HVAC) Transmission Lines:
 - Overhead lines: Costs generally range between \$300,000 to \$1,000,000 per mile.
 - Underground lines: Costs generally range between \$1,000,000 and \$10,000,000 per mile.
 - High-Voltage Direct Current (HVDC) Transmission Lines:
 - Overhead lines: Costs can range between \$500,000 to \$2 million per mile.
 - Underground lines: Costs can range between \$3,000,000 to \$15,000,000 per mile
- Key Factors Affecting Costs:

The cost to construct neighborhood power distribution lines (rather than large high-capacity transmission lines) depends on whether the lines are overhead or underground, as well as factors like geography, local labor rates, and regulatory requirements. The following present rough cost estimates for construction:

- Overhead Neighborhood Power Distribution Lines: Costs generally range between \$150,000 to \$500,000 per mile.
- Underground Neighborhood Power Distribution Lines: Costs generally range between \$500,000 to \$2,000,000 or more per mile.

The cost to repair high-capacity power transmission lines varies widely depending on the extent of the damage, the location, and the type of transmission line. Here are some general considerations:

- High-Voltage Overhead Transmission Lines:
 - Minor Repairs (fixing or replacing a small section of damaged wire, insulators, or hardware): Costs generally range between \$10,000 and \$50,000 per mile.
 - Moderate Repairs (replacing several towers or larger segments of lines): Costs generally range between \$50,000 and \$200,000 per mile.
 - Major Repairs (such as extensive damage from storms, fires, or other disasters requiring multiple towers, wires, and more complex restoration): Costs generally range between \$200,000 to over \$1,000,000 per mile.
- High-Voltage Underground Transmission Lines:
 - Minor Repairs: Costs generally range between \$100,000 to \$500,000 per mile.
 - Major Repairs: Costs generally range between \$1,000,000 to \$5,000,000 or more per mile.

The cost to repair neighborhood power distribution lines, which typically carry lower voltage power than high-capacity transmission lines, also depends on several factors, such as the extent of the damage, whether the lines are overhead or underground, and the location.

- Overhead Neighborhood Distribution Lines:
 - Minor Repairs (such as fixing downed lines, poles, or transformers): Costs generally range between \$5,000 to \$20,000 per mile.
 - Moderate Repairs (replacing several poles, wires, or small transformers): Costs generally range between \$20,000 to \$100,000 per mile.
 - Major Repairs (extensive damage from a major storm or accident affecting many poles, transformers, and lines): Costs generally range between \$100,000 to \$500,000 per mile.
- Underground Neighborhood Distribution Lines:
 - Minor Repairs (fixing small sections of cable or minor equipment malfunctions): Costs generally range between \$50,000 to \$150,000 per mile.
 - Moderate Repairs (replacing larger segments of underground cable): Costs generally range between \$150,000 to \$500,000 per mile.
 - Major Repairs (extensive damage to underground systems, possibly caused by floods, storms, or construction accidents): Costs generally range between \$500,000 to \$2,000,000 per mile.

Factors influencing both reconstruction and repair costs for electrical transmission lines include:

- Terrain: Building lines through mountainous or densely populated areas will increase costs.
- Permitting and Land Acquisition: Securing permits and land can add significant costs.
- Environmental and Regulatory Costs: Meeting environmental impact requirements and complying with local regulations can also influence the final price.
- Voltage Level: Higher voltage transmission lines, such as those over 500 kV, are generally more expensive than lower voltage lines.

Medical, Education, and Response Facilities

The following table, utilizing information from the Abiquiu Dam Inundation Map and GIS analysis, details downstream medical, education, and response facilities likely to be impacted by the failure:

Table 43: Abiquiu Dam Breach Analysis Impacted Infrastructure

Infrastructure Classification	Number of Facilities Potentially Impacted
Emergency Operations Center	2
Educational Facilities	1
Fire Stations	4
Law Enforcement Center	1

Source: Abiquiu Dam Breach Analysis and Rio Arriba County

A review of areas potentially impacted by the failure of high hazard dams did not indicate any medical, educational, or response facilities in potential inundation areas.

Communication Systems

No comprehensive mapping of communications systems was available for review to compare against known inundation zones. However, it is assumed that communications lines and towers are in known inundation areas. Of particular concern are 911 and dispatch systems. All jurisdictions are served by a 911 and dispatch system, providing direct dispatching for:

- Law Enforcement
- Emergency Medical Services
- Fire

Flood water from a dam failure can disrupt this vital communications system, affecting reliability and functionality. Some of the key vulnerabilities include:

- **Physical Damage to Infrastructure:** Flood water can cause physical damage to communication infrastructure such as cell towers, antennas, satellite dishes, and power lines. This damage can result in interruptions or complete failure of communication services.
- **Power Outages:** Flood water can lead to power outages by knocking down power lines or damaging electrical substations. Communication systems that rely on electricity, such as landline phones, internet routers, and cellular towers, may cease to function during power outages.
- **Structural Instability:** Flood water can cause structural instability in communication towers and buildings housing communication equipment. If these structures are not properly reinforced, they may collapse or sustain damage, disrupting communication services.

The cost to repair communications networks can vary widely depending on the extent of the damage, the size of the network, and the specific technologies involved. Repair costs may include expenses for labor, equipment replacement or repair, materials, and any additional resources required to restore the network to full functionality. The following data, from the U.S. Department of Homeland Security Cybersecurity and Infrastructure Security Agency, indicates cost ranges for communications system components:

Table 44: Summary of Communication System Component Costs

Components	Examples	Cost	Expected Lifespan
Infrastructure	Towers, shelters, commercial and backup power equipment,	\$\$\$-\$\$\$\$\$	20–25 years
Fixed Station Equipment	Antennas, repeaters, towers on wheels, consoles, mobile stations, servers, computers, physical and electronic security elements (e.g., fencing, cameras, monitors, environmental conditions)	\$\$-\$\$\$	3-15 years

Table 44: Summary of Communication System Component Costs

Components	Examples	Cost	Expected Lifespan
Devices	Handheld portable radios, cellular phones, satellite phones, mobile data devices	\$-\$\$	2-10 years
Accessories	Holsters, chargers, speakers, lapel microphone extensions, Bluetooth, vehicle kits, air cards, intercoms	\$	2-10 years
Features	Encryption to protect against security risks, ruggedization to ensure reliant services, Over-the-Air-Programming, automatic roaming	\$-\$\$\$	-
Software and Data Storage	Global information system, emergency notifications, monitoring, call answering, database access, Automatic Vehicle Locator	\$-\$\$	-

Source: U.S. Department of Homeland Security Cybersecurity and Infrastructure Security Agency

Environmental Impacts

The environmental impact of dam or levee failures depends on the circumstances of the failure. After a failure occurs, the resulting flooding and moving debris can affect wildlife and natural habitats. The spread of pollution and hazardous materials can have negative impacts on the environment. Ecosystems and natural habitats may be destroyed, causing the migration or death of local wildlife. Depending on the timing and location of the failure, it can result in rapid changes in water temperature downstream. This can be harmful to temperature-sensitive aquatic species and ecosystems. Dam failures can disrupt natural ecological processes, such as nutrient cycling, sediment transport, and flow regimes. These disruptions can have cascading effects on ecosystems.

Jurisdictional Concerns

- **Espanola:** Approximately 5,000 people, 2,280 structures valued at \$22,515,300, and road and rail infrastructure were identified in failure inundation areas. Additionally, two fire facilities were identified in potential failure inundation areas. Potentially compounding these issues, the proximity of the dam to the jurisdiction would limit warning time.
- **Ohkay Owingeh:** Approximately 1,000 people, 280 structures valued at \$73,024,000, and road infrastructure were identified in failure inundation areas. Additionally, one law enforcement center and tribal government offices were identified in failure inundation areas. Potentially compounding these issues, the proximity of the dam to the jurisdiction would limit warning time.

Cascading Impacts

Cascading impacts often result when one a hazard event triggers one or more differing hazard events or loss of community lifelines. Cascading impacts associated with dam failure may include:

- Flooding
- Landslides
- Erosion
- Environmental degradation
- Loss of power associated with facilities that provide hydropower
- Loss of water supply
- Damage to agricultural lands

Consequence Analysis

This consequence analysis lists the potential impacts of a hazard on various elements of a community. The impact of each hazard is evaluated in terms of disruption of operations, recovery challenges, and overall wellbeing to all Rio Arriba County residents and first responder personnel. The consequence analysis supplements the hazard profile by analyzing specific impacts.

Table 45: Dam Failure Consequence Analysis

Subject	Potential Impacts
Impact on the Public	Heavy flooding can cause power loss, property damage, injury, and death, and the displacement of populations. Standing water can also pose a public health risk due to the reproduction of disease vectors such as mosquitos.
Impact on Responders	Heavy flooding may cause inaccessibility of roadways for first responders as well as damage of materials and resources. First responders will also have to facilitate evacuation measures to move people from the flooded area.
Continuity of Operations	Local jurisdictions maintain continuity plans which can be enacted as necessary based on the situation. Flooding caused by dam failure may create power outages, debris damage, and road closures.
Delivery of Services	Delivery of services may be disrupted due to flood-damaged bridges and roadways. Transit systems may face closures due to public safety concerns. The ability to deliver food, drinking water, and services will be heavily disrupted. Flooding may also interrupt communications and transportation due to power failure and accessibility challenges.
Property, Facilities, and Infrastructure	Flooding from failures impacts roads and bridges, businesses, hospitals, and other critical entities. Water and sewer systems may also be damaged. Homes and businesses may be completely destroyed if situated close to the failure point.
Impact on Environment	Flooding and moving debris can affect natural areas and wildlife, spreading pollution and hazardous materials. Ecosystems and natural habitats may be completely destroyed, causing migration or death of wildlife.
Economic Conditions	There is a fiscal impact on the government after a failure due to disruption of travel and commerce routes and employee's ability to travel to work. Recourses at all levels are utilized, impacting the ability to access resources long-term.
Public Confidence in Governance	Direct, immediate, and effective actions must be taken in order to maintain public confidence. Response activities must include all levels of government.

5.8.7 Future Development

Rio Arriba County, the Ohkay Owingeh, and participating jurisdictions are experiencing consistent population decline or a static population as people increasingly migrate from rural areas to urban centers. The rural-to-urban population movement has significant implications for all participating jurisdictions, including school closures and reduced economic activity. Based on population projections, this decreasing or static population trend is expected to continue in Rio Arriba County through 2050. While unlikely, any additional growth within dam inundation areas would place additional populations at risk. Should any population increase occur, potentially vulnerable populations could face disproportionate effects from a dam failure.

Closely tracking population data, but tending to lag population changes, housing data is a good indicator of changing demographics and growth. Rio Arriba County, the Ohkay Owingeh, and all participating jurisdictions have generally seen static to decreasing housing growth over the previous 20-year period. Of particular concern when considering housing data is mobile home residences. Mitigating this concern, all jurisdictions have seen a consistent decline in the percentage of mobile homes as part of housing stock. As the population continues to decline, it is expected that housing development will also initially slow and then decrease.

Future land use planning should be proactive to address future hazard conditions. Current building codes limit the locating of any new development, structures, or critical facilities and infrastructure within potential dam inundation areas. Along with the continued enforcement of building codes, the restrictions and requirements are expected to decrease future vulnerability.

5.8.8 Mitigation Opportunities

The following table presents examples of potential actions that can be instituted for mitigating the dam failure hazard:

Table 46: Potential Dam Failure Mitigation Actions

Category	Example Action
Planning and Regulation	Advising the public about the local dam inundation areas and flood protection measures.
	Requiring a thorough watershed analysis for all proposed dam or reservoir projects.
	Establishing a green infrastructure program to link, manage, and expand existing parks, preserves, greenways, etc.
	Taking action to minimize the effects of flooding on people, property, and building contents through measures including flood warning, emergency response, and evacuation planning.
Infrastructure	Implementing an inspection, maintenance, and enforcement program to help ensure continued structural integrity of dams.
	Routinely cleaning debris from support bracing underneath low-lying bridges.
	Remove dam and return to natural system.
Natural Systems	Developing an open space acquisition, reuse, and preservation plan targeting hazard areas.
	Preserve floodplain storage capacity by limiting or prohibiting the use of fill within the floodplain.
	Compensating an owner for partial rights, such as easement or development rights, to prevent a property from being developed.
Education	Educating the public about securing debris, propane tanks, yard items, or stored objects that may otherwise be swept away, damaged, or pose a hazard if picked up and washed away by floodwater.
	Using outreach programs to advise homeowners of risks to life, health, and safety.
	Offering GIS hazard mapping online for residents and design professionals.

5.9 Drought

5.9.1 Hazard Description

Drought is defined as an abnormally dry period lasting months or years when an area has a deficiency of water and precipitation in its surface and or underground water supply. It is, however, a normal, seasonal, and recurrent feature of climate that occurs in virtually all climate zones—typically in late spring through early fall. The duration of drought varies widely. There are cases when drought develops relatively quickly and lasts a very short period of time, exacerbated by extreme heat and/or wind, and there are other cases when drought spans multiple years, or even decades. The hydrological imbalance can be grouped into the following non-exclusive categories:



- Agricultural: When the amount of moisture in the soil no longer meets the needs of previously grown crops
- Hydrological: When surface and subsurface water levels are significantly below their normal levels
- Meteorological: When there is a significant departure from the normal levels of precipitation
- Socio-Economic: When the water deficiency begins to significantly affect the population

When below average, little or no rain falls, soil can dry out, and plants can die. If unusually dry weather persists and water supply problems develop, the period is defined as a drought. Human activity such as over-farming, excessive irrigation, deforestation, and poor erosion controls can exacerbate a drought’s effects. It can take weeks or months before the effects of below average precipitation on bodies of water are observed. Depending upon the region, droughts can happen more quickly, and be noticed sooner, or have their effects naturally mitigated. The more humid and wet an area is, the faster the effects will be realized. A naturally dry region, which typically relies more on subsurface water, will take more time to actualize its effects.

Periods of drought can have significant environmental, agricultural, health, economic, and social consequences. The effects vary depending upon vulnerability and regional characteristics. Droughts can also reduce water quality through a decreased ability for natural rivers and streams to dilute pollutants and increase contamination. The most common effects are diminished crop yield, increased erosion, dust storms, ecosystem damage, reduced electricity production due to reduced flow through hydroelectric dams, shortage of water for industrial production, and increased risk of wildland fires.

5.9.2 Location and Extent

All of Rio Arriba County, including all participating jurisdictions, is susceptible to drought conditions. However, the specific susceptibility to drought depends on various factors, including climate patterns, land use practices, and water management strategies.

Droughts are regularly monitored by multiple federal agencies using a number of different indices. One of the best indicators of historic drought periods is provided by the U.S. Drought Monitor. The U.S. Drought Monitor provides a summary of drought conditions across the United States, including Rio Arriba County. Often described as a blend of art and science, the map is updated weekly by combining a variety of data-based drought indices and indicators, along with local expert input, into a single composite drought indicator. The following table details the U.S. Drought Monitor categories:

Table 47: U.S. Drought Monitor Categories

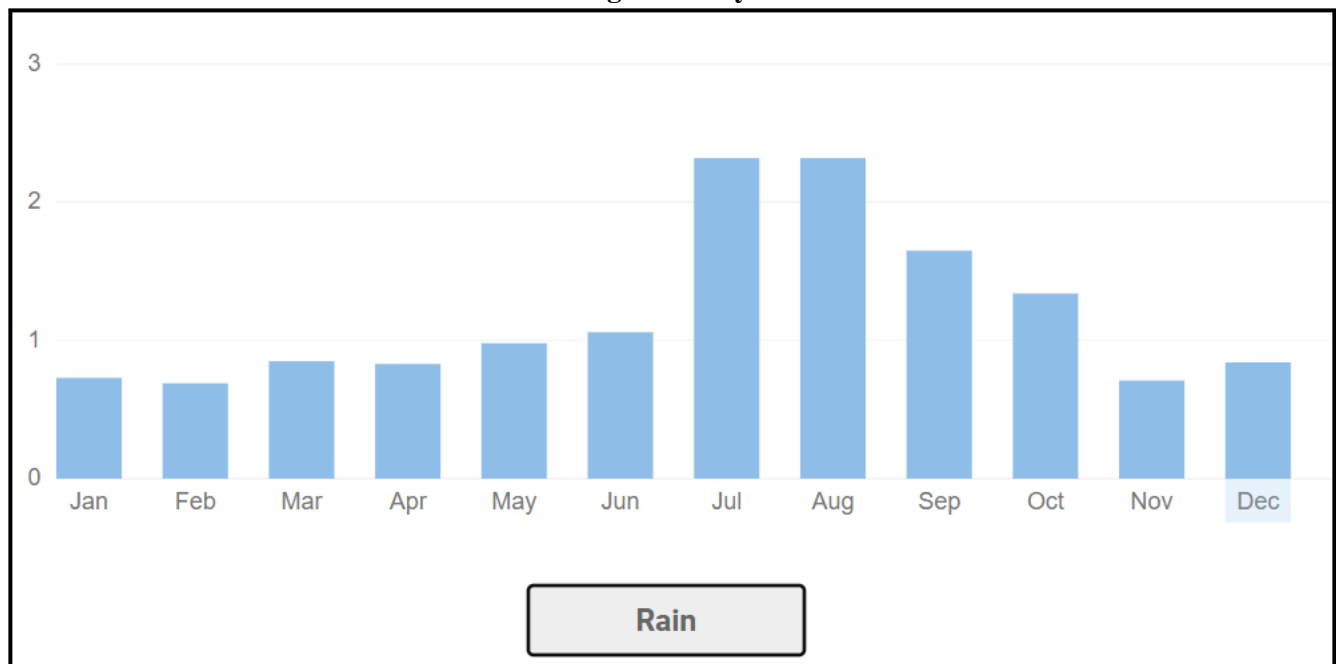
Rating	Described Condition	Possible Impacts
None	No drought conditions	None
D0	Abnormally Dry	<ul style="list-style-type: none">• Short-term dryness slowing planting, growth of crops• Some lingering water deficits• Pastures or crops not fully recovered

Table 47: U.S. Drought Monitor Categories

Rating	Described Condition	Possible Impacts
D1	Moderate Drought	<ul style="list-style-type: none"> • Some damage to crops, pastures • Some water shortages developing • Voluntary water-use restrictions requested
D2	Severe Drought	<ul style="list-style-type: none"> • Crop or pasture loss likely • Water shortages are common • Water restrictions imposed
D3	Extreme Drought	<ul style="list-style-type: none"> • Major crop/pasture losses • Widespread water shortages or restrictions
D4	Exceptional Drought	<ul style="list-style-type: none"> • Exceptional and widespread crop/pasture losses • Shortages of water creating water emergencies

Source: U.S. Drought Monitor

Precipitation data is collected by the NWS. The following chart indicates annual precipitation averages for Rio Arriba County:

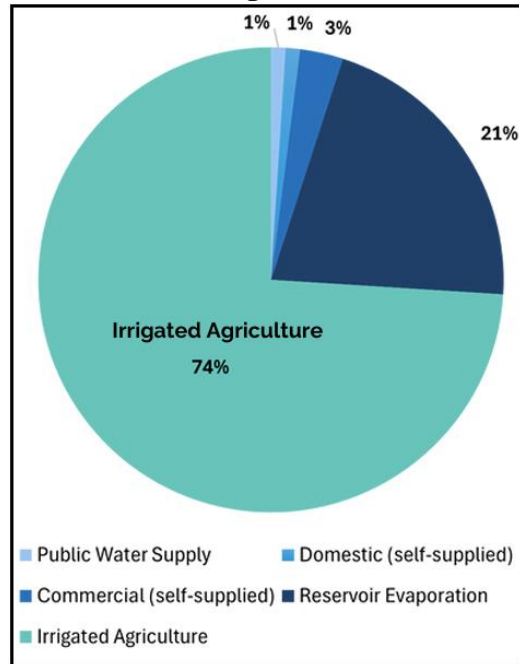
Chart 15: Average Monthly Rainfall Totals

Source: NWS

Water in Rio Arriba County is a vital resource for agriculture, domestic use, and the environment. Groundwater is used in Rio Arriba County for all drinking water supplies, with the exception of the Village of Chama. Surface water sources in the Rio Chama Arriba include the Rio Chama and its tributaries. Additionally, the San Juan-Chama Project also diverts water from the upper reaches of the San Juan River in Colorado into the Heron Reservoir. For agricultural uses, 94% of the water is pulled from surface sources.

Many rural residents of Rio Arriba County depend on groundwater for their domestic water needs, as municipal water systems are limited in more isolated areas. Private wells are common, and during times of drought or groundwater depletion, residents can face shortages or need to deepen wells.

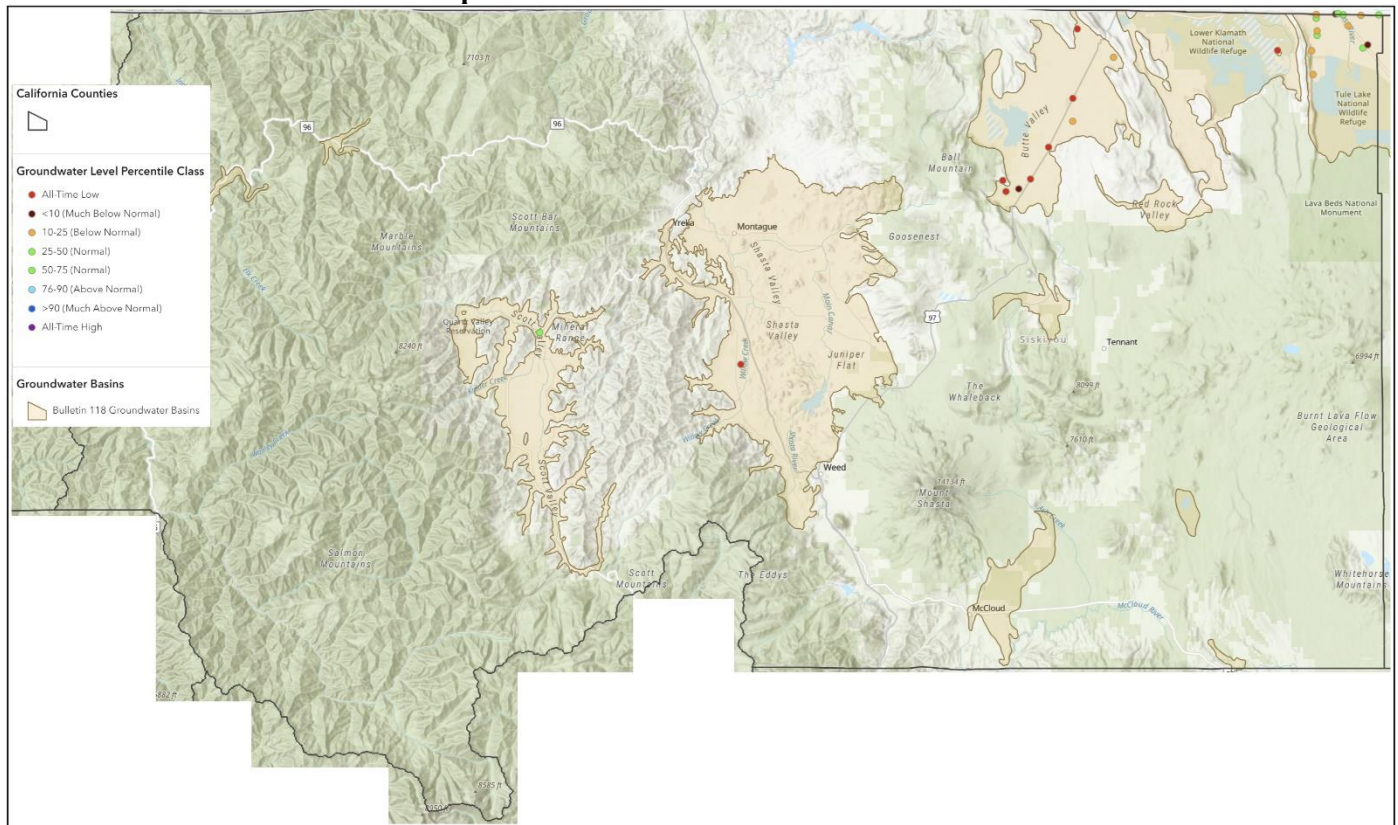
Chart 16: Water Usage in Rio Arriba County



Source: Southwest Environmental Finance Center

The following map, from the New Mexico Natural Resources Agency, shows the current groundwater level percentile class for Rio Arriba County:

Map 20: Groundwater Level Percentile Class



Source: New Mexico Natural Resources Agency

Current drought conditions, which change weekly, may be found on the U.S. Drought Monitor website.

The MPC view drought as not only a local or county hazard, but as a regional hazard as well. Discussions with the MPC and a review of all available data indicated that drought is a concern for all participating jurisdictions, with all jurisdictions having similar concerns. The following provides a narrative of the level of jurisdictional concern:

- **Rio Arriba County:** Drought identified as a community concern as citizens, agriculture, and the environment are vulnerable. Additionally, an increase in drought condition will have a negative impact on wildfire conditions.
- **Chama:** Drought identified as a community concern as citizens, agriculture, and the environment are vulnerable. Additionally, an increase in drought condition will have a negative impact on wildfire conditions.
- **Espanola:** Drought identified as a community concern as citizens, agriculture, and the environment are vulnerable. Additionally, an increase in drought condition will have a negative impact on wildfire conditions.
- **Ohkay Owingeh:** Drought identified as a community concern as citizens, agriculture, and the environment are vulnerable. Additionally, an increase in drought condition will have a negative impact on wildfire conditions.

5.9.3 Previous Occurrences

Historical events of significant magnitude or impact can result in a Presidential Disaster Declaration. Rio Arriba County has experienced no Presidential Disaster Declarations related to drought.

In New Mexico, the governor has the authority to declare a state of emergency or disaster under various state statutes and provisions. The following details New Mexico drought disaster declarations:

Table 48: Governor of New Mexico Rio Arriba Disaster Declarations, 2019 - 2024

Year	Executive Order	Incident Type
2023	2023-060	Drought and Severe Fire Conditions (statewide)
2021	2021-028	Drought and Severe Fire Conditions (statewide)
2020	2020-084	Drought (statewide)
2020	2020-040	Drought and Severe Fire Conditions (statewide)

Source: NMDHSEM

Comprehensive data on droughts, drought impacts, and drought forecasting is extremely limited and often inaccurate. Due to the complexity of drought monitoring and the large areas droughts impact, agencies have difficulty quantifying and standardizing drought data.

One of the best indicators of historic drought periods is provided by the U.S. Drought Monitor, which lists weekly drought conditions for the Rio Arriba County. Historical data was gathered from the U.S. Drought Monitor weekly reports for the 20-year period between 2005 and 2024. This data was compiled and aggregated to provide a yearly estimate of the percentage of Rio Arriba County in each Drought Monitor category.

Table 49: Percentage Area in U.S. Drought Monitor Category, 2005 - 2024

Year	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
2024 (YTD)	0.4%	65.5%	63.0%	36.6%	6.7%	0.0%
2023	43.9%	54.8%	44.3%	34.1%	17.2%	0.2%
2022	15.9%	84.1%	70.3%	55.9%	24.8%	0.0%
2021	0.0%	100.0%	99.2%	96.0%	75.0%	25.5%
2020	0.0%	100.0%	98.2%	80.2%	48.8%	7.7%
2019	18.1%	81.9%	61.1%	37.3%	19.3%	4.0%
2018	0.0%	100.0%	100.0%	94.4%	83.2%	55.0%
2017	88.0%	10.1%	1.2%	0.0%	0.0%	0.0%
2016	37.8%	60.3%	0.0%	0.0%	0.0%	0.0%
2015	9.4%	90.6%	45.4%	24.2%	0.0%	0.0%
2014	0.0%	100.0%	95.2%	65.7%	4.7%	0.0%

Table 49: Percentage Area in U.S. Drought Monitor Category, 2005 - 2024

Year	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
2013	0.0%	100.0%	97.2%	67.9%	22.9%	0.0%
2012	5.9%	93.6%	81.2%	18.0%	0.1%	0.0%
2011	15.4%	83.5%	64.9%	32.6%	1.2%	0.0%
2010	60.1%	38.4%	1.3%	0.0%	0.0%	0.0%
2009	86.3%	11.7%	0.2%	0.0%	0.0%	0.0%
2008	64.4%	33.7%	0.0%	0.0%	0.0%	0.0%
2007	47.2%	52.3%	5.2%	0.0%	0.0%	0.0%
2006	0.7%	99.3%	62.8%	21.0%	0.2%	0.0%
2005	4.8%	95.2%	51.6%	16.4%	5.3%	0.0%

Source: U.S. Drought Monitor

The Secretary of Agriculture is authorized to designate counties as disaster areas to make emergency loans available to producers suffering losses in those counties and in counties that are contiguous to a designated county. USDA Secretarial disaster designations must be requested of the Secretary of Agriculture by a governor or the governor's authorized representative, and there is an expedited process for drought. The following table represents the total number of Secretarial Disaster Declarations, by county, for the 10-year period of 2015 to 2024 for Rio Arriba County:

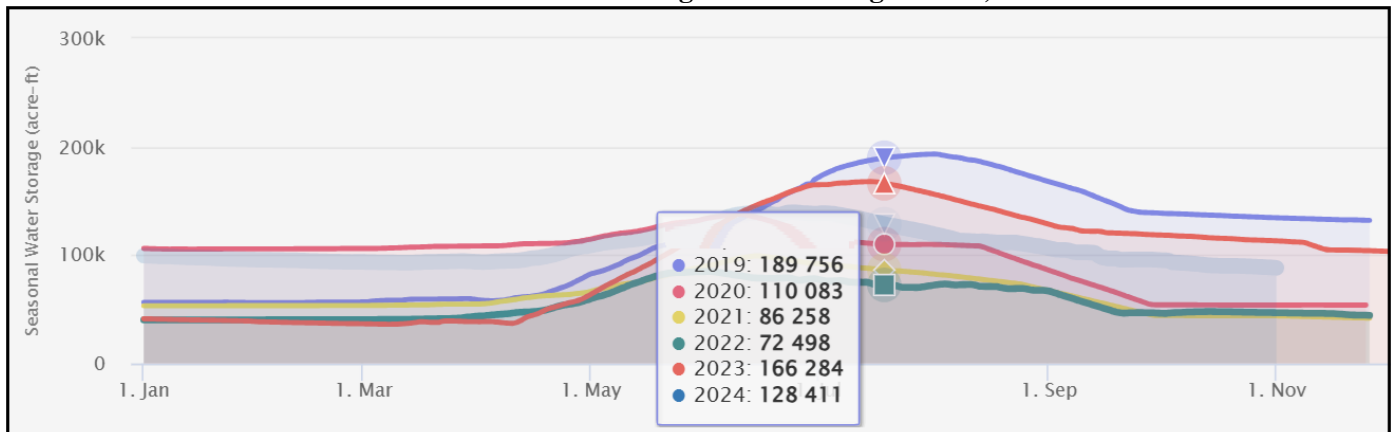
Table 50: Secretarial Drought Disaster Declarations, 2015 -2024

Jurisdiction	2024	2023	2022	2021	2020	2019	2018	2017	2016	2015
Rio Arriba County	S5669, S5678	S378, S5557	S5147, S5154	S4790	S4648, S4651, S47791	S4469, S4481	S4300, S4329	-	-	S3788, S3823

Source: USDA Farm Service Agency

Note: - designates no declarations

The Heron Reservoir, a major supplier of agricultural water resources, generally experiences seasonal cycles in water levels from year to year. The following chart details the levels of the reservoir from 2019 to 2024:

Chart 17: Heron Reservoir Average Water Storage Levels, 2019 - 2024

Source: New Mexico Department of Water Resources

5.9.4 Probability of Future Events

Historically, drought has affected Rio Arriba County and all participating jurisdictions on a reoccurring basis. In reviewing historical data from the U.S. Drought Monitor weekly reports for Rio Arriba County from 2005 through 2024 a weekly average can be created indicating the percentage time in each Drought Monitor category. This average can be used to extrapolate the potential likelihood of future drought conditions.

Table 51: Estimated Weekly Probability of Rio Arriba County Being in U.S. Drought Monitor Category

None	D0-D4	D1-D4	D2-D4	D3-D4	D4
24.9%	72.8%	52.1%	34.0%	15.5%	4.6%

Data: U.S. Drought Monitor

Rio Arriba County and all participating jurisdictions can experience rapid droughts, with a sudden onset of intense dry periods following a period of normal precipitation. While these conditions may last only a few months, they can result in agricultural losses, water supplies shortages, and low stream and river volume.

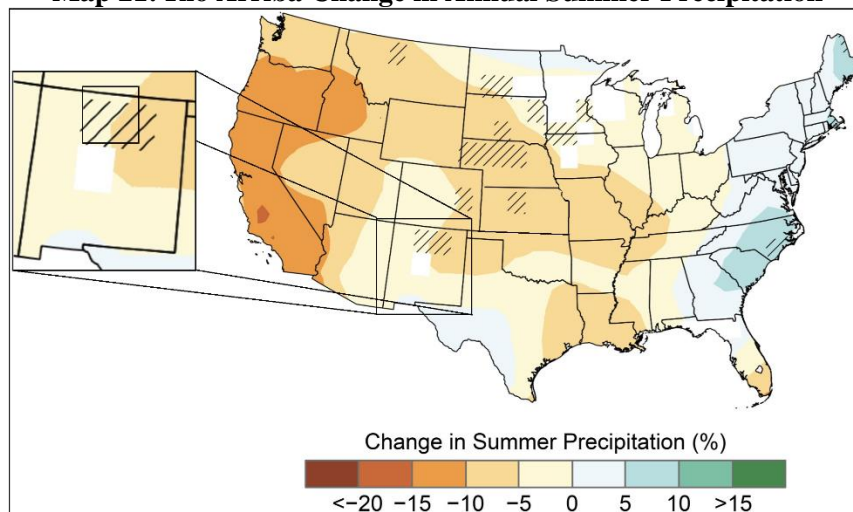
While predicting drought provides many challenges, NOAA’s National Integrated Drought Information System provides the Drought Early Warning System to improve drought early warning capacity. The system is a network of regional and national partners that share information and coordinate actions to help communities in the region cope with drought. Developing and implementing the system allows New Mexico and Rio Arriba County to quickly respond to emerging drought conditions. Through developing regional systems, the National Integrated Drought Information System is building the foundation for a nationwide system to improve drought forecasting.

5.9.5 Projected Changes in Hazard Location, Intensity, Frequency, and Duration

According to the National Institutes of Health National Center for Biotechnology Information publication Global Drought Trends and Future Projections “Drought is one of the most difficult natural hazards to quantify and is divided into categories (meteorological, agricultural, ecological and hydrological), which makes assessing recent changes and future scenarios extremely difficult.” However, using long term data estimates of future drought conditions can be determined through a combination of climate modeling, historical data analysis, and scientific assessments. This modelling takes into account factors such as temperature, precipitation, soil moisture, and other relevant variables.

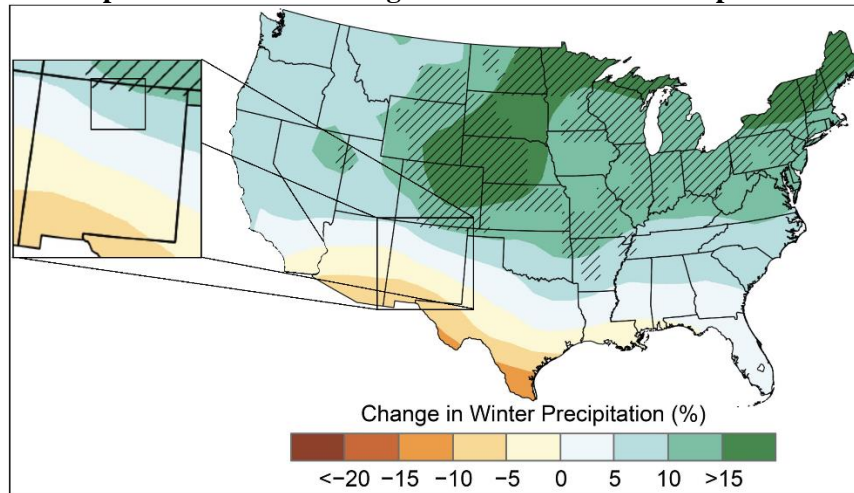
Because snowpack plays an important role in the management of New Mexico’s complex water system, some of the most impactful droughts have coincided with years of abnormally low snowpack accumulation during the winter months. The historical record indicates periodic prolonged wet and dry periods (Figure 5). Drought conditions can be exacerbated by warm temperatures. The record warmth in 2014 and 2015, in combination with multiple years of below average precipitation (Figure 2b), led to one of New Mexico’s most severe droughts.

Current modelling from the NOAA State Climate Summary 2022 for New Mexico suggests that winter precipitation is projected to increase slightly in Rio Arriba County and all participating jurisdictions, but these changes are small relative to the natural variability. The following map indicates the expected slight annual decrease in summer precipitation and a slight increase in winter precipitation for Rio Arriba County and all participating jurisdictions:

Map 21: Rio Arriba Change in Annual Summer Precipitation

Source: NOAA NCEI State Climate Summary 2022 for New Mexico

Map 22: Rio Arriba Change in Annual Winter Precipitation

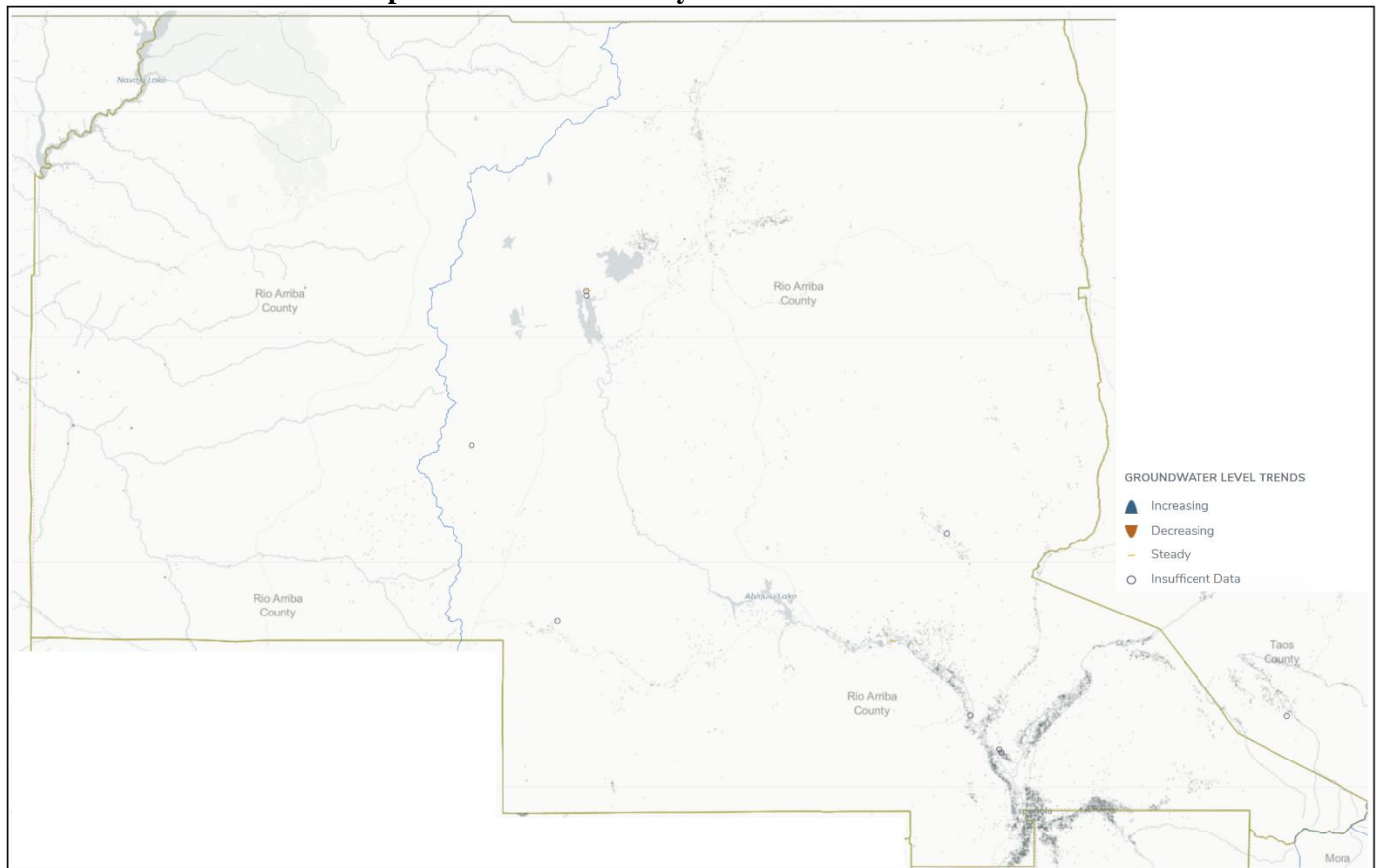


Source: NOAA NCEI State Climate Summary 2022 for New Mexico

Projected rising temperatures are projected to raise the snow line, which will increase the likelihood that precipitation will fall as rain rather than snow. This may result in a reduced snowpack and consequently a reduction in water storage. Additionally, projected higher spring temperatures will result in an earlier melting of the snowpack, which can have critical implications for Rio Arriba County and participating jurisdictions for water storage.

The following map, based on data form New Mexico Bureau of Geology and Mineral Resource, groundwater trends in Rio Arriba County. As indicated by the map, the is currently insufficient data to determine long term trends.:

Map 23: Rio Arriba County Groundwater Level Trends



Source: New Mexico Bureau of Geology and Mineral Resource

Beginning in July 2023, the New Mexico Bureau of Geology and Mineral Resources (NMBGMR) is conducting a 1-year hydrogeologic study in Rio Arriba County regions with state legislative funding. One goal of this study is to evaluate the quantity and quality of water in these regional aquifers as communities face increasing challenges of groundwater supply in the face of increased aridity and warmer temperatures. NMBGMR’s research team will focus on characterizing the groundwater aquifers in the communities of Chama, Dixon, Abiquiu, Medanales, and El Rito. While surface water accounts for approximately 92% of water use in this region (primarily for agriculture), groundwater is the main water source for domestic use for households, institutions, and businesses, supplied by a community system or private domestic wells. By assessing the different aquifer characteristics, such as groundwater recharge mechanisms and groundwater flow rates, this study can provide these communities with vital information to help manage future water resource options.

The initial phase of this project includes compiling existing groundwater well data and surface water data. Then, from September to November of 2023, the research team hopes to inventory a selection of wells, measure groundwater levels, and collect water samples. These depth-to-water measurements will be used to differentiate regional aquifers and estimate groundwater flow directions.

5.9.6 Vulnerability and Impact

FEMA NRI

Using the FEMA NRI, and consisting of three input components (expected annual loss, social vulnerability, and community resilience), the first table was created indicating the potential risk to Rio Arriba County and all participating jurisdictions from drought. In order to gain an understanding of vulnerability, the second table details the estimated annual loss data for Rio Arriba County and participating jurisdictions. To help understand the risk and vulnerability participating jurisdictions data from the FEMA NRI was run on a census tract level. As the NRI does not generate data for individual jurisdictions, census tract analysis is the closest analogue available to understand individual jurisdiction conditions.

Table 52: Participating Jurisdiction Drought Risk Index

Jurisdiction	Census Tract	Risk Index	National Percentile	Events per year
Rio Arriba County	All	Relatively Moderate	88.0	84.2
Chama	35039000500	Relatively Moderate	97.5	86.2
Espanola	35039940700	Relatively Low	90.6	83.4
Ohkay Owingeh	35039944100	Relatively Moderate	98.3	81.1

Source: FEMA NRI

Table 53: Participating Jurisdiction Drought Expected Annual Loss

Jurisdiction	Census Tract	EAL	National Percentile	Drought EAL
Rio Arriba County	All	Relatively Moderate	85.5	\$373,000
Chama	35039000500	Relatively Moderate	97.2	\$62,000
Espanola	35039940700	Relatively Low	89.0	\$3,800
Ohkay Owingeh	35039944100	Relatively Moderate	97.8	\$89,000

Source: FEMA NRI

Population

Droughts are rarely a direct cause of death, though the associated heat, dust, and stress can all contribute to increased mortality. However, drought can severely challenge a public water supplier through depletion of the raw water supply and greatly increased customer water demand. Even if the raw water supply remains adequate, problems due to limited treatment capacity or limited distribution system capacity may be encountered. Water supply planning is the key to minimizing the effects of drought on the population. Public water suppliers should continue to work to identify vulnerabilities and develop infrastructure, conservation plans, and partnerships to reduce the likelihood of running out of water during a drought.

Additionally, the loss of community lifelines can have a direct economic impact on the population. As an overview, the May 2023 FEMA Benefit-Cost Analysis Sustainment and Enhancements Standard Economic Value Methodology Report indicates the following loss values for community lifelines:

Table 54: Economic Impacts of Loss of Service Per Capita Per Day (in 2022 dollars)

Category	Loss
Loss of Wastewater Services	\$66
Loss of Water Services	\$138

Source: May 2023 FEMA Benefit-Cost Analysis Sustainment and Enhancements Standard Economic Value Methodology Report

At greater risk may be the vulnerable populations and equity priority communities, including the especially young, the elderly, and those below the poverty level. Hazard occurrences can exacerbate existing vulnerabilities and create new challenges. Vulnerable populations may have pre-existing health conditions that make them more susceptible to heat-related illnesses and dehydration, both of which can be exacerbated during droughts. People on fixed incomes and with limited resources may face difficulties in adapting their homes to withstand hazard conditions or may lack financial resources to cope with the increased costs of food, water, and energy. Details concerning potentially vulnerable populations may be found in Section 3.4: Socially Vulnerable and At-Risk Populations.

Buildings and Structures

In general, buildings are not directly vulnerable to losses as a result of drought. However, there is a potential that building occupants could be impacted by power failures caused by either increased utility demand or damaged power delivery infrastructure. In addition, drinking water infrastructure may be specifically vulnerable to the impacts of drought. Any decrease in groundwater supplies would stress this infrastructure and may cause shortages or rationing.

Governmental Operations

Governmental operations and facilities will likely experience minimal impacts from drought conditions, unless there are substantial power, communications, or water outages. However, reduced water availability would likely have an immediate impact on firefighting efforts in urban and suburban areas as fire suppression equipment requires a minimum level of water pressure to activate.

Transportation and Electrical Infrastructure

Droughts can have numerous impacts on both transportation and electrical distribution systems, often leading to challenges that require proactive management. The impacts of droughts on transportation systems may include:

- **Cracking and Shifting:** Drought conditions can cause soil to dry out and shrink, leading to cracks and shifts in roadways, especially in areas with expansive clay soil. This can result in uneven surfaces, potholes, and damage to the structural integrity of roads, making them unsafe for use.
- **Roadbed Damage:** Low moisture levels can cause subsidence and roadbed instability, requiring more frequent road repairs and maintenance.
- **Soil Subsidence:** The foundations of bridges can be compromised if the surrounding soil dries out and shifts. This can increase the stress on bridge supports, potentially leading to structural issues that require costly repairs.
- **Track Shifting and Damage:** The ground beneath railroad tracks can shift or crack during prolonged droughts, leading to track misalignment or buckling. This increases the risk of derailments and requires more frequent inspection and maintenance.
- **Runway Damage:** The same soil subsidence issues that affect roadways can also impact runways, causing cracks and instability that may need repairs.

Additionally, drought can impact both the electrical generation capacity and transmission. The impacts of droughts on electrical systems may include:

- **Hydropower Generation Reduced Water Availability:** Drought directly impacts hydropower plants by reducing the water available to generate electricity. Lower water levels in reservoirs and rivers mean reduced flow through turbines, limiting the amount of power that can be produced. In severe droughts, hydropower plants may have to shut down altogether, reducing overall grid capacity.

- **Thermal Power Plant (Water-Cooled) Cooling Water Shortages:** Thermal power plants (such as coal, natural gas, and nuclear plants) rely on water for cooling. Drought can reduce the availability of water for these cooling processes, forcing plants to reduce output or shut down temporarily.
- **Damage to Power Lines:** Drought increases the risk of wildfires, which can damage or destroy electrical transmission lines, substations, and other infrastructure. Wildfires can cause widespread power outages, as seen in several instances in New Mexico and Australia.
- **Preemptive Power Shutoffs:** To prevent wildfires, power utilities may preemptively shut down power lines during extreme drought and dry wind conditions to avoid sparking fires. This can lead to significant disruptions for businesses and residents.
- **Transmission Line Sag:** Droughts often coincide with extreme heat, which can cause power as the wires expand. This increases the risk of contact with trees or the ground, potentially leading to power outages or safety hazards.

Mapping concerning transportation and electrical infrastructure may be found in Section 3.9: Community Lifelines and Critical Infrastructure. Information concerning the costs to repair or reconstruct transportation and electrical infrastructure may be found in Section 5.8.6.

Water and Wastewater Utilities

Water utilities are particularly vulnerable to drought conditions due to the direct impact on both water availability and supply. Water utilities can be affected by drought through:

- **Reduced Water Availability:** The reduction in water availability directly impacts the amount of water that water utilities can draw from local sources.
- **Lower Reservoir Levels:** Lower reservoir levels can affect the ability to meet water demand during periods of high usage.
- **Declining Groundwater Levels:** Lower groundwater levels make it more challenging for utilities to extract water.
- **Water Quality Challenges:** Lower water levels can lead to higher concentrations of contaminants, minerals, and sediments in the available water sources, requiring more extensive and costly treatment processes.
- **Increased Treatment Costs:** Treating water from depleted or lower-quality sources during drought conditions may require additional treatment steps, technologies, or chemicals, leading to increased operational costs for water utilities.
- **Competition for Water Resources:** During droughts, there is increased competition for limited water resources among various users, including agriculture, industry, and households. Water utilities may face challenges in securing sufficient water supplies amid this heightened competition.
- **Impact on Water Infrastructure:** Reduced water flow in rivers and streams can expose water infrastructure, such as pipelines, to the risk of corrosion.
- **Water Use Restrictions:** To conserve water during droughts, authorities may implement water use restrictions and conservation measures.

The Drinking Water Bureau regulates public water systems in New Mexico. A public water system is any water system that serves at least 15 service connections or 25 individuals at least 60 days out of the year. In general, there are three classifications of systems, as follows:

- **Community (C) Water Systems:** A system that serves at least 15 service connections (which may include factories, schools, or places of housing that are on the same distribution system as residences) used by year-round residences or regularly serve at least 25 year-round residents.
- **Non-transient Non-Community (NTNC) Water Systems:** A system that serves at least 25 of the same persons over six months per year not at their residence (e.g., schools or factories that have their own water source).

- **Non-Community (NC) Water Systems:** A system that serves at least 25 persons (but not the same 25) over six months per year, not at their residence (e.g., campgrounds or highway rest stops that have their own water source).

The following have been identified as water utility providers in Rio Arriba County:

Table 55: Rio Arriba County Water Utility Providers

System Number	Water System Name	System Type	Primary Source	Water Type
NM3591521	Abiquiu Dam	NC		GW
NM3590121	Abiquiu Elementary School	NTNC		GW
NM3591821	Abiquiu Inn	NC		GW
NM3500221	Abiquiu Mdwca	C		GW
NM3502421	Agua Sana Wua	C		GW
NM3535021	Alcalde Mdwca	C		GW
NM3504121	Ancones Mdwca	C		GW
NM3502621	Apodaca Mdwca	C		GW
NM3500321	Barranco Mdwca	C		GW
NM3580621	Bpoe 1747 Recreation Area	NC		GW
NM3590921	Brazos Mdwca	NC		GW
NM3500521	Canjilon Water System	C		GW
NM3500421	Canon Plaza Mdwca	C		GW
NM3500621	Canones Mdwca	C		GW
NM3500821	Capulin Mdwca	C		GW
NM3500921	Cebolla Mdwca	C		GW
NM3501021	Chama Water System	C		SW
NM3503821	Chama West Water Users Association	C		GW
NM3500121	Chamita Mdwca	C		GW
NM3593121	Chimayo Elementary School	NTNC		GW
NM3501521	Christ In The Desert Monastery	C		GW
NM3501221	Cordova Mdwca	C		GW
NM3596521	Corkins Lodge	NC		GW
NM3592121	Coronado High School	C		GW
NM3580221	Coyote Admin Site Usfs Snf	NC		GW
NM3501321	Coyote Mdwca	C		GW
NM3511021	Delancey Street Foundation	C		GW
NM3501421	Dixon Mdwca	C		GW
NM3591621	Echo Amphitheater Usfs Carson	NC		GW
NM3536221	El Rito Canyon Mdwca	C		GW
NM3504021	El Rito Regional Water & Waste Water Asn	C		GW
NM3593621	El Vado Lake State Park	NC		SW
NM3501821	Ensenada Mdwca	C		GW
NM3591021	Escalante High School	NTNC		GW
NM3501921	Espanola Water System	C		GW
NM3502021	Gallina Water System	C		GW
NM3591721	Ghost Ranch Conference Center	NTNC		GW
NM3502426	Greater Chimayo Mdwca	C		GW
NM3593221	Heron Lake State Park (Surface Water)	NC		SW
NM3503921	Hopewell Lake Campground Usfs Carson	NC		GW
NM3566221	La Asociacion De Agua De Los Brazos	C		GWP
NM3502121	La Madera Mdwca	C		GW
NM3502321	Lindrieth Community Water Coop Inc	C		GW
NM3502921	Los Ojos Mdwca	C		GW
NM3502721	Lumberton Mdwca	C		SW
NM3533021	Lybrook Mdwca	C		GW
NM3594521	Mccurdy School	NTNC		GW
NM3504221	Mesa Shopping Center	NTNC		GW

Table 55: Rio Arriba County Water Utility Providers

System Number	Water System Name	System Type	Primary Source Water Type
NM3593821	Navajo Lake State Park - Sims Mesa	NC	SW
NM3556821	Ojo Sarco Mdwca	C	GW
NM3590829	Pilar Yacht Club & Cafe	NC	GW
NM3580121	Rio Arriba County Detention Center	NTNC	GW
NM3510221	Rio Arriba County Velarde Treatment Fac.	NTNC	GW
NM3500721	Rio Embudo Mdwca	C	GW
NM3502221	Rutheron Mutual Water Association	C	GU
NM3596721	Stonehouse Lodge	NC	GW
NM3503321	Tierra Amarilla Mdwca	C	GW
NM3503421	Truchas Mdwca	C	GW
NM3503521	Vallecitos Mdwca	C	SW
NM3503621	Valley Estates Water & Sewer Association	C	GW
NM3529421	Velarde Mdwca	C	GW
NM3566321	Archuleta Mobile Home Park	NP	-
NM3530121	Arroyo Del Agua Mdwca	NP	-
NM3596821	Canjilon Lakes Campground	NP	-
NM3594121	Carinos Charter School	NP	-
NM3543826	Chimayo Mdwca	NP	-
NM3511126	Chimayo Rv Park	NP	-
NM3580521	Cowboys Place Cafe	NC	GW
NM3596921	Coyote Elementary School.	NP	-
NM3592221	Duke City Lumber Company	NP	GW
NM3581021	El Alamo Dinner Bell	NP	-
NM3501621	El Llano Mdwca	NP	-
NM3560721	El Paso Natural Gas (Largo)	C	GW
NM3560821	El Paso Natural Gas (Lindrith)	C	GW
NM3560921	El Paso Natural Gas (Lowry)	C	GW
NM3561021	El Paso Natural Gas (Ojito)	NTNC	GW
NM3595521	El Rito Elementary School	NP	-
NM3501721	El Rito Mdwca	NP	-
NM3595121	El Vado Lake Resort	NP	-
NM3597621	Embudo Station	NP	-
NM3597521	Enchant A Rama Water Co Op	NP	-
NM3590626	Four Winds Restaurant	NP	GW
NM3580321	Gordos Cafe	NP	-
NM3564921	Grant Mobile Home Park	NP	-
NM3502326	Greater Chimayo Mdwca	NP	-
NM3592921	Hernandez Elementary School	NP	-
NM3593721	Heron Lake State Park (Groundwater)	NP	-
NM3593921	Jemez Mountain Electric Co-Op	NP	-
NM3598121	La Charola	NP	-
NM3594321	La Clinica Del Pueblo De Rio Arriba	NP	-
NM3580421	La Cocinita	NP	GW
NM3596021	Lake Shore Inn	NP	GW
NM3590321	Largo Canyon Elementary School	NP	GW
NM3597021	Lindrith Cafe	NC	GW
NM3598221	Little Mountains & Little Rivers Day Car	NP	GW
NM3502521	Llano Chimayo Mdwca	NP	-
NM3591921	Los Ninos Del Valle	NP	GW
NM3594421	Los Ojos Fish Hatchery	NC	GU
NM3545521	Montecito Mdwca	NP	-
NM3580021	Navajo City Roadhouse Cafe	NP	-
NM3593321	Northern New Mexico Community College	NP	-
NM3565621	Northwest Pipeline - Gobernador Camp	C	GW

Table 55: Rio Arriba County Water Utility Providers

System Number	Water System Name	System Type	Primary Source Water Type
NM3591421	Piedra Alumbre Visitors Center	NP	-
NM3503121	Placitas Mdwca	NP	-
NM3501121	Plaza Blanca Water System	NP	-
NM3540021	Ponderosa Mhp	NP	GW
NM3595726	Rancho De Chimayo	NP	-
NM3503021	Rio Arriba County Onate Visitor'S Center	NP	-
NM3502821	Rio Arriba County Rural Events Center	NP	-
NM3595021	Rio Arriba County Senior Citizen Center	NP	-
NM3510521	Siete Del Norte	NP	-
NM3590821	Starlighter Drive-In	NP	GW
NM3566121	Sunterra Gas Processing-Lybrook Plant	C	GW
NM3592721	Velarde Elementary School	NP	-
NM3592421	Western Holiday Motel	NP	GW
NM3503721	Youngsville Mdwca	NP	-

Source: State Water Resources Control Board Division of Drinking Water

Drought can severely challenge a public water supplier through depletion of the raw water supply and greatly increased customer water demand. Even if the raw water supply remains adequate, problems due to limited treatment capacity or limited distribution system capacity may be encountered. Water supply planning is the key to minimizing the effects of drought on the population. Public water suppliers should continue to work to identify vulnerabilities and develop infrastructure, conservation plans, and partnerships to reduce the likelihood of running out of water during a drought.

Communities and citizens served by private wells rather than water supply districts may be at higher risk to drought conditions, and may see the following impacts:

- **Lowering of Water Table:** Drought conditions can lead to a lowering of the water table, which is the level at which groundwater is located. Private wells that rely on groundwater may experience reduced yields or, in extreme cases, may run dry.
- **Decreased Well Recharge:** Drought reduces the amount of precipitation, leading to decreased recharge of groundwater. Private wells depend on a sustainable recharge rate to maintain a consistent and reliable water supply.
- **Increased Competing Demands:** During a drought, increased water demand for agricultural irrigation, municipal water supply, and other uses can create competition for the available groundwater. Private wells may face challenges due to this increased demand.
- **Water Quality Concerns:** Lower groundwater levels during droughts can lead to changes in water quality. Concentrations of minerals, contaminants, and pollutants may increase, affecting the suitability of water for drinking and other uses.

Should it be required to drill a private well deeper to accommodate for drought conditions impacting the level of the water table, on average, the cost to drill a private water well in the United States can range from \$15 to \$45 per foot. However, it's important to note that this is a general estimate, and actual costs can vary based on geological and hydrogeological conditions and well depth.

Additionally, drought can impact wastewater treatment facilities, and operations, including:

- **Biological Treatment Efficiency:** Many wastewater treatment plants use biological processes that rely on microorganisms to break down waste. These microorganisms depend on a certain balance of water, oxygen, and waste concentration to function effectively. During droughts, changes in the wastewater's composition and flow can reduce the efficiency of biological treatment systems, requiring process adjustments or additional chemical treatments.

- **Pipe Cracking and Ground Shifts:** Drought causes soil to dry out and shrink, potentially leading to ground shifts that can crack or damage underground sewer pipes. This can result in leaks, blockages, or sewer line failures that require costly repairs.
- **Increased Infiltration and Inflow:** During drought, groundwater levels may drop, and sewer systems can experience increased infiltration of saline or contaminated water, particularly in coastal areas. This can exacerbate the corrosion of pipes and other infrastructure.

Rio Arriba County has one wastewater treatment plant in Espanola.

The costs to repair or reconstruct water and wastewater utility plants and distribution systems can vary significantly based on factors such as the size of the facility, the extent of the damage, local labor costs, and material availability. However, some general estimates can provide insight into the typical expenses.

- **Water Utility Plants**
 - Minor repairs: These may involve fixes to pumps, valves, or small sections of piping. On average, minor repairs for water treatment facilities can range from \$10,000 to \$100,000, depending on the scale of the damage and the equipment involved.
 - Moderate repairs: More substantial repairs, such as fixing filtration systems or repairing damaged tanks, can cost anywhere from \$500,000 to \$2,000,000. These projects often involve replacing large equipment and reconfiguring damaged systems.
 - Major repairs or partial reconstruction: For significant damage, such as structural failures, system-wide overhauls, or upgrades, the cost may rise to \$10,000,000. This typically includes substantial replacement of infrastructure, new piping systems, and modernizations to meet current standards.
 - Reconstruction Costs: Complete reconstruction of a water utility plant can be very expensive, often costing between \$30,000,000 and \$20,000,000, depending on the capacity of the plant and the complexity of the systems involved.
- **Wastewater Treatment Plants**
 - Minor repairs (such as fixing aerators, pumps, or control systems) can cost between \$50,000 and \$500,000, depending on the facility's size and the severity of the issues.
 - Moderate repairs: Involves fixing critical components like clarifiers or digesters and can range from \$1,000,000 to \$5,000,000.
 - Major repairs or upgrades: For larger systems, like upgrading an entire section of a plant or replacing significant infrastructure, the costs can escalate to \$10,000,000.
 - Reconstruction Costs: Complete reconstruction of wastewater plants typically ranges between \$50,000,000 and \$30,000,000, depending on the plant's capacity and required technology. Factors such as meeting modern regulatory standards can also drive costs.
- **Distribution Systems (Water and Wastewater)**
 - Water Distribution System Repair Costs: Repairing or replacing damaged pipelines, pumps, or valves in water distribution systems can cost anywhere from \$50,000 to \$200,000 per mile for minor repairs. More extensive pipe replacement, especially in urban areas where digging and rerouting traffic are involved, can escalate to \$500,000 to \$2,000,000 per mile.
 - Wastewater Distribution Repair Costs: pipelines (especially those dealing with larger sewage systems) tend to have higher repair costs due to increased complexity. These can range from \$1 million to \$3 million per mile, especially in densely populated regions or for large diameter pipes.
 - Water Distribution Reconstruction Costs: For water distribution system reconstruction, costs can range from \$1,000,000 to \$5,000,000 per mile, particularly for high-capacity urban systems with large pipe diameters or advanced technology like smart metering.
 - Wastewater Distribution Reconstruction Costs: For wastewater system reconstruction, particularly for larger pipelines, the cost per mile can range from \$3,000,000 to \$8,000,000, depending on the urban density, excavation challenges, and regulatory requirements.

Medical, Education, and Response Facilities

In general, medical, educational, and response facilities are not directly vulnerable to losses as a result of drought. Both operations and facilities will likely experience minimal impacts from drought conditions, unless there are substantial power, communications, or water outages.

Communication Systems

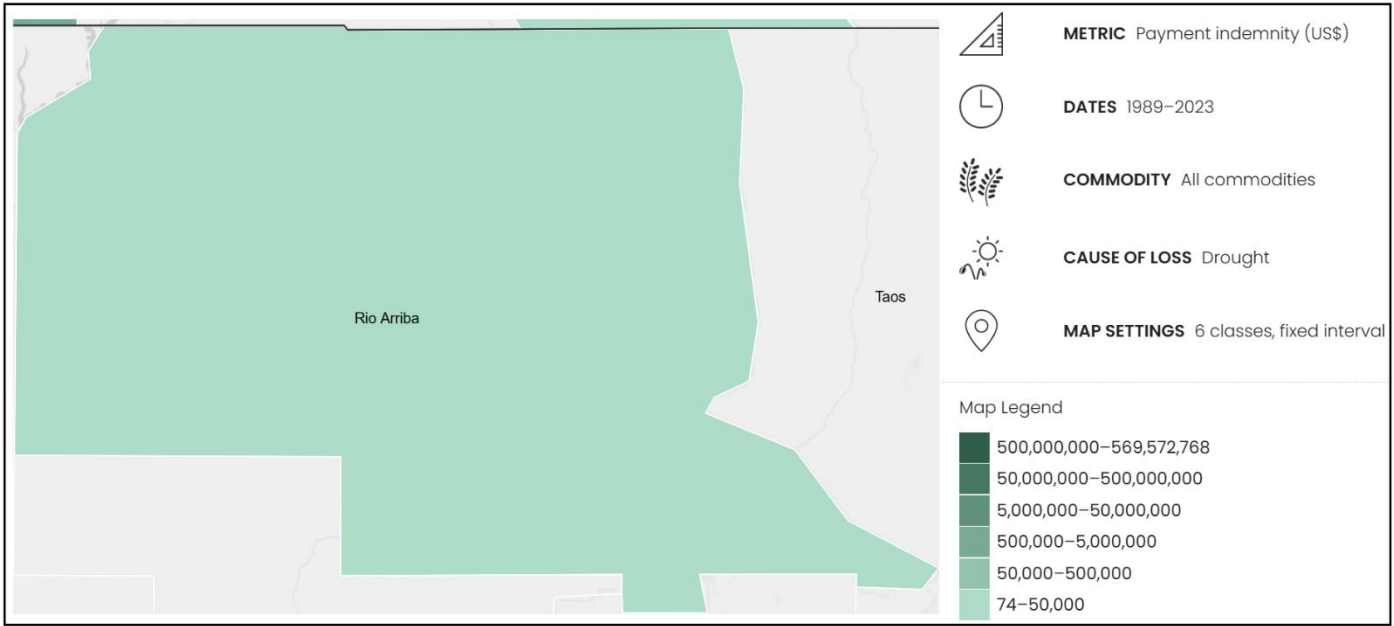
In general, communications systems are not directly vulnerable to losses as a result of drought, and would likely experience minimal impacts from drought conditions, unless there are substantial power outages.

Environmental and Agricultural Impacts

Drought conditions can cause significant agricultural impacts. In addition to obvious losses in yields in both crop and livestock production, drought is associated with increases in insect infestations, plant disease, and wind erosion. Droughts also bring increased problems with insects and disease to forests and reduce growth. The incidence of wildfires increases substantially during extended droughts, which in turn places both human and wildlife populations at higher levels of risk.

The following map from the United States Department of Agriculture details total county-wide agricultural losses due to drought conditions from 1989 - 2023:

Map 24: Agricultural Losses Due to Drought Conditions, 1989 - 2023



Source: United States Department of Agriculture

Although environmental losses are difficult to quantify, increasing public awareness and concern for environmental quality has forced public officials to focus greater attention and resources on these effects. Environmental losses are the result of damage to plant and animal species, wildlife habitat, and air and water quality, wildfires, degradation of landscape quality, loss of biodiversity, and soil erosion. Some of the effects are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for some time or may even become permanent. Wildlife habitat, for example, may be degraded through the loss of wetlands, lakes, and vegetation. However, many species will eventually recover from it if it is a temporary aberration. However, the degradation of landscape quality, with increased soil erosion, may lead to a more permanent loss of biological productivity of the landscape.

Jurisdictional Concerns:

As of this plan there is a deficit of community specific data to help quantify both vulnerability and historic impact. However, over the life of this plan the MPC will work to quantify the local level impacts of hazard occurrences to

citizens, vulnerable populations, structures, and infrastructure to better inform both this living LHMP and future planning efforts. The following initial vulnerabilities and potential impacts have been identified on a jurisdictional level:

- **Chama:** With 16.5% of citizens living in poverty, drought is a concern as access to water may become more expensive due to supply limitations. Additionally, the remote nature of the jurisdiction may hinder future access to water supplies. Additionally, potential climate change effects may exacerbate future water concerns for the jurisdiction.
- **Espanola:** With 23.4% of citizens living in poverty, drought is a concern as access to water may become more expensive due to supply limitations. Additionally, potential climate change effects may exacerbate future water concerns for the jurisdiction.
- **Ohkay Owingeh:** With 20.6% of citizens living in poverty, drought is a concern as access to water may become more expensive due to supply limitations. Additionally, potential climate change effects may exacerbate future water concerns for the jurisdiction.

Cascading Impacts

Cascading impacts often result when one a hazard event triggers one or more differing hazard events or loss of community lifelines. Cascading impacts associated with drought may include:

- Decrease in water quality
- Increased wildfire risk
- Environmental degradation
- Land subsidence
- Damage to agricultural lands

Consequence Analysis

This consequence analysis lists the potential impacts of a hazard on various elements of a community. The impact of each hazard is evaluated in terms of disruption of operations, recovery challenges, and overall wellbeing to all Rio Arriba County residents and first responder personnel. The consequence analysis supplements the hazard profile by analyzing specific impacts.

Table 56: Drought Consequence Analysis

Subject	Potential Impacts
Impact on the Public	If the drought coincides with warmer months, vulnerable populations may face an increased risk of dehydration, death, heat-related illness, heat stroke. Lower quantities of water may also increase the likelihood of contamination due to higher concentrations of bacteria. During droughts, dry soils and wildfires increase the number of airborne particles, such as pollen and smoke, which can worsen chronic respiratory illnesses.
Impact on Responders	Reduced water availability would likely complicate firefighting efforts in urban and suburban areas where wildfire-fighting tactics such as chemical retardants and controlled burns are less suitable. Some fire suppression equipment requires a minimum level of water pressure to activate. If the drought coincides with warm months, first responders may face increased risk of heat-related injuries or death.
Continuity of Operations	Local jurisdictions maintain continuity plans which can be enacted as necessary based on the situation. While the expectation is minimal, this threat may impact an agency's ability to implement their continuity plan based on the hazard's potential to impact power, communications, or water outages. Critical life-saving activities and fire suppression will be directly impacted by these outages.
Delivery of Services	Droughts may impact the delivery of goods and services if there are shortages of raw materials.
Property, Facilities, and Infrastructure	Drought conditions may threaten the levels or quality of municipal public water supplies or impact small communities and/or private potable water wells.

Table 56: Drought Consequence Analysis

Subject	Potential Impacts
Impact on Environment	The potential of drought-related impacts could have significant impacts on supplies of animal feed, livestock, meat and dairy products, and processed grain products, and on crop production. Drought conditions may also increase the potential for fires. Drought is also associated with insect infestations, plant disease, wind erosion of soil, and decrease in levels of water produced by natural aquifers.
Economic Conditions	The economic impacts from a drought could be significant. Droughts have the potential to drain state, and local resources, which will have a significant fiscal impact on the local government.
Public Confidence in Governance	Droughts can adversely affect the public, first responders, infrastructure, agriculture, economy, and overall operations. Direct, effective, and timely response by all levels of government is required for public confidence in governance, especially in recognizing and mitigating economic impacts of the drought.

5.9.7 Future Development

Rio Arriba County, the Ohkay Owingeh, and participating jurisdictions are experiencing consistent population decline or a static population as people increasingly migrate from rural areas to urban centers. The rural-to-urban population movement has significant implications for all participating jurisdictions, including school closures and reduced economic activity. Based on population projections, this decreasing or static population trend is expected to continue in Rio Arriba County through 2050. While unlikely, should any population increase occur, potentially vulnerable populations could face disproportionate effects from a drought. Of particular concern are the increasing number of unhoused persons within the county. Additionally, it is expected that there will be an increase in the number of elderly citizens and citizens living below the poverty level in all jurisdictions as a percentage of total population. These higher percentages may increase future vulnerability due to increased demands on water supplies, causing an increase in commodity pricing.

Closely tracking population data, but tending to lag population changes, housing data is a good indicator of changing demographics and growth. Rio Arriba County, the Ohkay Owingeh, and all participating jurisdictions have generally seen static to decreasing housing growth over the previous 20-year period. Current building codes require considerations for water conservation, and any renovation to existing housing stock will require adherence to these provisions.

Extreme heat conditions will continue to be considered for any future jurisdictional development or renovation, including climate or heat proofing structures. In addition, jurisdictions will help areas adapt to extreme heat by encouraging the usage of heat-resistant materials during infrastructure renovation and design.

5.9.8 Mitigation Opportunities

The following table presents examples of potential actions that can be instituted for mitigating the drought hazard.

Table 57: Example Drought Mitigation Actions

Category	Example Action
Planning and Regulation	Gather and analyze water and climate data to gain a better understanding of local climate and drought history.
	Identify available water supplies.
	Improve water supply monitoring.
	Develop a drought emergency plan.
	Develop criteria or triggers for drought-related actions.
	Develop a drought communication plan to facilitate timely communication of relevant information.
	Establish an irrigation time/scheduling program or process so that all agricultural land gets the required amount of water.
	Develop an ordinance to restrict the use of public water resources for non-essential usage.

Table 57: Example Drought Mitigation Actions

	Adopt ordinances to prioritize or control water use, particularly for emergency situations like fire fighting
Infrastructure	Design water delivery systems to accommodate drought events.
	Develop new or upgrading existing water delivery systems to eliminate breaks and leaks
Natural Systems	Incorporate drought tolerance practices into landscape ordinances to reduce dependence on irrigation.
	Provide incentives for xeriscaping.
	Use permeable driveways and surfaces to reduce runoff and promote groundwater recharge
Education	Provide information on installing low-flow water saving showerheads and toilets.
	Provide information on adjusting sprinklers to water the lawn and not the sidewalk or street.
	Provide information on installing rain-capturing devices for irrigation.
	Encourage the installation of graywater systems in homes to encourage water reuse

5.10 Extreme Heat

5.10.1 Hazard Description

Extreme heat events occur when climate conditions produce temperatures well outside of the predicted norm. These extremes can have severe impacts on human health and mortality, natural ecosystems, agriculture, and other economic sectors.

The Centers for Disease Control and Prevention (CDC) identifies the following six groups as being especially vulnerable to extreme heat:

- Older Adults (aged 65)
- Infants and Children
- Individuals with Chronic Conditions
- Low-income Individuals
- Athletes
- Outdoor workers



5.10.2 Location & Extent

Rio Arriba County, located in northern New Mexico, has a high-desert climate characterized by a combination of semi-arid and alpine climate zones. This region is influenced by its diverse topography and elevation range, which varies from around 5,000 feet to over 13,000 feet.

Summers are typically warm to hot in the lower elevations and milder in higher areas, with average high temperatures ranging from 80°F to 90°F (27°C to 32°C) in valleys and around 70°F (21°C) or cooler at higher altitudes. Winters can be cold, especially in higher elevations, with temperatures frequently dropping below freezing, particularly at night. Daytime highs in winter range from the 30s to 50s °F (1°C to 10°C) at lower elevations but are often much colder in mountainous regions.

The county experiences a broad temperature range due to its altitude variations, with higher elevations experiencing cooler temperatures year-round. While all of Rio Arriba County is vulnerable to extreme heat, in general terms mountainous communities are at a much lower risk of extreme heat events. Extreme heat may be defined as follows.

- **Extreme Heat:** Days when the maximum temperature is above 91.4 degrees Fahrenheit.

The following table, using data from the NWS, details the recorded maximum and average maximum temperatures for Rio Arriba County:

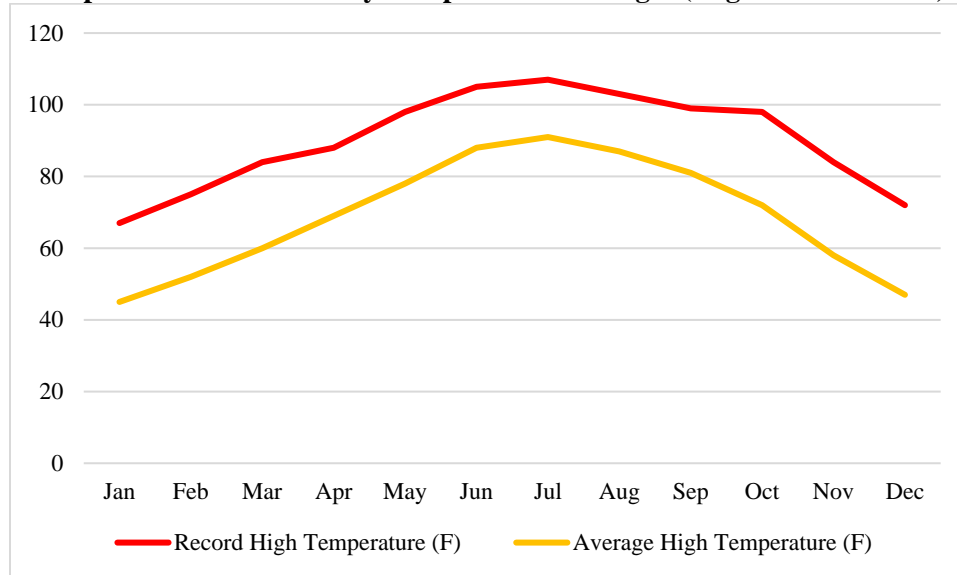
Table 58: Rio Arriba County Temperature Averages (Degrees Fahrenheit)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Record High Temperature (F)	67	75	84	88	98	105	107	103	99	98	84	72
Average High Temperature (F)	45	52	60	69	78	88	91	87	81	72	58	47

Source: NWS

The following graphs illustrate the above data.

Graph : Rio Arriba County Temperature Averages (Degrees Fahrenheit)



Source: NWS

The MPC view extreme heat as both a local and county-wide hazard. Discussions with the MPC and a review of all available data indicated that while extreme heat is a concern for all participating jurisdictions, some jurisdictions may have a greater concern. The following provides a narrative of the level of jurisdictional concern:

- **Rio Arriba County:** Extreme heat identified as a community concern as citizens, agriculture, and the environment are vulnerable. Additionally, an increase in extreme heat conditions may increase wildfire events.
- **Chama:** Extreme heat identified as a minor, but potentially increasing community concern as citizens, agriculture, and the environment are potentially vulnerable. Any increase in extreme heat conditions may increase wildfire events. However, the elevation of the jurisdiction is expected to have a mitigation effect on temperatures.
- **Espanola:** Extreme heat identified as a minor, but potentially increasing community concern as citizens, agriculture, and the environment are potentially vulnerable. Any increase in extreme heat conditions may increase wildfire events. However, the elevation of the jurisdiction is expected to have a mitigation effect on temperatures.
- **Ohkay Owingeh:** Extreme heat identified as a minor, but potentially increasing community concern as citizens, agriculture, and the environment are potentially vulnerable. Any increase in extreme heat conditions may increase wildfire events. However, the elevation of the jurisdiction is expected to have a mitigation effect on temperatures.

5.10.3 Previous Occurrences

Historical events of significant magnitude or impact can result in a Presidential Disaster Declaration. Rio Arriba County has experienced no Presidential Disaster Declarations related to extreme heat.

The President can declare an emergency for any occasion or instance when the President determines federal assistance is needed. Rio Arriba County has experienced no Emergency Declarations related to extreme heat.

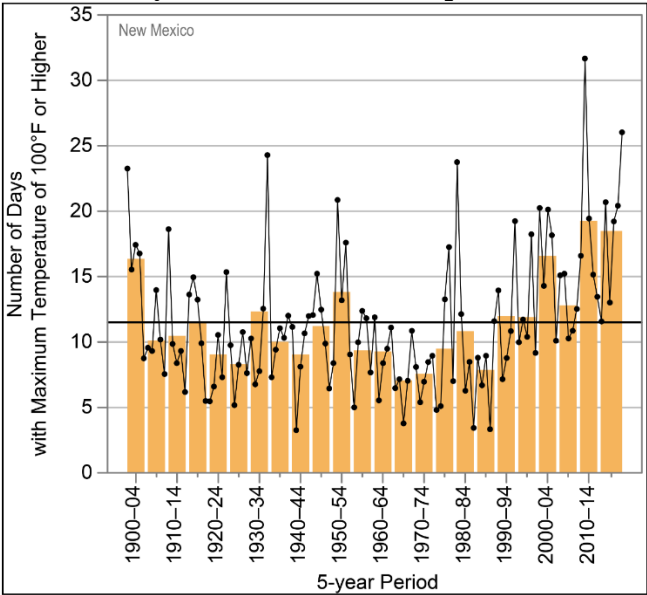
In New Mexico, the governor has the authority to declare a state of emergency or disaster under various state statutes and provisions. Rio Arriba County has experienced no proclamations of a State of Emergency related to extreme heat.

Additionally, data from the NCEI from 1950 through 2024 indicates no reported extreme heat events.

According to the NOAA NCEI State Climate Summary 2022 for New Mexico, since 1990 the number of extremely hot days has risen on average (although not all locations have experienced increases). The greatest number of days was

recorded in the 2010–2014 period, with the 5 long-term stations averaging 19 days per year with temperatures higher than 100°F.

Chart 18: Number of Days with Maximum Temperature of 100° F or Higher



Source: NOAA NCEI State Climate Summary 2022 for New Mexico

5.10.4 Probability of Future Events

The following tables, using data from the NCEI, indicate the yearly probability of an extreme heat event, the number of deaths or injuries, and estimated property damage for all Rio Arriba County participating jurisdictions based on 75 years’ worth of reporting data:

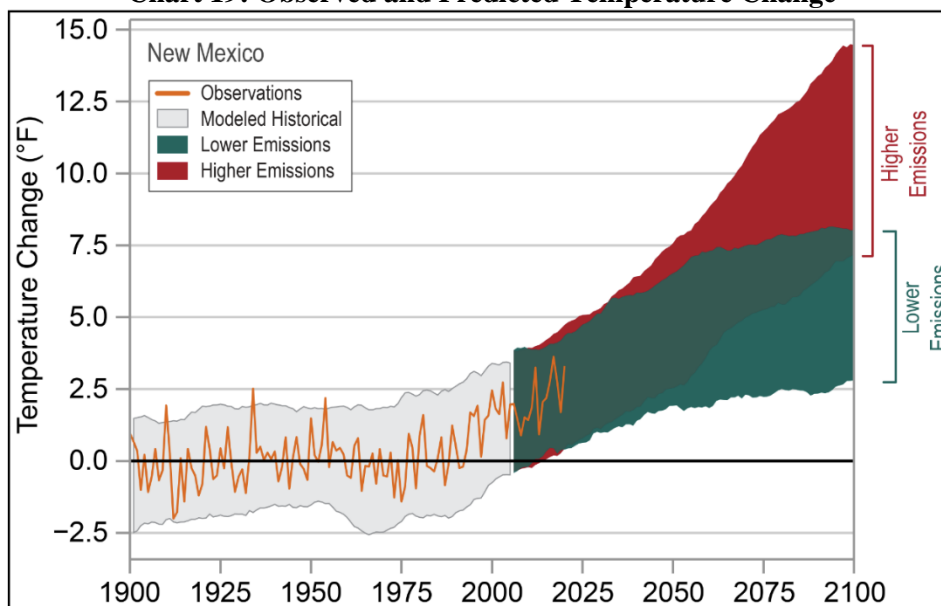
Table 59: Rio Arriba County NCEI Extreme Heat Event Probability Summary

County	Number of Events	Average Events per Year	Deaths / Injuries	Average Deaths / Injuries per Year	Property Damage	Average Property Damage per Year
Rio Arriba	0	0	0	0	\$0	\$0

Source: NCEI

The following chart indicates the projected temperature change for Rio Arriba County utilizing two global climate models. One model utilizes information in which greenhouse gas emissions continue to increase (higher emissions), with the other model utilizing information in which greenhouse gas emissions increase at a slower rate (lower emissions). Temperatures in, detailed by the orange line, have risen 2° F since the beginning of the early 1900s. Based on both the higher emission and lower emission models, continued warming is projected throughout this century.

Chart 19: Observed and Predicted Temperature Change



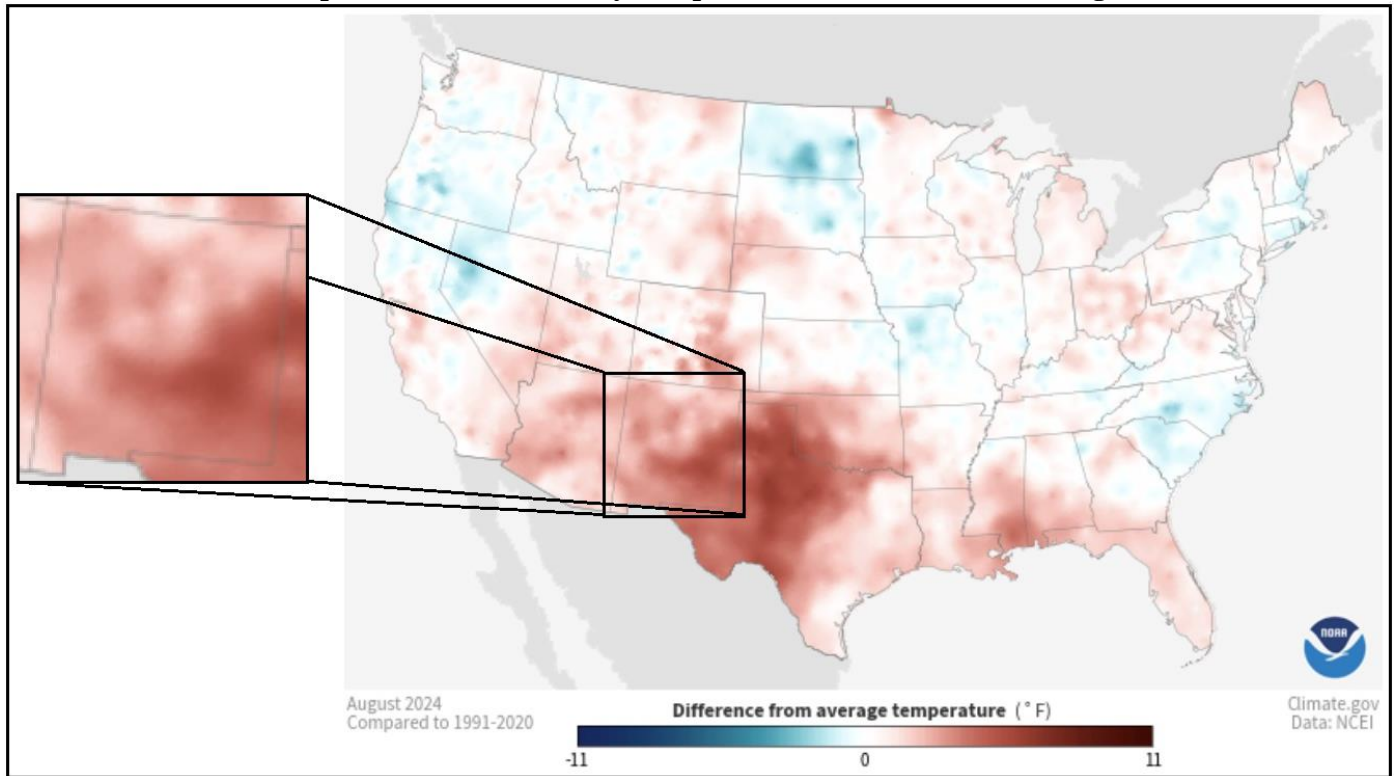
Source: NOAA NCEI State Climate Summary 2022 for New Mexico

5.10.5 Projected Changes in Location, Intensity, Frequency, and Duration

When discussing extreme temperatures, climate change should be considered as it may markedly change future events. Recent climate modeling results indicate that extreme heat events may become more common for Rio Arriba County. Recent multiyear periods have been among some of the warmest on record for Rio Arriba County. Rising average temperatures produce a more variable climate system which may result in an increase in the frequency and severity of some extreme weather events including longer and hotter heat waves. Additionally, rising temperatures can harm air quality and amplify existing threats to human health. Warmer weather can increase the production of ground-level ozone, a pollutant that causes lung and heart problems. Heat stress is expected to increase as climate change brings hotter summer temperatures and more humidity. Certain people are especially vulnerable, including children, the elderly, the sick, and those living below the poverty line.

Available data suggests that both the average high temperatures and the record high temperature will likely continue to increase over the coming years. as indicated by the following map from NOAA indicating the temperature difference from average:

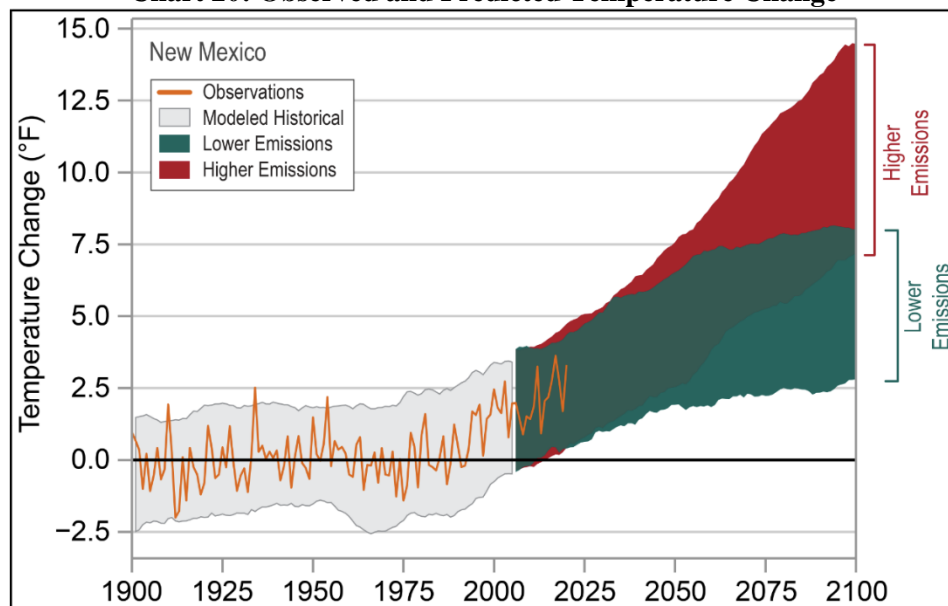
Map 25: Rio Arriba County Temperature Difference from Average



Source: NOAA

The following chart indicates the projected temperature change for Rio Arriba County utilizing two global climate models. One model utilizes information in which greenhouse gas emissions continue to increase (higher emissions), with the other model utilizing information in which greenhouse gas emissions increase at a slower rate (lower emissions). Temperatures in, detailed by the orange line, have risen 2° F since the beginning of the early 1900s. Based on both the higher emission and lower emission models, continued warming is projected throughout this century.

Chart 20: Observed and Predicted Temperature Change



Source: NOAA NCEI State Climate Summary 2022 for New Mexico

5.10.6 Vulnerability and Impact

FEMA NRI

Using the FEMA NRI, and consisting of three input components (expected annual loss, social vulnerability, and community resilience), the first table was created indicating the potential risk to Rio Arriba County and all participating jurisdictions from extreme heat. In order to gain an understanding of vulnerability, the second table details the estimated annual loss data for Rio Arriba County and participating jurisdictions. To help understand the risk and vulnerability participating jurisdictions data from the FEMA NRI was run on a census tract level. As the NRI does not generate data for individual jurisdictions, census tract analysis is the closest analogue available to understand individual jurisdiction conditions.

Table 60: Participating Jurisdiction Extreme Heat Risk Index

Jurisdiction	Census Tract	Risk Index	National Percentile	Events per Year
Rio Arriba County	All	No rating	0.0	0
Chama	35039000500	No rating	0.0	0
Espanola	35039940700	No rating	0.0	0
Ohkay Owingeh	35039944100	No rating	0.0	0

Source: FEMA NRI

Table 61: Participating Jurisdiction Extreme Heat Expected Annual Loss

Jurisdiction	Census Tract	EAL	National Percentile	Extreme Heat EAL
Rio Arriba County	All	None	0.0	\$0
Chama	35039000500	None	0.0	\$0
Espanola	35039940700	None	0.0	\$0
Ohkay Owingeh	35039944100	None	0.0	\$0

Source: FEMA NRI

Population

A primary concern with this hazard is human health safety issues, as extreme heat can be a direct cause of death. Specific at-risk groups include outdoor workers, farmers, young children, and senior citizens. Impacts on human health can include:

- **Heat Exhaustion and Heat Stroke:** Prolonged exposure to high temperatures can lead to heat exhaustion, characterized by heavy sweating, weakness, and dizziness. If untreated, it can escalate to heat stroke, a life-threatening condition with symptoms like confusion, high body temperature, and loss of consciousness.
- **Respiratory Issues:** High temperatures can worsen air quality, increasing levels of ozone and allergens, which can exacerbate asthma and other respiratory conditions.
- **Cardiovascular Strain:** Extreme heat can put additional stress on the heart, increasing the risk of heart attacks and other cardiovascular problems, particularly in older adults.
- **Dehydration:** Heat can lead to increased fluid loss through sweating, which can result in dehydration, affecting bodily functions and overall health.

The following table discusses potential impacts on human health related to excessive heat by temperature range.

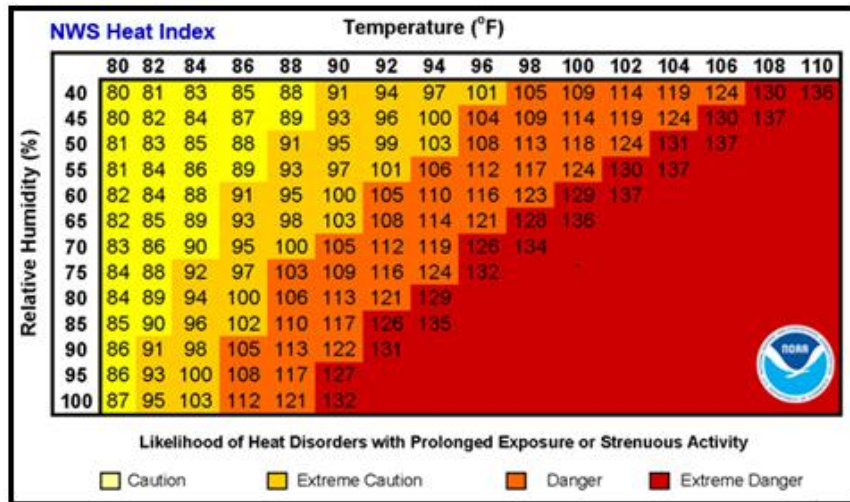
Table 62: Extreme Heat Impacts on Human Health

Heat Index Temperature	Potential Impact on Human Health
80-90° F	Fatigue possible with prolonged exposure and/or physical activity
90-105° F	Sunstroke, heat cramps, and heat exhaustion possible
105-130° F	Heatstroke/sunstroke is highly likely with continued exposure

Source: National Weather Service Heat Index Program

Exposure to direct sun can increase Heat Index values by as much as 15°F. The zone above 105°F corresponds to a Heat Index that may cause increasingly severe heat disorders with continued exposure and/or physical activity. The following graph, from the NWS, indicates Heat Index values.

Chart 21: Heat Index



Source: NWS

Extreme heat may disproportionately affect socially vulnerable populations, exacerbating pre-existing inequalities and making recovery more difficult for these groups. Extreme heat may disproportionately impact vulnerable populations in the following ways:

- **Elderly Individuals:** Older adults often have reduced physiological resilience to heat due to age-related factors and chronic health conditions, making them more susceptible to heat-related illnesses.
- **Children: Young** children are less able to regulate their body temperature and are at a higher risk for heat exhaustion and dehydration.
- **Low-Income Communities:** Those in low-income neighborhoods may lack access to air conditioning, adequate housing, or resources to stay cool, increasing their risk during heat events.
- **People with Chronic Health Conditions:** Individuals with cardiovascular, respiratory, or other chronic health issues may face heightened risks from extreme heat, as their bodies may struggle to cope with elevated temperatures.
- **Homeless Individuals:** People experiencing homelessness often have limited access to shelter and cooling facilities, making them particularly vulnerable during heat waves.

All Rio Arriba County and participating jurisdictions are vulnerable to the impacts of extreme heat. Please see Section 3.3: Population Data and Section 3.4: Socially Vulnerable and At-Risk Populations for data concerning jurisdictional populations.

Buildings and Structures

In general, buildings and structures will not be impacted by short-term extreme heat events. It is possible that long-term heat events could cause impacts, including:

- **Thermal Expansion:** High temperatures can cause building materials, such as metal and concrete, to expand. This can lead to warping, cracking, and structural stress.
- **Roof Damage:** Prolonged exposure to extreme heat can deteriorate roofing materials, leading to leaks, reduced lifespan, and increased maintenance costs.
- **Foundation Issues:** Prolonged heat can affect the moisture content in the soil surrounding a building's foundation, potentially leading to shifting or settling.

Transportation and Electrical Infrastructure

Extreme heat can have numerous impacts on both transportation and electrical distribution systems, often leading to challenges that require proactive management. The impacts of extreme heat on transportation systems may include:

- **Road Surface Damage:** High temperatures can cause asphalt to soften, leading to ruts, cracks, and buckling. This can compromise road safety and require costly repairs.
- **Railway Tracks:** Steel tracks can expand in extreme heat, leading to potential warping or misalignment (known as "sun kinks"), which can disrupt train services and pose safety risks.
- **Bridges and Overpasses:** Expansion joints may be affected, and excessive heat can lead to structural stress, potentially compromising safety and necessitating inspections or repairs.
- **Traffic Signals and Signage:** Heat can affect the functionality of electronic traffic signals and signage, leading to malfunctions that could result in traffic disruptions or accidents.
- **Public Transit Systems:** Buses and trains may face increased operational challenges due to overheating engines and equipment failures, which can impact schedules and reliability.

Extreme heat can impact both the electrical generation capacity and transmission. The impacts of extreme heat on electrical systems may include:

- **Increased Demand:** High temperatures typically lead to increased use of air conditioning, resulting in a surge in electricity demand that can strain the grid.
- **Transformer Overheating:** Electrical transformers can overheat during extreme heat events, leading to failures or outages.
- **Power Lines:** Extreme heat can cause power lines to sag due to thermal expansion, increasing the risk of contact with trees or other objects, which can result in outages or fires.
- **Substation Performance:** High temperatures can impair the performance of substations, potentially leading to overloads and failures.
- **Energy Efficiency:** Excessive heat can reduce the efficiency of power generation, particularly for fossil fuel and nuclear plants, leading to decreased output during peak demand times.
- **Renewable Energy Impact:** While solar panels can generate more energy in high temperatures, their efficiency can drop significantly beyond certain heat thresholds.

Mapping concerning transportation and electrical infrastructure may be found in Section 3.9: Community Lifelines and Critical Infrastructure. Information concerning the costs to repair or reconstruct transportation and electrical infrastructure may be found in Section 5.8.6.

Water and Wastewater Utilities

Water and wastewater utilities are vulnerable to extreme events due to the potential for plant damages and distribution system damages. Impacts may include:

- **Pipe bursts and leaks:** Heat can cause soil to dry and shift, leading to cracks or bursts in aging water distribution pipes. Temperature fluctuations also lead to expansion and contraction in pipes, potentially increasing the risk of failure.
- **Reduced efficiency of equipment:** Pumps, motors, and other mechanical systems in water treatment facilities may become less efficient or experience overheating during prolonged high temperatures.
- **Reduced water availability:** In open water storage or reservoirs, high temperatures lead to greater evaporation, reducing the overall available water supply. This may lead to restrictions or necessitate sourcing from alternative supplies.
- **Changes in treatment efficiency:** Biological treatment processes in wastewater treatment plants can be disrupted due to temperature, impacting the breakdown of organic matter and nutrient removal processes.

Information concerning the costs to repair or reconstruct water and wastewater infrastructure may be found in Section 5.8.6.

Medical, Education, and Response Facilities

While extreme temperatures may result in a temporary increase in patients, it is considered unlikely that any influx would overwhelm current medical capabilities. Depending on educational facility capability, extreme temperatures may necessitate the closure of the facility for the duration of the event. These closures are expected to have additional economic consequences as caregivers may be required to miss or modify work. First response facilities are expected to be unimpacted.

Mapping concerning medical, education, and response facilities may be found in Section 3.9: Community Lifelines and Critical Infrastructure. Available insurance valuation data concerning identified jurisdictional medical, education, and response facilities may be found in Section 3: Valuation Data.

Communication Systems

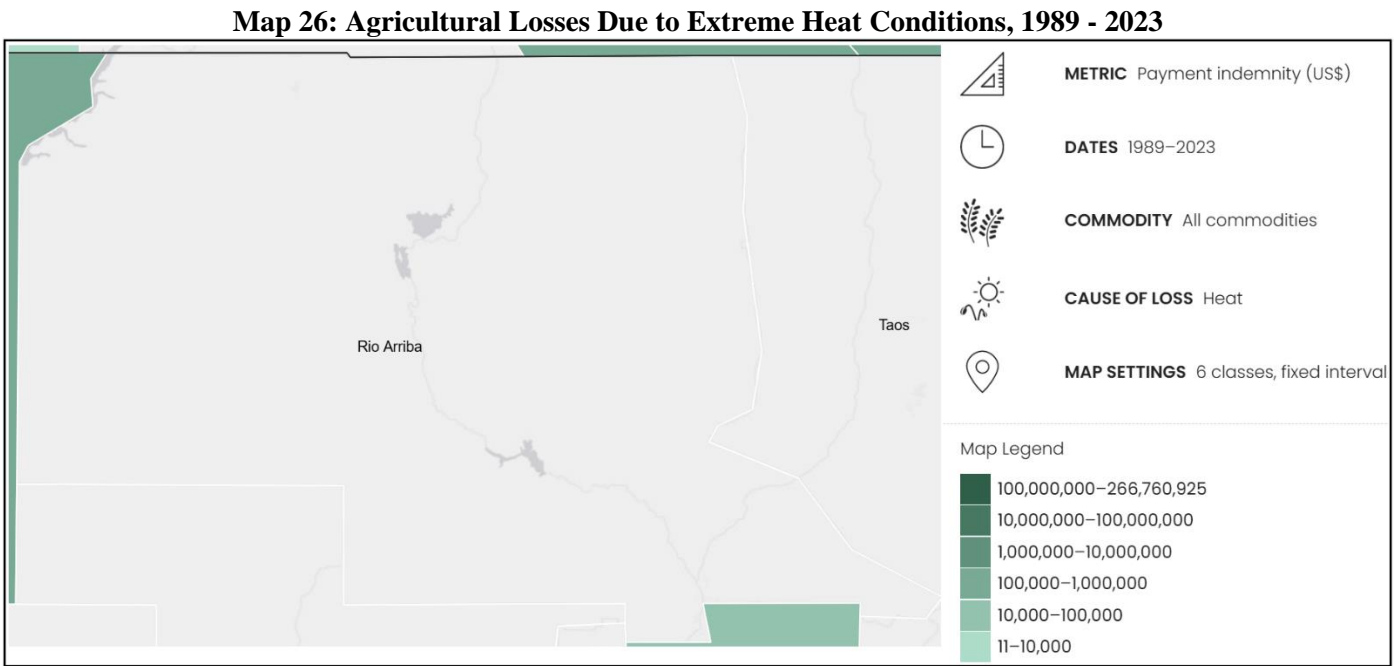
Extreme heat can disrupt this vital communications system, affecting reliability and functionality. Extreme heat can lead to power outages due to down power lines or damaging electrical substations. Communication systems that rely on electricity, such as landline phones, internet routers, and cellular towers, may cease to function during power outages.

The cost to repair communications networks can vary widely depending on the extent of the damage, the size of the network, and the specific technologies involved. Repair costs may include expenses for labor, equipment replacement or repair, materials, and any additional resources required to restore the network to full functionality. Estimated repair cost from the U.S. Department of Homeland Security Cybersecurity and Infrastructure Security Agency may be found in Section 5.8.6.

Environmental and Agricultural Impacts

Extreme heat can cause significant damage to the local environment by dehydrating vegetation and wildlife, which may result in cascading effects to the surrounding environment, such as drought, wildfires, mudslides, or landslides. Extreme temperatures may severely decrease the yield of the agricultural sector. The yield of cash crops may be reduced, livestock may be adversely impacted by extreme heat, or grazing losses may be incurred by farmers or ranchers; potentially resulting in decreased food security. In the event of significant agricultural losses caused by extreme heat or drought, some assistance may be available to impacted farms or ranches.

Extreme heat conditions can cause significant agricultural impacts. The following map from the United States Department of Agriculture details total county-wide agricultural losses, by county, due to extreme heat conditions from 1989 - 2023:



Source: United States Department of Agriculture

Jurisdictional Concerns:

As of this plan there is a deficit of community specific data to help quantify both vulnerability and historic impact. However, over the life of this plan the MPC will work to quantify the local level impacts of hazard occurrences to citizens, vulnerable populations, structures, and infrastructure to better inform both this living LHMP and future planning efforts. The following initial vulnerabilities and potential impacts have been identified on a jurisdictional level:

- **Chama:** Due to higher elevation, Chama has not had any adverse impacts from extreme heat events. Additionally, it is expected that the higher elevation will naturally mitigate future regional occurrences.
- **Espanola:** With 23.4% of citizens living in poverty, extreme heat is a concern as increase energy costs and lack of air conditioning in housing causing cooling difficulties. Additionally, extreme heat may impact tourism and impact popular community events like the Valley Fiesta and Electric Light Parade, lowering potential community revenue.
- **Ohkay Owingeh:** With 20.6% of citizens living in poverty, extreme heat is a concern as increase energy costs and lack of air conditioning in housing causing cooling difficulties. Additionally, extreme heat may impact tourism and impact popular community events like the Turtle Dance and Christmas Celebration, lowering potential community revenue.

Cascading Impacts

Cascading impacts often result when one a hazard event triggers one or more differing hazard events or loss of community lifelines. Cascading impacts associated with extreme may include:

- Drought conditions, or worsening of drought conditions
- Heat-related illnesses and mortality
- Power outages
- Water shortage and/or diminished water quality
- Crop failure and reduced yields and livestock mortality
- Wildfires

Consequence Analysis

This consequence analysis lists the potential impacts of a hazard on various elements of a community. The impact of each hazard is evaluated in terms of disruption of operations, recovery challenges, and overall wellbeing to all Rio Arriba County residents and first responder personnel. The consequence analysis supplements the hazard profile by analyzing specific impacts.

Table 63: Extreme Temperature Consequence Analysis

Subject	Potential Impacts
Impact on the Public	Extreme temperatures can have severe consequences for health, particularly for the elderly and young. Loss of electricity may impact heating or air conditioning leading to poorly tolerated indoor temperatures. Physical effects of extreme temperatures can cause major health problems and may lead to injury or death.
Impact on Responders	Without proper mitigation efforts, responders may be susceptible to temperature-related illness. Extreme temperatures may also damage instruments or equipment necessary for response activities. First responders may face dangerous road conditions leading to accidents and prolonged response times.
Continuity of Operations	Local jurisdictions maintain continuity plans which can be enacted as necessary based on the situation. This hazard may impact an agency’s ability to implement continuity operations due to power outages, causing a lack of computer/network access.
Delivery of Services	Extreme temperatures can impact efficient delivery or inability of goods or services due to potential health impacts on workers. Equipment and vehicles may be damaged, and the delivery of services may be delayed due to poor travel conditions

Table 63: Extreme Temperature Consequence Analysis

Subject	Potential Impacts
Property, Facilities, and Infrastructure	Facility integrity is at risk with regards to power cables and stations being overused and limiting operations. This could lead to limits on facility heating or cooling.
Impact on Environment	Extreme temperatures can cause significant damage to the local environment and result in habitat loss, invasive species, and changes in migration. Livestock are adversely affected by extreme temperatures and may suffer medical problems or death. A significant impact on water supply caused by elevated temperatures is the increase in frequency and impact of harmful algal blooms and occurrence of cyanobacteria.
Economic Conditions	Extreme temperatures may drain local resources. Under some conditions, some of the costs can be recouped through federal grant reimbursements.
Public Confidence in Governance	Governmental response, on all levels, requires direct actions that must be immediate and effective to maintain public confidence.

5.10.7 Future Development

Rio Arriba County, the Ohkay Owingeh, and participating jurisdictions are experiencing consistent population decline or a static population as people increasingly migrate from rural areas to urban centers. The rural-to-urban population movement has significant implications for all participating jurisdictions, including school closures and reduced economic activity. Based on population projections, this decreasing or static population trend is expected to continue in Rio Arriba County through 2050. While unlikely, should any population increase occur, potentially vulnerable populations could face disproportionate effects from a drought. Of particular concern are the increasing number of unhoused persons within the county. Additionally, it is expected that there will be an increase in the number of elderly citizens and citizens living below the poverty level in all jurisdictions as a percentage of total population. These higher percentages may increase future vulnerability due to increased demands on energy supplies, causing an increase in commodity pricing.

Closely tracking population data, but tending to lag population changes, housing data is a good indicator of changing demographics and growth. Rio Arriba County, the Ohkay Owingeh, and all participating jurisdictions have generally seen static to decreasing housing growth over the previous 20-year period. Current building codes require considerations for extreme heat, and any renovation to existing housing stock will require adherence to these provisions.

5.10.7 Mitigation Opportunities

The following table presents examples of potential actions that can be instituted for mitigating the extreme heat hazard.

Table 64: Example Extreme Heat Mitigation Actions

Category	Example Action
Planning and Regulation	Adopt and enforcing updated building code provisions to properly insulate structures.
	Support financial incentives, such as low interest loans or tax breaks, for home and business owners who retrofit their structures to mitigate heat.
	Develop an inventory of public and commercial buildings that may be used for cooling shelters.
Infrastructure	Encourage installation of green roofs, which provide shade and remove heat from the roof surface and surrounding air.
	Use cool roofing products that reflect sunlight and heat away from a building.
Natural Systems Protection	Increase tree plantings around buildings to shade parking lots and along public rights-of-way.
Education	Develop an outreach program about extreme heat risk and mitigation activities in homes, schools, and businesses.
	Educate homeowners about retrofitting homes and encouraging retrofit to mitigate heat.

5.11 Flood

5.11.1 Hazard Description

Flooding is the overflow or accumulation of water on normally dry land, often caused by heavy rainfall, snowmelt, or the failure of natural or artificial barriers. Flooding can lead to the inundation of homes, roads, farmland, and other areas, causing damage to property, disruption of daily life, and potential threats to human safety and the environment.

A floodplain is a flat or gently sloping area adjacent to a river, stream, or other water body. These areas act as a buffer during periods of heavy rainfall or snowmelt, absorbing excess water and preventing it from rushing downstream too quickly. In its common usage, a floodplain refers to areas inundated by the 100-year flood, the flood that has a 1% chance of being equaled or exceeded in any given year, and the 500-year flood, the flood that has a 0.2% chance of being equaled or exceeded in any given year. The 100-year flood is the national minimum standard to which communities regulate their floodplains through the NFIP.



5.11.2 Location and Extent

A variety of factors affect the severity of flooding within Rio Arriba County. These include topography, weather characteristics, development, and geology. Intense flooding may create extreme damage and disruption in any jurisdiction affected.

Flash Flooding

Flash flooding occurs during heavy or extended periods of rain, generally when the ground is unable to rapidly absorb the water. Most flash flooding in Rio Arriba County is caused by intense and stationary storm events and atmospheric rivers. Heavy sustained rain can create rapid flooding very quickly, and flooding can occur miles away from where the rain fell. Factors that can contribute to the severity of flash flooding include rainfall intensity, duration, drainage condition, and ground conditions (paved or unpaved). Flash floods are particularly dangerous to people and property, as six inches of moving water can knock a person down and two feet can lift a vehicle. As there is often little warning of a flash flood event, they are the cause of most flood fatalities.

Riverine Flooding

Riverine flooding refers to the overflow of water from a river or a stream onto adjacent land areas. This type of flooding occurs when the water level in a river or stream rises significantly and exceeds its banks, inundating the surrounding areas. The severity of riverine flooding can be influenced by the amount and intensity of rainfall in the watershed, the size, shape, and slope of the river or stream channel, and the presence of dams on the river system.

Urban Flooding

FEMA defines urban flooding as ‘the inundation of property in a built environment, particularly in more densely populated areas, caused by rain falling on increased amounts of impervious surfaces and overwhelming the capacity of drainage systems.’ In Rio Arriba County, urban flooding has consistently increased due to a number of factors, including the filling for development of natural wetlands and waterways, the reduction of permeable surfaces, and the aging and insufficient capacity of stormwater systems.

To establish floodplains, FEMA adopted the Base Flood Elevation (BFE), which is the computed elevation that floodwater is anticipated to rise during a flood that has a 1% chance of occurring in any given year. The BFE establishes the regulatory requirement for the elevation or floodproofing of structures, and the relationship between the BFE and a given structure’s elevation determines the flood insurance premium through the NFIP.

FEMA, through the Risk Mapping, Assessment, and Planning (Risk MAP) program, works with partners to assess and map these flood risks producing Flood Insurance Rate Maps (FIRMs). As an additional benefit, the FIRMs serve as the basis for NFIP regulations and flood insurance purchase requirements.

SFHAs are defined as the area that will be inundated by the flood event having a 1% chance of being equaled or exceeded in any given year. The 1% annual chance flood is also referred to as the base flood or 100-year flood. The FIRM depicts the SFHA, including the 1%-annual-chance flood. These areas are labeled on the map as zone, as explained in the following table:

The following table details FEMA’s FIRM flood zone classifications.

Table 65: Flood Zone Classifications

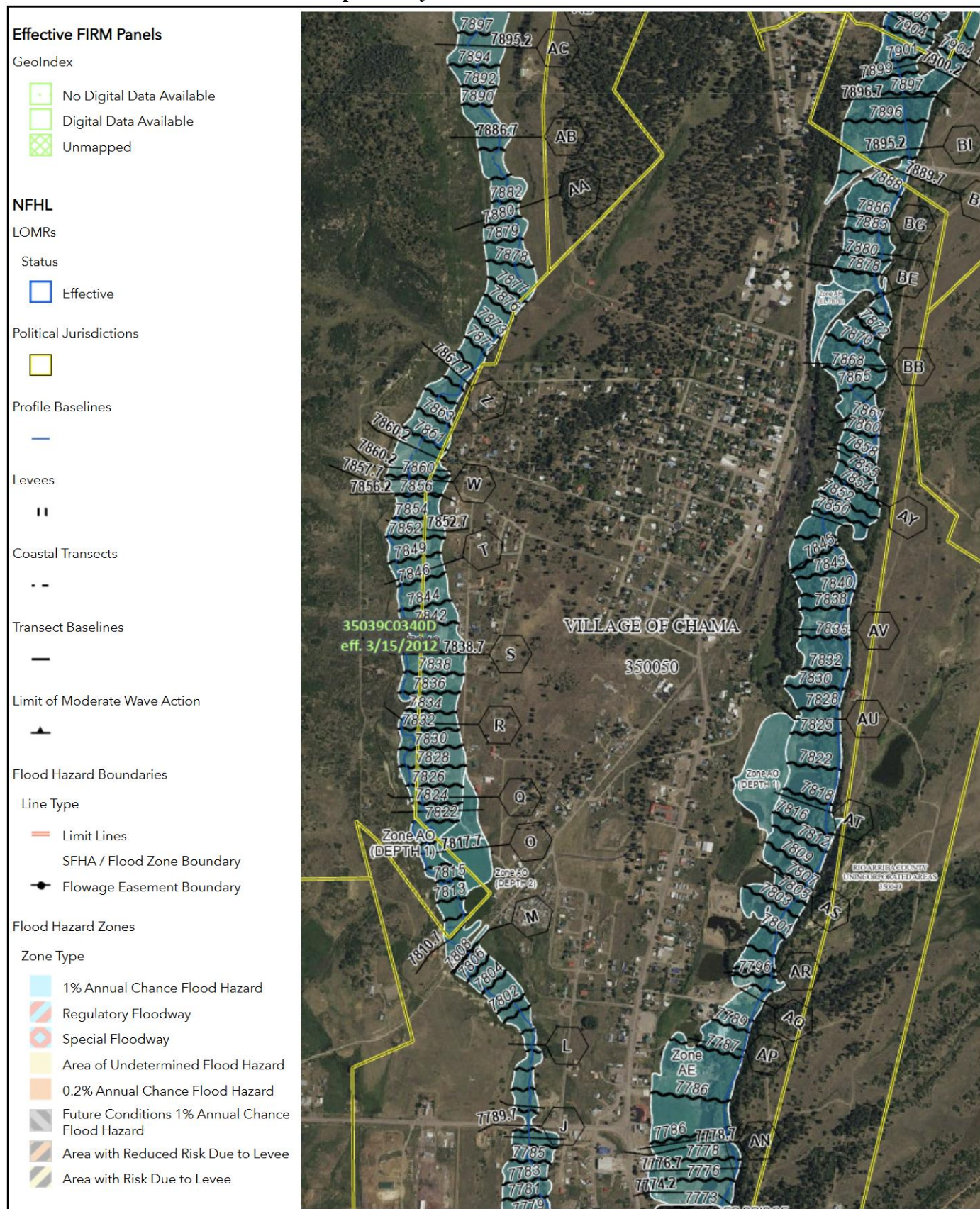
Zone	Description
A	The 1%-annual-chance or base floodplain. There are six (6) types of A Zones.
AE	The base floodplain where base flood elevations are provided.
AH	Shallow flooding base floodplain. BFEs are provided.
AO	The base floodplain with sheet flow, ponding, or shallow flooding. Base flood depths (feet above ground) are provided.
AR	The base floodplain that results from the decertification of a previously accredited flood protection system that is in the process of being restored to provide a 1%-annual-chance or greater level of flood protection.
A99	Area to be protected from base flood by levees or Federal Flood Protection Systems under construction. BFEs are not determined.
B or Shaded X	Areas between the limits of the base flood and the 0.2% annual-chance (or 500-year) flood.
C or Unshaded X	Areas of minimal flood hazard, which are the areas outside the SFHA and higher than the elevation of the 0.2% annual-chance flood

Source: FEMA

The following maps for all participating jurisdictions are FEMA FIRMettes, small, customized sections of a larger FIRM. FIRMettes are typically used to identify flood zones and assess flood risks for a specific area, and they offer:

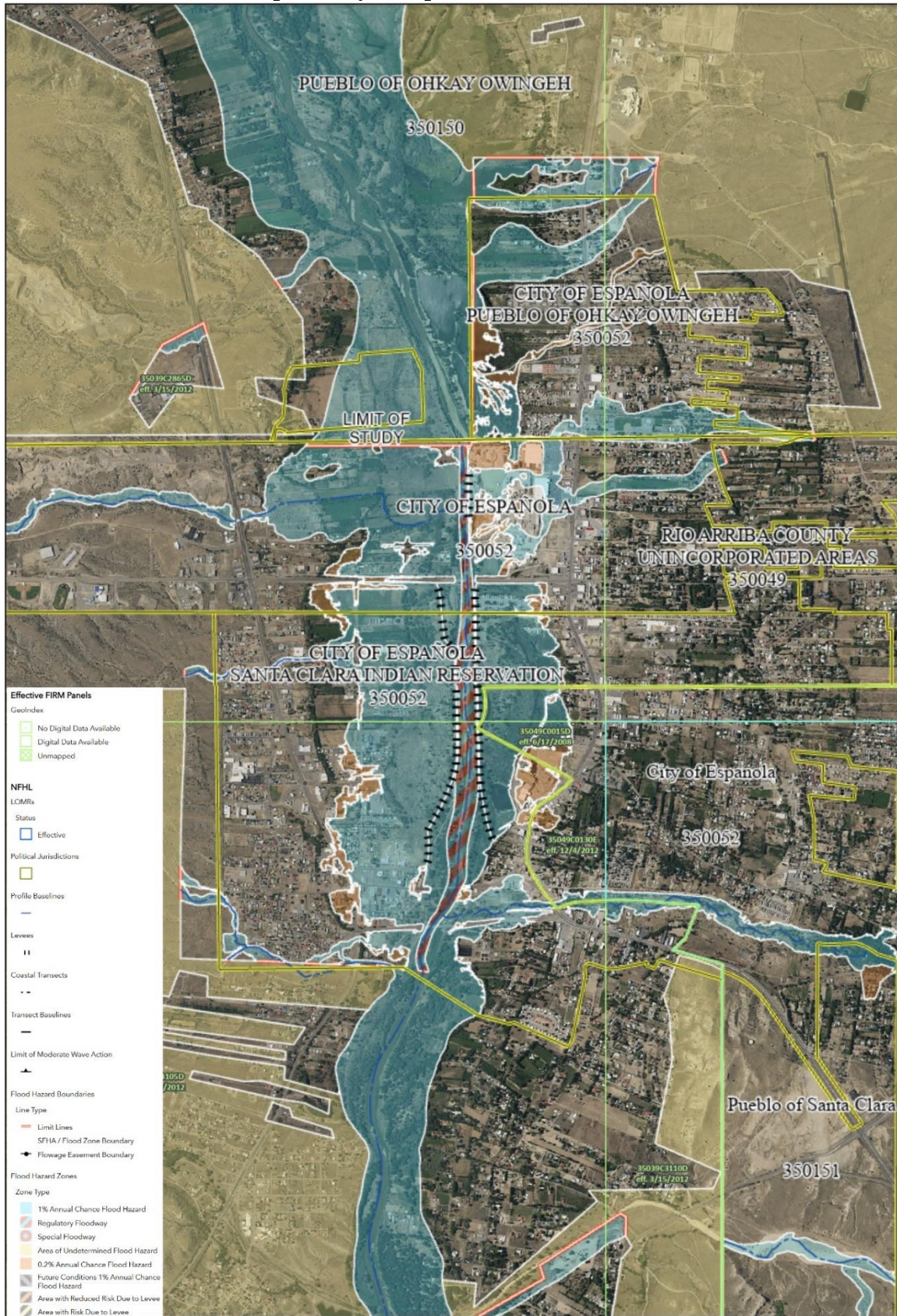
- **Customized Area:** Unlike full FIRMs, which cover large areas, a FIRMette is a focused, zoomed-in version of the map for a smaller, specific location.
- **Flood Zones:** It shows the flood zones for the selected area.
- **Elevation Information:** It may include BFEs, which help determine flood risks and insurance requirements.
- **Official Use:** FIRMettes are legally recognized and used in flood insurance determinations and community planning.

Map 27: City of Chama FEMA FIRMette



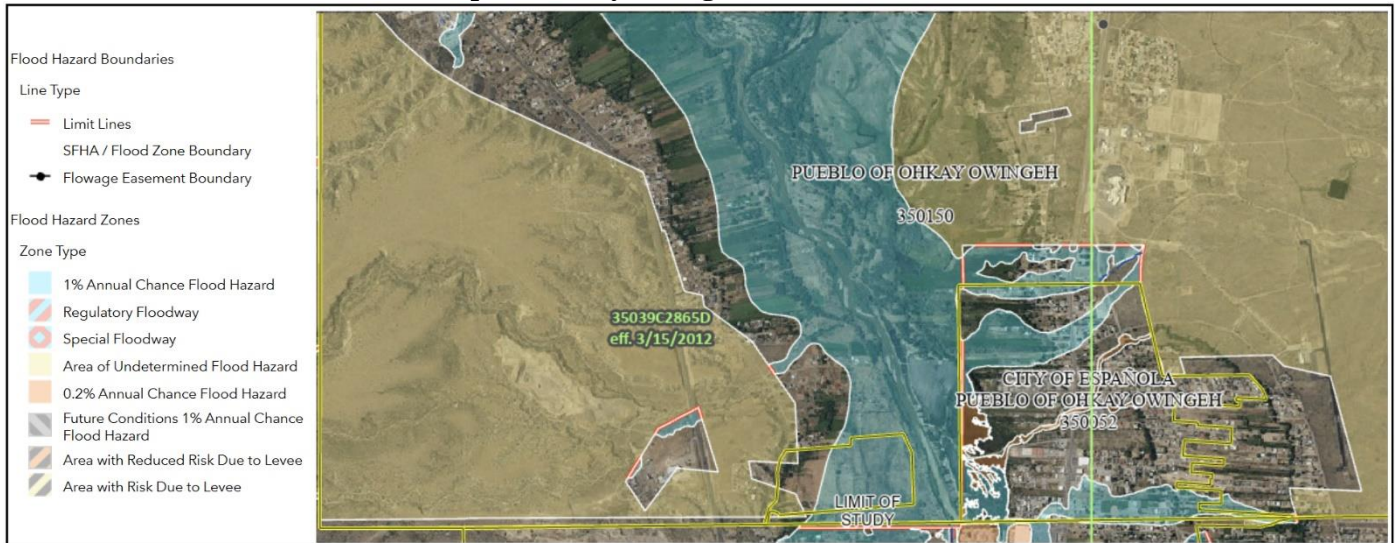
Source: FEMA

Map 28: City of Espanola FEMA FIRMette



Source: FEMA

Map 29: Ohkay Owingeh FEMA FIRMette



Source: FEMA

Rio Arriba County, New Mexico, experiences flooding risks primarily along the county's rivers and low-lying areas, especially during the monsoon season (typically July through September) and spring snowmelt.

Discussions with the MPC and a review of all available data indicated that while flooding is a concern for all participating jurisdictions, levels of concern may vary. The following provides a narrative of the level of jurisdictional concern:

- **Rio Arriba County:** Both flood and flash flood identified as a community concern as citizens, structures, and infrastructure are vulnerable. Additionally, wildfire burn scars have increased concern over flash flooding.
- **Chama** Both flood and flash flood identified as a community concern as citizens, structures, and infrastructure are vulnerable. Additionally, wildfire burn scars have increased concern over flash flooding.
- **Espanola:** Both flood and flash flood identified as a community concern as citizens, structures, and infrastructure are vulnerable. Additionally, wildfire burn scars have increased concern over flash flooding.
- **Ohkay Owingeh** Both flood and flash flood identified as a community concern as citizens, structures, and infrastructure are vulnerable. Additionally, wildfire burn scars have increased concern over flash flooding.

5.11.3 Previous Occurrences

Historical events of significant magnitude or impact can result in a Presidential Disaster Declaration. The following table details flood Disaster Declarations for Rio Arriba County:

Table 66: Rio Arriba County Presidentially Declared Disasters

Designation	Declaration Date	Incident Type	Individual Assistance	Public Assistance
DR-4197-NM	10/6/2014	Severe Storms, Flooding	\$6,276,380	-
DR-4152-NM	10/29/2013	Severe Storms, Flooding , Mudslides	\$41,827,081	-
DR-1659-NM	1/30/2006	Severe Storms, Flooding	\$34,407,619	-
DR-1301-NM	9/22/1999	Severe Storms, Flooding	\$1,968,330	-
DR-589-NM	6/23/1979	Severe Storms, Snowmelt, Flooding	-	-
DR-380-NM	5/11/1973	Severe Storms, Snowmelt, Flooding	-	-

Source: FEMA

-: Not reported

There have been no Emergency Declarations for flood for Rio Arriba County.

In New Mexico, the governor has the authority to declare a state of emergency or disaster under various state statutes and provisions. The following represent State of New Mexico flood disaster declarations from 2019-2024.

Table 67: Governor of New Mexico Rio Arriba Disaster Declarations, 2019 - 2024

Year	Executive Order	Incident Type
2022	2022-119	Flood
2021	2021-053	Flood
2019	2019-014	Flood

Source: NMDHSEM

In addition to the above, the following table presents NCEI identified flood events in Rio Arriba County from 1950 to 2024:

Table 68: Rio Arriba County NCEI Flood Events

Event Type	Number of Days with Events	Property Damage	Deaths and Injuries
Flood	2	\$305,000	0
Flash Flood	32	\$5,697,000	2

Source: NCEI

Recent events of note include:

- **June 20, 2024:** Heavy rains forced sharp rises along the Rio Chama between Medanales and Espanola. These rises were observed to peak at 7.95 feet at the Rio Chama near Chamita (CMTN5) gauge, resulting in flooding along U.S. Highway 84 between the junction of U.S. Highway 285 and Abiquiu that impacted 40 residences. This also resulted in heavy sand deposits near Medanales that resulted in the Rio Chama rerouting through adjacent agricultural fields two days later on June 22nd. Damage is an estimate given the lack of information and is an aggregate of the damage caused by the rerouting of the Rio Chama into the aforementioned agricultural fields as this was a direct result of the flash flooding that occurred on the night of the 20th into the morning of the 21st. Damages were estimated at \$500,000.
- **May 2, 2023:** Rapid snow melt led to high river rises and overbank flooding at and downstream of the junction between the Rio Ojo Caliente and Rio Chama. Ten homes had water come right up to the house structure. This flooded yards, wells and septic tanks. Damages were estimated at \$300,000.
- **August 22, 2016:** Near Hernandez two elderly residents rescued from a mobile home that was washed off its foundation and displaced over 50 feet downstream. Up to 30 homes were inundated with water and at least 10 families displaced from flood waters. U.S. Highway 285, highway 74, and county road 57 all closed to remove mud and debris. County Road 57 washed over with mudslides from nearby mesa. Damages were estimated at \$2,000,000.
- **July 7, 2015:** A flash flood wave moved down Yeso Rito arroyo in less than 30 minutes, resulting in significant damage at Ghost Ranch. At least three older structures and a ropes course were completely destroyed. One newer studio structure was seriously damaged. Trees were snapped in half and mud filled several other structures. Damage has been estimated between \$500,000 and \$1,000,000s. No injuries were reported.

It is worth noting that damage estimates indicated by the NCEI are often artificially low. This underreporting is a result of the way the events are reported to the NCEI, often by the local and/or NWS office. When reporting an event, the NWS office does not have access to the actual damage assessment resulting from that event. As such, the report often details a very low amount or zero-dollar amount for damages.

5.11.4 Probability of Future Incidents

Based on historical occurrences, Rio Arriba County will continue to experience flood events on an annual basis. The definition of each flood zone's classification is used for the purpose of calculating the yearly probability of a riverine flood. Jurisdictions with property in a 100-year floodplain can expect a 1% annual chance of flooding within the designated areas. Jurisdictions with property in a 500-year floodplain can expect a 0.2% annual chance of flooding

within the designated areas. FEMA FIRMs can be consulted to provide assistance in determining flooding probability for jurisdictions within Rio Arriba County.

The following tables, using data from the NCEI, indicate the yearly probability of a flood or flash flood event, the number of deaths or injuries, and estimated property damage for Rio Arriba County based on 75 years’ worth of reporting data:

Table 69: Rio Arriba County NCEI Flood and Flash Flood Event Probability Summary,

Event Type	Days with Event	Average Events per Year	Deaths / Injuries	Average Deaths / Injuries per Year	Property Damage	Average Property Damage per Year
Flood	2	<1	0	0	\$305,000	\$4,067
Flash Flood	32	1	2	<1	\$5,697,000	\$75,960

Source: NCEI

5.11.5 Projected Changes in Location, Intensity, Frequency, and Duration

The location, intensity, frequency, and duration of flooding are influenced by a combination of natural and human-induced factors. Continued urbanization, deforestation, and changes in land use can alter natural drainage patterns along with burn scars from wildfires. The conversion of natural landscapes to impervious surfaces, such as roads and buildings, reduces the ability of the land to absorb water, leading to increased runoff and the potential for urban flooding. Alterations to river channels, including channelization and dam construction, can influence the flow of water. Modifications may lead to changes in river behavior, affecting the potential for both upstream and downstream flooding. Poorly planned infrastructure, inadequate stormwater management, and the lack of effective drainage systems in urban areas can contribute to localized flooding. The increase in impervious surfaces reduces natural infiltration, leading to more runoff during rainfall events.

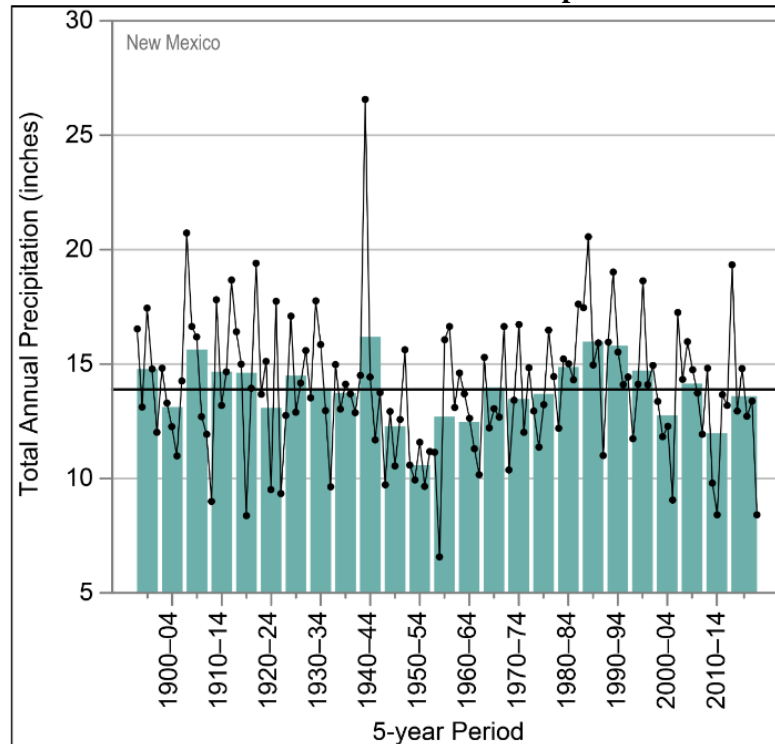
The NOAA NCEI State Climate Summary 2022 for New Mexico indicates that although projections of annual precipitation are uncertain, precipitation in spring is projected to decrease across most of the state. Precipitation is highly variable from year to year and decade to decade. The wettest multiyear periods were in the early 1940s and mid-1980s, and the wettest consecutive 5 years was the 1984–1988 interval. The driest multiyear periods were in the early 1950s and early 2010s, and the driest consecutive 5 years was the 1952–1956 interval.

Unlike many areas of the United States, New Mexico has not experienced an upward trend in the frequency of extreme precipitation events. The annual number of 1-inch extreme precipitation events has been variable since 1985, fluctuating in a similar fashion to the pronounced variations in total annual precipitation.

An important feature of New Mexico’s summer climate is the North American Monsoon, which can start in late June and extend into September. In some regions of the state, monsoon rainfall accounts for half of the annual precipitation and plays an important role in supporting the agricultural economy.

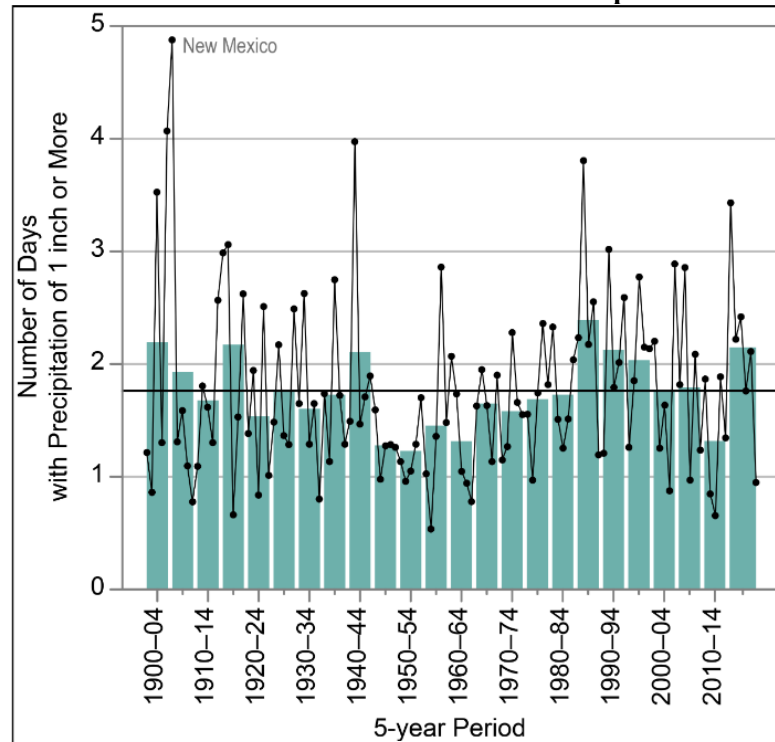
The following charts, from the NOAA NCEI State Climate Summary 2022 for New Mexico, detail precipitation patterns:

Chart 22: Observed Annual Precipitation

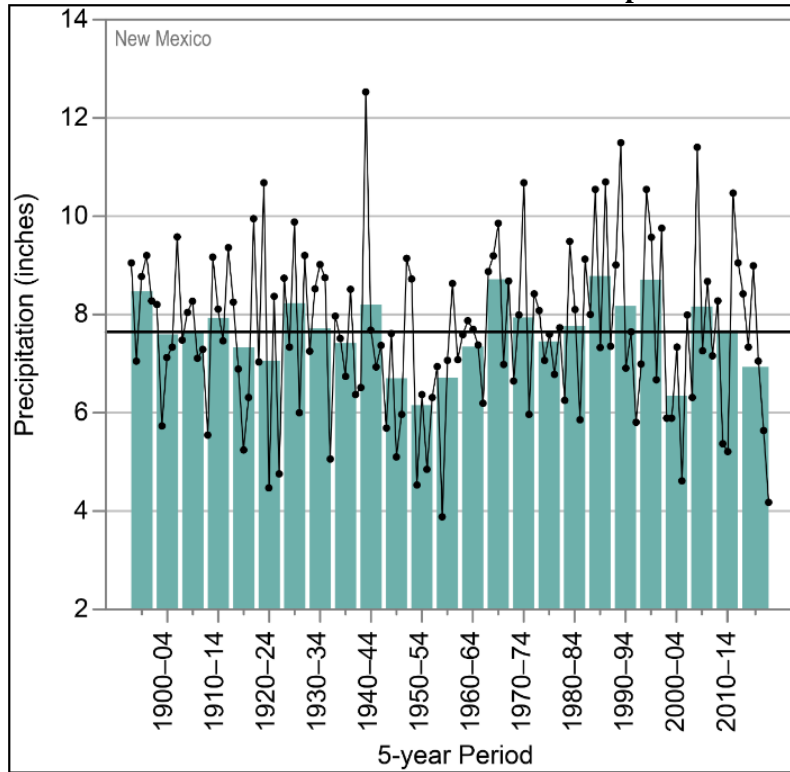


Source: NOAA NCEI Summary 2022 for New Mexico

Chart 23: Observed Number of 1" Extreme Precipitation Events



Source: NOAA NCEI Summary 2022 for New Mexico

Chart 24: Observed Monsoon Season Precipitation

Source: NOAA NCEI Summary 2022 for New Mexico

5.11.6 Vulnerability and Impact

FEMA NRI

Using the FEMA NRI, and consisting of three input components (expected annual loss, social vulnerability, and community resilience), the first table was created indicating the potential risk to Rio Arriba County and all participating jurisdictions from riverine flooding. In order to gain an understanding of vulnerability, the second table details the estimated annual loss data for Rio Arriba County and participating jurisdictions. To help understand the risk and vulnerability participating jurisdictions data from the FEMA NRI was run on a census tract level. As the NRI does not generate data for individual jurisdictions, census tract analysis is the closest analogue available to understand individual jurisdiction conditions.

Table 70: Participating Jurisdiction Riverine Flood Risk Index

Jurisdiction	Census Tract	Risk Index	National Percentile	Events per Year
Rio Arriba County	All	Relatively Low	73.6	1.2
Chama	35039000500	Relatively Moderate	83.4	1.2
Espanola	35039940700	Relatively High	94.1	1.2
Ohkay Owingeh	35039944100	Relatively High	93.8	1.2

Source: FEMA NRI

Table 71: Participating Jurisdiction Riverine Flood Expected Annual Loss

Jurisdiction	Census Tract	EAL	National Percentile	Riverine Flood EAL
Rio Arriba County	All	Relatively Low	69.5	\$946,000
Chama	35039000500	Relatively Moderate	80.6	\$61,000
Espanola	35039940700	Relatively High	91.2	\$168,000
Ohkay Owingeh	35039944100	Relatively High	91.2	\$170,000

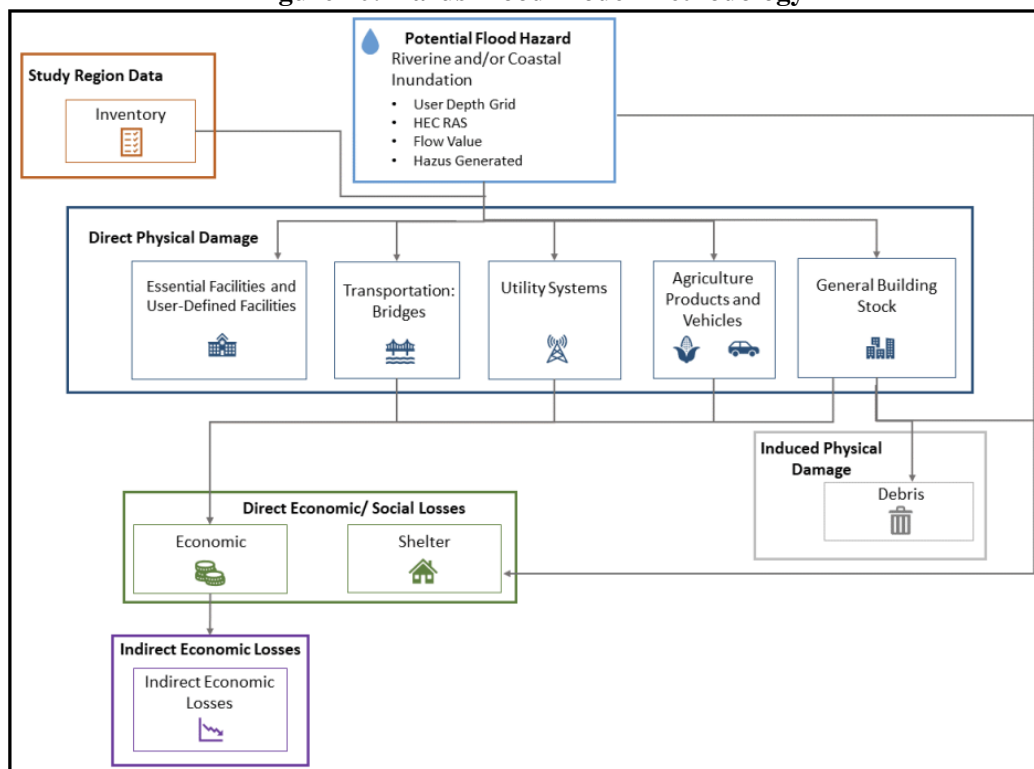
Source: FEMA NRI

FEMA Hazus

For purposes of this plan, a Hazus Flood Model was generated to provide an estimate of the consequences to a flood. The resulting loss estimate generally describes the scale and extent of damage and disruption that may result from the

modeled flood event. The Hazus software uses GIS technologies for performing analyses with inventory data and displaying losses and consequences on applicable tables and maps. The following figure provides a graphic representation of the modules that the Hazus Flood Model Methodology is comprised of, and their interrelation in deriving estimates.

Figure 10: Hazus Flood Model Methodology



Source: FEMA

The results of the Hazus analysis were utilized to estimate potential losses for flooding. The intent of this analysis was to enable Rio Arriba County to estimate where flood losses could occur and the degree of severity using a consistent methodology. The Hazus model helps quantify risk along known flood-hazard corridors as well as lesser streams and rivers that have a drainage area of ten square miles or more.

Hazus determines the displaced population based on the inundation area, not necessarily impacted buildings. As a result, there may be a population vulnerable to displacement even if the structure is not vulnerable to damage. Individuals and households will be displaced from their homes even when the home has suffered little or no damage either because they were evacuated or there was no physical access to the property because of flooded roadways.

Flood sheltering needs are based on the displaced population, not the damage level of the structure. Hazus determines the number of individuals likely to use government-provided short-term shelters through determining the number of displaced households as a result of the flooding. To determine how many of those households and the corresponding number of individuals will seek shelter in government-provided shelters, the number is modified by factors accounting for income and age. Displaced people using shelters will most likely be individuals with lower incomes and those who do not have family or friends within the immediate area. Since the income and age factors are taken into account, the proportion of displaced population and those seeking shelter will vary from county to county.

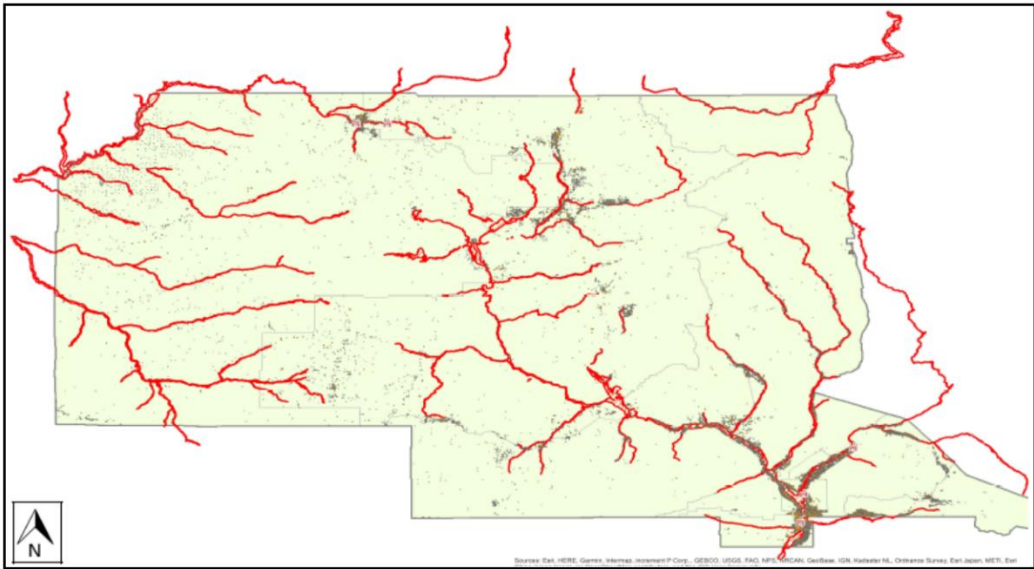
Additionally, Hazus takes into account flood depth when modeling damage (based on FEMA's depth-damage functions). Generated reports capture damage by occupancy class (in terms of square footage impacted) by damage percent classes. Occupancy classes include agriculture, commercial, education, government, industrial, religion, and residential. Damage percentage classes are grouped by 10% increments up to 50%. Buildings that sustain more than 50% damage are considered to be substantially damaged.

The Hazus analysis also provides an estimate of the repair costs for impacted buildings as well as the associated loss of building contents and business inventory. Building damage can also cause additional losses to a community by restricting a building’s ability to function properly. Income loss data accounts for losses such as business interruption and rental income losses as well as the resources associated with damage repair and job and housing losses. These losses are calculated by Hazus using a methodology based on the building damage estimates.

The damaged building counts generated by Hazus are susceptible to rounding errors and are likely the weakest output of the model due to the use of census blocks for analysis. Generated reports include this disclaimer: “Unlike the earthquake and hurricane models, the flood model performs its analysis at the census block level. This means that the analysis starts with a small number of buildings within each census block and applies a series of distributions necessary for analyzing the potential damage. The application of these distributions and the small number of buildings make the flood model more sensitive to rounding errors that introduces uncertainty into the building count results.” Additionally, losses are not calculated for individual buildings, but instead are based on the performances of entire classes of buildings obtained from the general building stock data. In the flood model, the number of grid cells (pixels) at each flood depth value is divided by the total number of grid cells in the census block. The result is used to weigh the flood depths applied to each specific occupancy type in the general building stock. First floor heights are then applied to determine the damage depths to analyze damages and losses.

The following map illustrates the extent of the Hazus scenario:

Map 30: Hazus Flood Scenario Extent



The following table provides the HAZUS results for damaged buildings, destroyed buildings, and total economic loss for Rio Arriba County:

Table 72: Rio Arriba County Hazus Flood Scenario Economic Impacts

Damaged Buildings	Destroyed Buildings	Total Economic Loss	Debris Generation (tons)
386	89	\$608,350,000	10,039

Source: FEMA Hazus

The following table provides the HAZUS results for displaced households, damaged buildings, destroyed buildings, and total economic loss for Rio Arriba County:

Table 73: Rio Arriba County Hazus Flood Scenario Displaced Population

Displaced Households	Persons Seeking Shelter	Displaced Population
955	554	2,864

Source: FEMA Hazus

The Hazus model indicated that the following number of critical facilities are estimated to be damaged or suffer loss of use from the flood scenario.

Table 74: Rio Arriba Hazus Flood Scenario Number of Critical Facilities Damaged or Impacted

Emergency Operations Centers	Fire Stations	Hospitals	Police Stations	Schools
0	0	0	0	4

Source: FEMA Hazus

Population

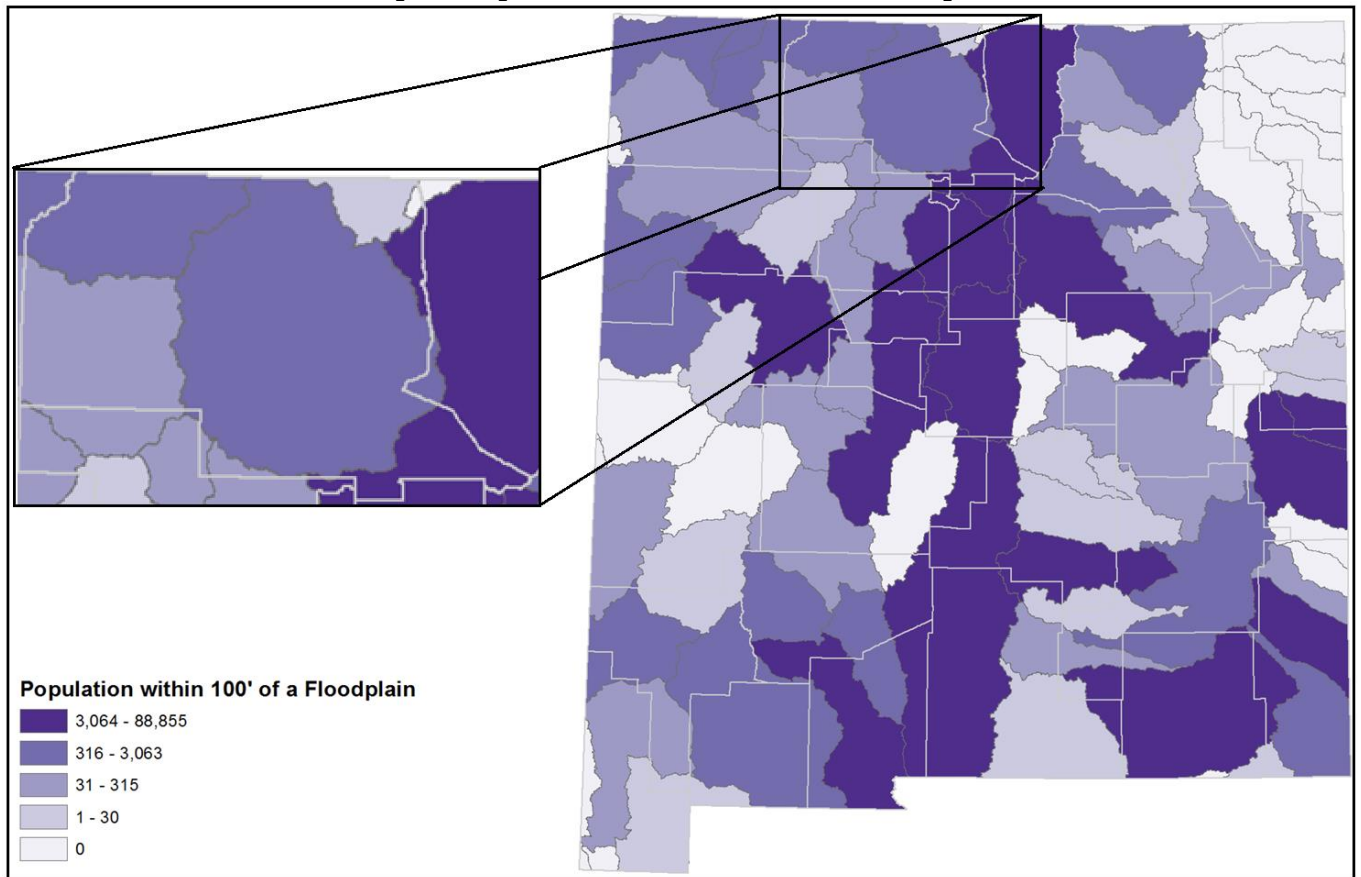
A primary concern with this hazard is human health safety issues, as extreme heat can be a direct cause of death. Specific at-risk groups include outdoor workers, farmers, young children, and senior citizens. Impacts on human health can include:

- **Loss of Life:** Flooding is one of the leading causes of weather-related fatalities worldwide. Fast-rising floodwaters can lead to drowning and other water-related accidents, resulting in the tragic loss of lives.
- **Injuries:** Floods can cause injuries due to waterborne diseases, contaminated floodwaters, debris, and accidents during evacuation or rescue operations.
- **Displacement:** Many people may be forced to evacuate their homes during floods and will require emergency shelter or temporary housing. Prolonged displacement can be emotionally and economically challenging.
- **Health Risks:** Floodwaters often contain pollutants, sewage, and hazardous materials. Exposure to contaminated water can lead to waterborne diseases, infections, and other health risks.
- **Mental Health Effects:** Survivors of floods may experience a range of emotional and psychological challenges, including post-traumatic stress disorder, anxiety, depression, and grief.
- **Food and Water Shortages:** Floods can contaminate water supplies and disrupt the distribution of food. This can lead to shortages of clean drinking water and essential food items.
- **Impact on Vulnerable Populations:** Vulnerable populations, including the elderly, children, people with disabilities, and those living in poverty, are often disproportionately affected by floods due to limited resources and mobility challenges.

Especially critical is timely evacuation orders, and adherence to those orders. If evacuation is not heeded, or flood waters rise quickly enough, citizens could drown or become trapped for extended periods of time with no access to services or medical care. Of special concern are long-term care and medical facilities where it can take longer to evacuate, or evacuation may be impossible. Additionally, lower income citizens may not have the means to relocate, whether it be lack of transportation or lack of resources to afford temporary shelter.

The following map, from the New Mexico Multi-Hazard Risk Portfolio And FEMA RISKmap, provides an estimated population exposed to flooding for all participating jurisdictions:

Map 31: Population Within 100 Feet of a Floodplain



Source: New Mexico Multi-Hazard Risk Portfolio And FEMA RISKmap

Buildings and Structures

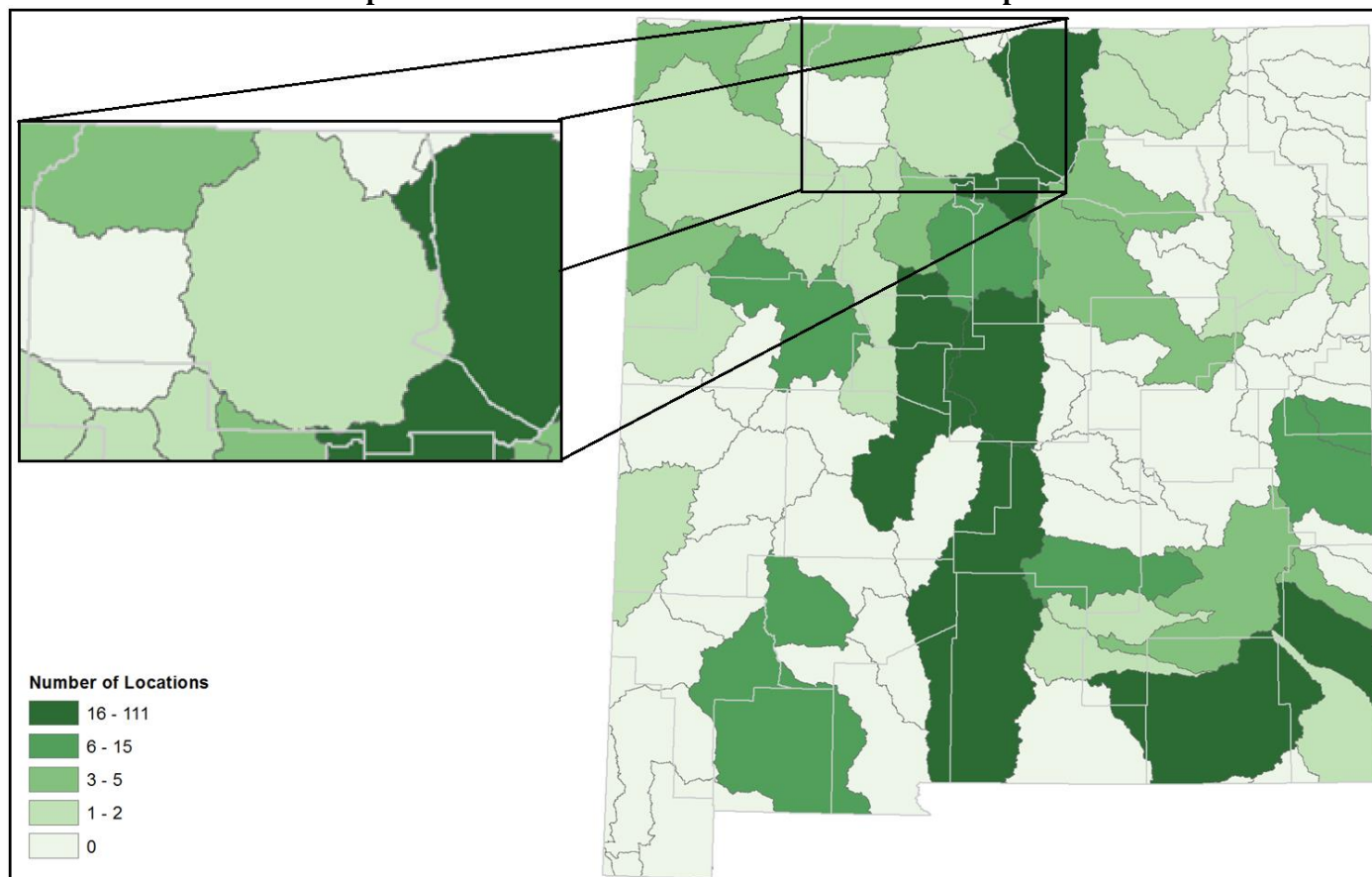
Floods can have significant and often costly impacts on buildings and structures. These impacts can disrupt essential services, damage infrastructure, and pose safety risks. The extent of the impact depends on factors such as the severity of the flood, the preparedness of the infrastructure, and the effectiveness of flood management measures. Here are some of the common impacts of floods on facilities and critical infrastructure:

- **Foundation Damage:** Floodwaters can erode the soil supporting the foundation, leading to settling, cracks, or even collapse. Scouring and soil liquefaction during floods may undermine the stability of buildings, especially those on weak soils.
- **Wall and Floor Damage:** High water pressure, especially from fast-moving floods, can crack walls, warp floors, and cause floors to collapse.
- **Building Collapse:** If the foundation is significantly compromised, or if water levels rise too quickly, entire buildings may collapse, especially older structures or those not designed for flood resilience.
- **Water Seepage:** Even shallow flooding can cause water to seep into the building's structure, leading to rotting of wooden frames, mold growth, and damage to insulation and electrical systems.
- **Interior Damage:** Drywall, carpets, furniture, and appliances may all be ruined by prolonged exposure to floodwater, which often carries contaminants like sewage and chemicals.
- **Electrical Short Circuits and Fire:** Floodwaters can cause electrical systems to short-circuit, posing risks of fire or electrocution.
- **HVAC and Plumbing System Damage:** Heating, ventilation, and air conditioning systems, as well as plumbing systems, are vulnerable to water damage, potentially leading to the loss of potable water and proper sanitation in the building.
- **Mold:** After the floodwaters recede, mold and mildew can quickly develop in damp environments. This can lead to respiratory problems for occupants and further deterioration of the building materials.

- **Wood Rot and Corrosion:** Prolonged exposure to water can cause wooden materials to rot and metal components, like steel reinforcements, to corrode, weakening the building over time.

The following map, from the New Mexico Multi-Hazard Risk Portfolio And FEMA RISKmap, provides an estimated number of essential facilities exposed to flooding for all participating jurisdictions:

Map 32: Essential Facilities Within 100 Feet of a Floodplain



Source: New Mexico Multi-Hazard Risk Portfolio And FEMA RISKmap

Transportation and Electrical Infrastructure

Flooding can have numerous impacts on both transportation and electrical distribution systems. The impacts of flooding on transportation systems may include:

- **Scour and Erosion:** Floodwaters can wash away the supporting soil around and beneath roads, a process known as scour. This can lead to the collapse of the roadbed and destabilization of bridges and overpasses.
- **Undermining of Pavement:** Prolonged exposure to floodwaters can weaken the pavement structure, leading to cracks, potholes, and eventual failure of the roadway. Roads not designed for water drainage are especially susceptible to being washed out.
- **Potholes and Cracks:** Water penetrates cracks in the pavement, weakening the sublayers. Once the floodwaters recede and the weight of vehicles passes over, potholes can quickly form, creating hazards for drivers.
- **Surface Damage:** Asphalt roads, in particular, can become brittle after repeated water exposure, resulting in chunks of road surface breaking off.
- **Bridge Collapse:** Flooding can damage the support structures of bridges, particularly if water levels rise to exert pressure on the bridge's piers. Debris carried by floodwaters can accumulate around bridge structures, further stressing them.
- **Blocked or Collapsed Culverts:** Culverts, which allow water to pass beneath roads, can become blocked by flood debris, leading to water pooling on roads or forcing water to erode the roadbed around the culvert.

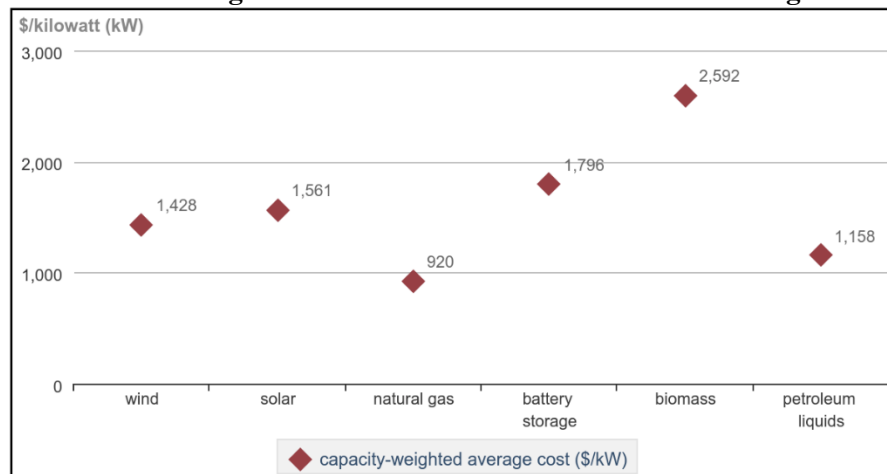
- **Road Inundation:** Flash floods or slow-rising waters can make roads impassable, either because of deep standing water or swift currents.
- **Landslides:** In hilly or mountainous regions, flooding increases the risk of mudslides and landslides, which can bury roads and highways under tons of debris, blocking transportation routes and requiring significant cleanup.
- **Debris Flows:** Heavy rains can wash debris, rocks, and soil onto roads, making them impassable and causing further damage to the road surface.
- **Foundation Weakening:** Repeated flooding over time can weaken the structural foundation of roads, even if the damage isn't immediately apparent. This could lead to long-term deterioration of highways and bridges, requiring expensive repairs or reconstruction.

Flooding can impact both the electrical generation capacity and transmission. The impacts of extreme heat on electrical systems may include:

- **Flooding of Substations:** Electrical substations, particularly those located in low-lying or flood-prone areas, are vulnerable to flooding. Water ingress into substations can cause short circuits and failures of critical equipment such as transformers, circuit breakers, and switchgear. If a substation is taken offline, large areas could lose power.
- **Transformer Damage:** Floodwaters can compromise oil-insulated transformers by causing leaks or mixing with the oil leading to transformer failures and extended outages.
- **Downed Power Lines:** Strong flood currents, debris, or trees falling due to saturated soil can bring down power lines, leading to localized or widespread outages.
- **Foundation Erosion:** Transmission towers and utility poles are susceptible to soil erosion during floods, which can undermine their foundations and cause structural instability or collapse.
- **Corrosion of Equipment:** Prolonged exposure to floodwaters can lead to the corrosion of metal components in transmission and distribution systems, shortening the lifespan of equipment and increasing the risk of failure.
- **Water Infiltration:** Electrical equipment, including power meters, transformers, and underground cabling, can experience short circuits if water infiltrates, leading to power outages and potential safety hazards. For example, underground electrical vaults can flood, damaging cables and transformers, and posing fire and electrocution risks.

The construction costs for a hydroelectric plant can vary significantly depending on the size, type of plant, location, and complexity of the project. Data concerning the construction costs of electrical generating plants from the U.S. Energy Information Administration indicates the following average per kW cost, by generating plant type, for new construction:

Chart 25: Average Construction Cost of Electrical Generating Plants



Source: U.S. Energy Information Administration

Water and Wastewater Facilities

Water and wastewater utilities are vulnerable to flood events due to the potential for plant damages and distribution system damages. Impacts may include:

- **Damage to Water Treatment Plants:** Floodwaters can inundate water treatment plants, damaging pumps, electrical systems, and filtration equipment. This can prevent the proper treatment of drinking water, leading to unsafe water supplies.
- **Damage to Wastewater Treatment Plants:** Wastewater facilities may experience flooding that overwhelms the capacity to treat sewage, leading to raw or partially treated sewage being discharged into nearby water bodies, contaminating them.
- **Damage to Pumping Stations:** Flooded pumping stations can fail, leading to service interruptions in both water distribution and sewage removal. These failures may require costly repairs or replacements.
- **Drinking Water Contamination:** Floodwaters often carry contaminants such as chemicals, sewage, and industrial waste. If this water infiltrates drinking water systems through broken pipes or overwhelmed treatment systems, it can lead to widespread contamination.
- **Backflow of Sewage:** In severe flooding, sewage can backflow into homes, streets, and businesses through overwhelmed or broken sewer systems. This not only poses health risks but also results in costly cleanup.
- **Increased Flow in Sewer Systems:** During floods, combined sewer systems (which handle both stormwater and sewage) can be overwhelmed by the sheer volume of water. This leads to combined sewer overflows where untreated sewage is discharged directly into rivers, harming the environment and public health.
- **Overwhelmed Stormwater Systems:** Flooding can overwhelm stormwater management systems, causing backups that flood streets and neighborhoods. In older urban areas, this may also overwhelm the sewer system, as stormwater and sewage often share the same infrastructure.

Information concerning the costs to repair or reconstruct water and wastewater infrastructure may be found in Section 5.8.6.

Medical, Education, and Response Facilities

A FEMA Hazus and GIS analysis of medical, educational, and response facilities within the 100-year floodplain indicates the following:

Table 75: Participating Jurisdiction Medical, Fire, and Response Facilities in 100-Year Floodplain

Jurisdiction	Medical Facilities	Educational Facilities	Fire Facilities	Police Facilities
Rio Arriba County	0	4	0	0
Chama	0	0	0	0
Espanola	0	4	0	0
Ohkay Owingeh	0	0	0	0

Source: FEMA Hazus

While flooding may result in a temporary increase in patients, it is considered unlikely that any influx would overwhelm current medical capabilities.

Depending on the educational facility capability and location, flooding may necessitate the closure of the facility for the duration of the event due to damages or lack of access. These closures are expected to have additional economic consequences as caregivers may be required to miss or modify work.

Depending on response facility capability and location, flooding may necessitate the closure of the facility for the duration of the event due to damage or lack of access. These closures are expected to have additional consequences through the disruption of emergency response capabilities.

Mapping concerning medical, education, and response facilities may be found in Section 3.9: Community Lifelines and Critical Infrastructure.

Communication Systems

No comprehensive mapping of communications systems was available for review to compare against known flood hazard areas. However, it is assumed that communications lines and towers are in known hazard areas. Flooding can disrupt this vital communications system, affecting reliability and functionality. Some of the key vulnerabilities include:

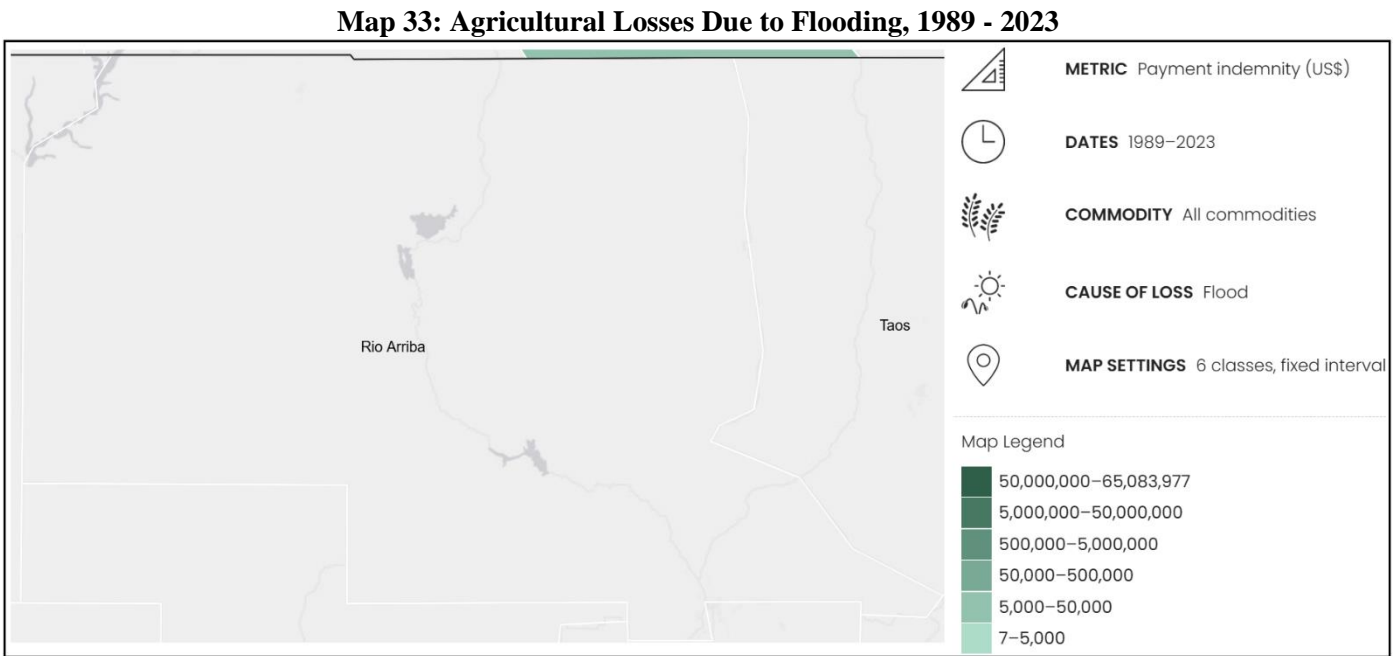
- **Physical Damage to Infrastructure:** Flood waters can cause physical damage to communication infrastructure such as cell towers, antennas, satellite dishes, and power lines. This damage can result in interruptions or complete failure of communication services.
- **Power Outages:** Flood waters can lead to power outages by knocking down power lines or damaging electrical substations. Communication systems that rely on electricity, such as landline phones, internet routers, and cellular towers, may cease to function during power outages.
- **Structural Instability:** Flood waters can cause structural instability in communication towers and buildings housing communication equipment. If these structures are not properly reinforced, they may collapse or sustain damage, disrupting communication services.

The cost to repair communications networks can vary widely depending on the extent of the damage, the size of the network, and the specific technologies involved. Repair costs may include expenses for labor, equipment replacement or repair, materials, and any additional resources required to restore the network to full functionality. Estimated repair cost from the U.S. Department of Homeland Security Cybersecurity and Infrastructure Security Agency may be found in Section 5.8.6.

Environmental and Agricultural Impacts

Environmental impacts from flooding can be far reaching. Of particular concern is flood related runoff, potentially carrying sewage, pesticides, or hazardous chemicals, which can cause long lasting environmental harm. Expected negative outcomes could include changes in habitat, a decrease of available food, and an increase in the spread of vector-associated disease due to standing water.

Flooding can cause significant agricultural impacts. The following map from the United States Department of Agriculture details total county-wide agricultural losses, by county, due to flooding from 1989 - 2023:



Source: United States Department of Agriculture

Jurisdictional Concerns:

As of this plan there is a deficit of community specific data to help quantify both vulnerability and historic impact. However, over the life of this plan the MPC will work to quantify the local level impacts of hazard occurrences to

citizens, vulnerable populations, structures, and infrastructure to better inform both this living LHMP and future planning efforts. The following initial vulnerabilities and potential impacts have been identified on a jurisdictional level:

- **Rio Chama River Basin:** The Rio Chama, a major tributary of the Rio Grande, is prone to flooding, especially in areas near Abiquiu, Española, Ohkay Owingeh, and along its length through the county. Heavy rains or snowmelt can cause the river to swell, impacting nearby communities, roads, and agricultural lands.
- **Rio Grande Valley:** In southern Rio Arriba County, the Rio Grande poses a flood risk, particularly near Española and Velarde, where the valley is broader and prone to flooding during intense rainstorms. The San Juan Pueblo (Ohkay Owingeh), located along the Rio Grande, this area may also experience flooding, which can impact cultural and residential sites.
- **Santa Cruz River:** The Santa Cruz River, a tributary of the Rio Grande, flows through communities like Santa Cruz, Española and Ohkay Owingeh. It can overflow during heavy rains, affecting nearby properties and roadways.
- **Rio Ojo Caliente:** Communities along the Rio Ojo Caliente, such as La Madera and Ojo Caliente, may experience flood risks, especially where the river's path winds through narrow valleys. Flash flooding can occur here after heavy rains, impacting local infrastructure and homes.
- **Arroyos and Tributaries:** Many dry arroyos, such as Canada del Ojo and Arroyo Seco, run through Rio Arriba County and can quickly become dangerous during rainstorms, especially in mountainous and foothill areas.

Cascading Impacts

Cascading impacts often result when one a hazard event triggers one or more differing hazard events or loss of community lifelines. Cascading impacts associated with extreme may include:

- Infrastructure and utility failure
- Economic disruption
- Flood related illnesses and mortality
- Power outages
- Population displacement
- Environmental degradation

Consequence Analysis

This consequence analysis lists the potential impacts of a hazard on various elements of a community. The impact of each hazard is evaluated in terms of disruption of operations, recovery challenges, and overall wellbeing to all Rio Arriba County residents and first responder personnel. The consequence analysis supplements the hazard profile by analyzing specific impacts.

Table 76: Flood Consequence Analysis

Subject	Potential Impacts
Impact on the Public	Significant flooding events can lead to the damage and loss of homes, property, and businesses. Flash flooding and excessive rainfall may lead to dangerous conditions on roadways. Closures of medical facilities is a major public health concern if flooding damages those facilities. Water sources may become contaminated, and water or sewer systems may be disrupted. Vector-associated disease may increase.
Impact on Responders	Fire, police, and emergency responders may be called on to evacuate people from impacted areas, as well as close roads, attend to the injured, and direct traffic away from the flooded area and roads. First responders may face challenges with transportation and access to a location. Flash floods and mudslides due to heavy rainfall can also injure first responders, as well as delay response operations.
Continuity of Operations	Local jurisdictions maintain continuity plans which can be enacted as necessary based on the situation. Floods which create power outages, debris damage, and road closures are not uncommon. This threat may impact an agency's ability to maintain continuity of

Table 76: Flood Consequence Analysis

Subject	Potential Impacts
	operations based on the incidents impact on power, communications and the potential to damage equipment and records within primary and alternate facilities.
Delivery of Services	Flooding can cause road and bridge closures, as well as disrupt transit services, impacting the ability to deliver goods and services. Exposure to flood waters may also damage or destroy physical goods such as food, clothing, and hygiene products.
Property, Facilities, and Infrastructure	Flooding can cause significant property destruction. Floods can disrupt normal daily activities due to the potential impact on schools, hospitals, and other public infrastructure. Transportation infrastructure can be damaged which could impact the freedom of movement or provision of utilities. Water sources can become contaminated. Water and sewer systems may be disrupted. Solid-waste collection and disposal may also be impacted, causing dangerous public health risks.
Impact on Environment	Rising waters from flooding impact the environment by spreading pollution, inundating water and wastewater treatment plants, and disrupting wildlife. Standing water following a flood event can facilitate the spread of vector-associated diseases.
Economic Conditions	Significant and repeated flooding can lower property value throughout the state, which can have a deleterious effect on the tax base. Furthermore, flooding drains response resources, which can be costly during a large flooding event for disaster reimbursement
Public Confidence in Governance	Ineffective flooding response can decrease the public's confidence in the ability to respond and govern. Multi-level government response requires direct actions that must be immediate and effective to maintain public confidence. Efficiency in response and recovery operations is critical in keeping public confidence high.

5.11.7 Future Development

Rio Arriba County, the Ohkay Owingeh, and participating jurisdictions are experiencing consistent population decline or a static population as people increasingly migrate from rural areas to urban centers. The rural-to-urban population movement has significant implications for all participating jurisdictions, including school closures and reduced economic activity. Based on population projections, this decreasing or static population trend is expected to continue in Rio Arriba County through 2050. While unlikely, should any population increase occur, potentially vulnerable populations could face disproportionate effects from a flood event

Closely tracking population data, but tending to lag population changes, housing data is a good indicator of changing demographics and growth. Rio Arriba County, the Ohkay Owingeh, and all participating jurisdictions have generally seen static to decreasing housing growth over the previous 20-year period. Current building codes, and where applicable flood ordinances, require considerations for building and renovating in flood prone areas.

Flooding will continue to be considered for any future jurisdictional development or renovation, including potentially relocating facilities prone to flooding. In addition, jurisdictions will help areas adapt by encouraging the usage of flood smart designs during infrastructure renovation and construction.

5.11.8 National Flood Insurance Program Communities

The NFIP is a federal program, managed by FEMA, which exists to provide flood insurance for property owners in participating communities, to improve floodplain management practices, and to develop maps of flood hazard areas. The following table presents NFIP participating communities.

Table 77: Rio Arriba County NFIP Communities

Community	Initial Flood Hazard Boundary Map Identified	Initial Flood Insurance Rate Map Identified	Current Effective Map Date
Rio Arriba County	10/25/1974	1/5/1989	3/15/2012
Chama	8/16/1974	8/5/1997	3/15/2012
Espanola	6/21/1974	2/19/1986	12/4/2012

Source: FEMA NFIP

The Community Rating System (CRS) is a voluntary program within the NFIP that provides insurance premium discounts to policy holders based on a jurisdiction’s adherence to floodplain management activities that exceed minimum NFIP requirements. As of this plan, no participating jurisdictions within Rio Arriba County are CRS participants.

5.11.9 FEMA Flood Policy and Loss Data

Rio Arriba County flood policy information was sourced from FEMA’s Flood Insurance Data and Analytics. The number of flood insurance policies in effect may not include all structures at risk of flooding, and it is likely that some properties are under-insured. The flood insurance purchase requirement is for flood insurance in the amount of federally backed mortgages, not the entire value of the structure. Additionally, contents coverage is not required. The following table shows the details of NFIP policy statistics for Rio Arriba County:

Table 78: Rio Arriba County NFIP Coverage

Jurisdiction	Number of Policies in Force	Total Coverage
Rio Arriba County	72	\$17,170,200
Chama	3	\$95,800
Espanola	47	\$11,756,900

Source: FEMA Flood Insurance Data and Analytics

The following table details NFIP coverage changes from 2023 to 2024 for Rio Arriba County:

Table 79: Rio Arriba County NFIP Coverage Changes

Jurisdiction	Policies in Force 2023	Policies in Force 2024	Change in Policies, 2023 - 2024	Total Coverage 2023	Total Coverage 2024	Change in Coverage, 2019 - 2024
Rio Arriba County	134	122	-12	\$32,708,400	\$49,029,300	-\$29,022,900

Source: FEMA

5.11.10 Repetitive Loss Structures

The NFIP defines a Repetitive Loss property as:

- Any insurable building for which two or more claims of more than \$1,000 were paid by the NFIP within any rolling 10-year period, since 1978. At least two of the claims must be more than 10 days apart.

The definition of severe repetitive loss as applied to this program was established in section 1361A of the National Flood Insurance Act, as amended, 42 U.S.C. 4102a. A Severe Repetitive Loss property is defined as a residential property that is covered under an NFIP flood insurance policy and:

- That has at least four NFIP claim payments (including building and contents) over \$5,000 each, and the cumulative amount of such claims payments exceeds \$20,000; or
- For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.

For both of the above, at least two of the referenced claims must have occurred within any ten-year period and must be greater than ten days apart.

No Repetitive Loss or Severe Repetitive Loss properties were noted in Rio Arriba County.

5.11.11 Mitigation Opportunities

The following table presents examples of potential actions that can be instituted for mitigating the flood hazard.

Table 80: Example Flood Mitigation Actions

Category	Example Action
Planning and Regulation	Determine and enforcing acceptable land uses to alleviate the risk of damage by limiting exposure in flood hazard areas. Floodplain and coastal zone management can be included in comprehensive planning.
	Develop a floodplain management plan and updating it regularly.
	Establish a green infrastructure program to link, manage, and expand existing parks, preserves, greenways, etc.
	Prohibit or limiting floodplain development through regulatory and/or incentive-based measures.
	Limit the percentage of allowable impervious surface within developed parcels.
	Encourage the use of porous pavement, vegetative buffers, and islands in large parking areas.
	Complete a stormwater drainage study for known problem areas.
	Develop engineering guidelines for drainage from new development.
	Design a “natural runoff” or “zero discharge” policy for stormwater in subdivision design.
	Regularly calculate and document the amount of flood-prone property preserved as open space.
	Conduct NFIP community workshops to provide information and incentives for property owners to acquire flood insurance.
	Revise the floodplain ordinance to incorporate cumulative substantial damage requirements.
Infrastructure	Install, re-route, or increase the capacity of a storm drainage system.
	Increase capacity of stormwater detention and retention basins.
	Require developers to construct on-site retention basins for excessive stormwater and as a firefighting water source.
	Routinely clean debris from support bracing underneath low-lying bridges.
	Elevate structures so that the lowest floor, including the basement, is raised above the base flood elevation.
	Raise utilities or other mechanical devices above expected flood levels.
	Elevate roads and bridges above the base flood elevation to maintain dry access.
	Floodproof water and wastewater treatment facilities located in flood hazard areas.
	Require that all critical facilities including emergency operations centers, police stations, and fire department facilities be located outside of flood-prone areas.
Natural Systems	Establish and managing riparian buffers along rivers and streams.
	Protect and preserve wetlands to help prevent flooding in other areas.
	Develop an open space acquisition, reuse, and preservation plan targeting hazard areas.
	Protect and enhance landforms that serve as natural mitigation features
Education	Encourage homeowners to purchase flood insurance.
	Annually distribute flood protection safety pamphlets or brochures to the owners of flood-prone property.
	Educate citizens about safety during flood conditions, including the dangers of driving on flooded roads.
	Encourage homeowners to install backflow valves to prevent reverse-flow flood damages.

5.12 Landslide

5.12.1 Hazard Description

A landslide is the movement of rock, soil, and debris down a slope due to gravity. It occurs when the stability of a slope changes from a stable to an unstable condition, often triggered by natural events such as heavy rain, earthquakes, volcanic activity, or human activities like deforestation or construction. Landslides can vary in speed and the materials involved, ranging from slow-moving soil shifts to fast and destructive flows of debris and rock. Types of landslides include:



- **Flows:** Flows occur when materials, like soil, rock, or debris, behave more like a fluid due to the addition of water. These can range from slow to extremely rapid.
 - **Debris Flow:** Fast-moving flow composed of a mix of water, soil, and debris. These are common in mountainous areas after heavy rains.
 - **Mudflow:** A specific type of debris flow that contains a large amount of fine materials like silt and clay, often occurring in areas with little vegetation.
 - **Earthflow:** A slower-moving flow made mostly of fine-grained materials such as clay or silt.
- **Slides:** Slides involve the downward movement of soil or rock along a defined surface or plane, like a layer of weak material.
 - **Rotational Slide (Slump):** The material moves along a concave surface, creating a backward rotation of the slope. This type is more common in softer, clay-rich soils.
 - **Translational Slide:** Material moves along a relatively flat or slightly inclined surface. These slides can be shallow or deep and tend to be faster than rotational slides.
- **Falls:** Falls occur when rock or debris becomes detached from a steep slope or cliff and free-falls due to gravity.
- **Lateral Spreads:** Lateral spreads occur when loose, water-saturated soil spreads horizontally due to liquefaction, often triggered by earthquakes.

In general, landslides may be characterized a shallow or deep-seated. The difference between shallow and deep-seated landslides lies primarily in their depth, causes, speed, and the type of materials involved. Each type presents unique challenges in terms of risk, behavior, and mitigation strategies. General differences are as follows:

Table 81: Comparison of Shallow and Deep-Seated Landslides

Factor	Shallow Landslides	Deep-Seated Landslides
Depth	Less than 10 meters (33 feet).	Greater than 10 meters (33 feet).
Material	Loose soil, debris, weathered rock.	Bedrock or consolidated materials.
Speed	Often fast-moving, can happen suddenly.	Slower movement, can happen over longer periods.
Triggers	Intense rainfall, snowmelt, or earthquakes.	Geological processes, erosion, tectonic activity.
Types	Debris flows, soil slides.	Rotational slides, translational slides.
Impacts	Immediate, localized damage to surface infrastructure.	Large-scale damage over time to deeper and larger areas.

Source: United States Geological Survey and New Mexico Department of Conservation

Common triggers of landslides may include:

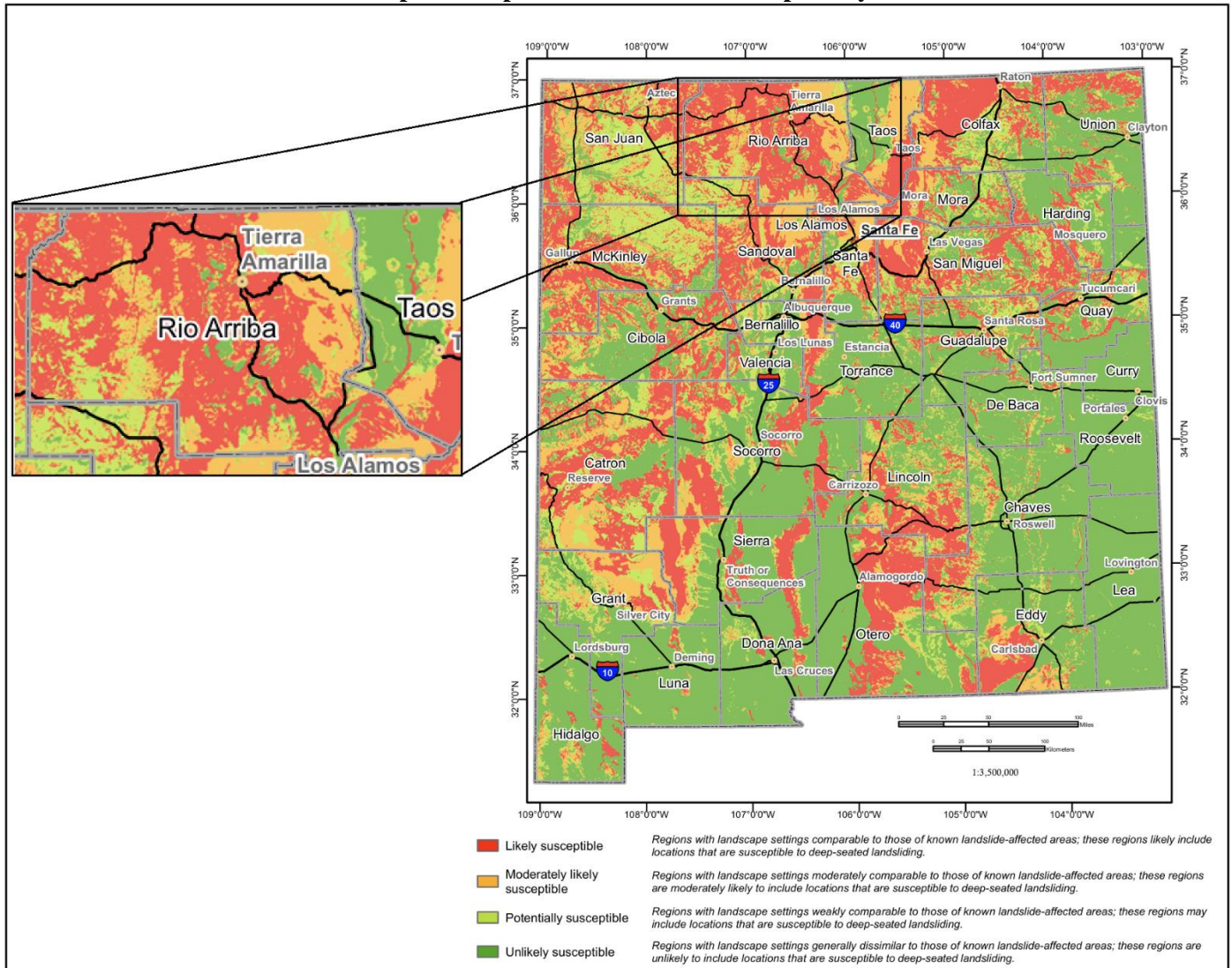
- **Heavy Rainfall:** Prolonged or intense rain saturates the ground, reducing the stability of slopes and leading to slides or flows.
- **Earthquakes:** The shaking from an earthquake can dislodge unstable soil or rock, triggering landslides.
- **Wildfires:** Wildfires make the landscape more susceptible to landslides. When rainstorms pass through, the water liquefies unstable, dry soil and burned vegetation.
- **Volcanic Activity:** Eruptions can cause the collapse of volcanic slopes or trigger lahars (volcanic mudflows).

- **Human Activities:** Deforestation, mining, construction, and the alteration of natural landscapes can destabilize slopes, increasing the likelihood of landslides.

5.12.2 – Location and Extent

The following map, from the New Mexico Bureau of Geology and Mineral Resources, shows the relative likelihood of landslides based on estimates of rock strength and steepness of slopes within Rio Arriba County. This landslide susceptibility map is intended to provide a general overview of where landslides are more likely to occur and is not appropriate for evaluation of landslide potential at any specific site. The map creates classes of landslide susceptibility (low to high). These classes express the generalization that on very low slopes, landslide susceptibility is low even in weak materials, and that landslide susceptibility increases with slope and in weak rocks.

Map 34: Deep-Seated Landslide Susceptibility



Source: New Mexico Bureau of Geology and Mineral Resources

The extent of a landslide is typically measured by determining its length, width, and depth using surveying techniques like GPS, terrestrial laser scanning, aerial photography, and satellite imagery, which allows for mapping the landslide's overall area and volume.

Discussions with the MPC and a review of all available data indicated that the landslide hazard is poorly documented and understood, and is presently not a hazard of concern for all participating jurisdictions. The following provides a narrative of the level of jurisdictional concern:

- **Rio Arriba County:** Identified as a hazard of concern, based on extremely limited available data.
- **Chama:** Identified as a community concern due to jurisdiction topography.
- **Espanola:** Not currently identified as a hazard of concern based on extremely limited available data and jurisdictional topography.
- **Ohkay Owingeh:** Not currently identified as a hazard of concern based on extremely limited available data and jurisdictional topography.

5.12.3 Previous Occurrences

Historical events of significant magnitude or impact can result in a Presidential Disaster Declaration. Rio Arriba County has experienced one Presidential Disaster Declarations related to landslides, reflected in the following table.

Table 82: Rio Arriba County Presidentially Declared Disasters

Designation	Declaration Date	Incident Type	Individual and Public Assistance	Mitigation Dollars Obligated
DR-4152-NM	10/29/2013	Severe Storms, Flooding, Mudslides	\$41,827,081	-

Source: FEMA

-: Not reported

The President can declare an emergency for any occasion or instance when the President determines federal assistance is needed. Rio Arriba County has experienced no Emergency Declarations related to landslides.

The Governor of the State of New Mexico, in accordance with the authority vested by the State Constitution and statutes, including the New Mexico Emergency Services Act Government Code section 8625, can declare a proclamation of a State of Emergency. Rio Arriba County has experienced no proclamations of a State of Emergency related to landslides.

As of this plan, no statewide database of landslide occurrence exists. A review of the previous LHMP, the State of New Mexico Hazard Mitigation Plan, and available local news reports did not reveal any major landslide occurrences in Rio Arriba County.

5.12.4 Probability of Future Events

Predicting the probability of landslide occurrence is tremendously challenging due to the large number of factors involved. Based on mapping from the New Mexico Bureau of Geology and Mineral Resources, the majority of Rio Arriba County has, including all participating jurisdictions, have a likely susceptibility to landslide events.

5.12.5 Projected Changes in Location, Intensity, Frequency, and Duration

Climate change is expected to significantly influence the occurrence and intensity of landslides. One of the primary drivers of landslides is water saturation, particularly during or after intense rainfall. Climate change is expected to lead to more extreme weather events and including heavy rainstorms, which can trigger both shallow and deep-seated landslides. Increased rainfall, especially over short periods, can saturate soil, reduce slope stability, and increase landslide susceptibility. As precipitation patterns become more erratic, flash floods can also trigger debris flows or rapid shallow landslides, particularly in areas with steep terrain or previous wildfire scars.

Warmer temperatures can cause snow to melt faster in mountainous regions. Rapid snowmelt saturates the soil quickly, increasing the risk of landslides. This effect is often observed during springtime when large volumes of melting snow combine with rain. As temperatures rise and precipitation patterns shift, some areas may experience changes in vegetation cover. In regions where vegetation cover decreases, slopes become less stable, increasing landslide risk.

Climate change has contributed to longer and more intense wildfire seasons. Wildfires remove vegetation that stabilizes slopes and helps absorb rainwater. Without this vegetation, the exposed soil is more prone to erosion and landslides, particularly during subsequent heavy rainfalls. Burned areas are especially vulnerable to debris flows and landslides for several years after a fire, as the land recovers and vegetation regrows. The loose, ashy soil in these areas is highly unstable when exposed to rain.

5.12.6 Vulnerability and Impact

FEMA NRI

Using the FEMA NRI, and consisting of three input components (expected annual loss, social vulnerability, and community resilience), the first table was created indicating the potential risk to Rio Arriba County and all participating jurisdictions from landslides. In order to gain an understanding of vulnerability, the second table details the estimated annual loss data for Rio Arriba County and participating jurisdictions. To help understand the risk and vulnerability participating jurisdictions data from the FEMA NRI was run on a census tract level. As the NRI does not generate data for individual jurisdictions, census tract analysis is the closest analogue available to understand individual jurisdiction conditions.

Table 83: Participating Jurisdiction Landslide Risk Index

Jurisdiction	Census Tract	Risk Index	National Percentile	Frequency (per year)
Rio Arriba County	All	Relatively Low	74.6	0
Chama	35039000500	Relatively Moderate	89.6	0
Espanola	35039940700	No rating	0	0
Ohkay Owingeh	35039944100	Relatively Moderate	77.0	0

Source: FEMA NRI

Table 84: Participating Jurisdiction Landslide Expected Annual Loss

Jurisdiction	Census Tract	EAL	National Percentile	Landslide EAL
Rio Arriba County	All	Relatively Low	73.7	\$36,000
Chama	06093000200	Relatively Moderate	58.9	\$3,400
Espanola	06093001100	None	0.0	\$0
Ohkay Owingeh	06093000800	Relatively Moderate	69.0	\$1,300

Population

Although major landslides occur infrequently in Rio Arriba County, a large landslide could have profound impacts on people, affecting their physical, emotional, and social well-being. The impacts can be broken down into the following categories:

- **Physical Impact:** Landslides can cause injuries and deaths, usually caused by falling debris striking a structure or vehicle. The extent of these injuries depends on the size of the landslide, building standards, and preparedness in the affected area. Access to Medical Services: Impacted persons may be cut off from medical care access due to road damage.
- **Emotional and Psychological Impact:** Survivors often experience psychological stress, anxiety, and trauma from the sudden and unpredictable nature of landslides can cause long-lasting fear, especially in areas where movement can continue for days or weeks.
- **Social and Economic Impact:** Economic losses can be devastating, especially for people whose businesses, jobs, or properties are destroyed or cut off due to road closures. The destruction of infrastructure such as transportation and utilities (electricity, water, gas) can disrupt daily life for extended periods.

Landslides may disproportionately affect socially vulnerable populations, exacerbating pre-existing inequalities and making recovery more difficult for these groups. Landslides may disproportionately impact these groups in the following ways:

- **Increased Risk of Injury and Death:** Many low-income communities are located in areas with higher landslide risk due to lower land prices. Vulnerable populations, especially in under-resourced areas, may live in buildings not built to modern safety standards, increasing their risk during seismic events.
- **Delayed or Inadequate Emergency Response:** Socially vulnerable populations may experience delayed access to rescue efforts, medical care, and emergency shelters due to geographic isolation, discrimination, or lack of resources like transportation. Rural, low-income, or marginalized communities may not receive the same level of emergency response as wealthier urban areas.

- **Economic Impact and Prolonged Recovery:** Landslides can disrupt working conditions, particularly for those in informal employment such as day laborers or small business owners. Socially vulnerable populations often lack savings or insurance to cushion the economic blow of losing their homes or jobs.

The loss of utility and communications services can also have a large impact on individuals. As an overview, the May 2023 FEMA Benefit-Cost Analysis Sustainment and Enhancements Standard Economic Value Methodology Report indicates the following loss values:

Table 85: Economic Impacts of Loss of Service Per Capita Per Day (in 2022 dollars)

Category	Loss
Loss of Electrical Service	\$199
Loss of Wastewater Services	\$66
Loss of Water Services	\$138
Loss of Communications/Information Technology Services	\$141

Source: May 2023 FEMA Benefit-Cost Analysis Sustainment and Enhancements Standard Economic Value Methodology Report

No comprehensive mapping concerning known or potential landslide area has been completed for Rio Arriba County or participating jurisdictions. As such, an estimated population vulnerable to landslides cannot be determined as of this plan.

Buildings and Structures

Buildings and structures can be damaged during landslides due to the intense ground movement. The severity of the damage depends on factors such as the size, distance from the landslide, local soil conditions, and the building's design, materials, and age. Soil movement can cause rigid components such as walls, beams, and foundations can crack or split. In severe cases, load-bearing walls may fail, leading to partial or complete building collapse. The vertical supports (columns) and horizontal supports (beams) may fail due to excessive forces, leading to the collapse of floors or entire sections of buildings.

Of particular concern to all jurisdictions are unreinforced masonry buildings. An unreinforced masonry building is constructed of brick or masonry with no steel reinforcing bars. Because these buildings were not built using modern building codes, they are much more likely to experience damage or collapse during a landslide. As of this plan, no survey has been conducted to determine the number of unreinforced masonry buildings in Rio Arriba County or participating jurisdictions.

No comprehensive mapping concerning known or potential landslide area has been completed for Rio Arriba County or participating jurisdictions. As such, an estimated number and value of structures vulnerable to landslides cannot be determined as of this plan.

Governmental Operations

Large scale impacts would not be expected on continued government operations, aside from transportation system disruptions impacting commutes to facilities.

Transportation and Electrical Infrastructure

Landslides can have numerous impacts on both transportation and electrical distribution systems. The impacts of landslides on transportation systems may include:

- **Roads and Highways:** Landslides can cause cracking, buckling, and collapse of roads, highways, and bridges. In severe cases, transportation networks are cut off, hindering emergency response, evacuation, and the transportation of goods.
- **Bridges and Tunnels:** Bridges are especially vulnerable to collapse during landslides due to the extreme forces exerted on their structures. Older bridges not built to modern codes are at higher risk of failure. Tunnels can also collapse or become blocked by debris, cutting off access to critical routes.

- **Railways:** Rail systems can be severely impacted by landslides, as tracks may buckle or become misaligned, leading to derailments.

A landslide can impact both the electrical generation capacity and transmission. The impacts of a landslide on electrical systems may include:

- **Power Plants:** Landslides can damage power generation facilities causing a cessation of services and costly repairs.
- **Transmission Lines:** Power transmission lines and substations can be damaged by extensive soil movement. This can result in prolonged power outages, which disrupt communication, emergency services, and basic living conditions.
- **Grid Instability:** Damage to power infrastructure can lead to cascading failures within the electrical grid. Substations, transformers, and electrical distribution networks can be knocked offline.

Mapping concerning transportation and electrical infrastructure may be found in Section 3.9: Community Lifelines and Critical Infrastructure. Information concerning the costs to repair or reconstruct transportation and electrical infrastructure may be found in Section 5.8.6.

Water and Wastewater Utilities

Water and wastewater utilities are vulnerable to landslide events due to the potential for plant damages and distribution system damages. Impacts may include:

- **Water Supply:** Landslides can rupture water pipes and damage water treatment facilities, leading to water shortages or contamination. In many cases, people are left without clean drinking water, and authorities must rely on temporary solutions like bottled water or emergency water delivery.
- **Wastewater Systems:** Sewer lines and wastewater treatment plants are particularly vulnerable to ground movement. Ruptured sewer lines can lead to sewage leaks, contaminating groundwater and local water sources. Damage to wastewater treatment plants can lead to untreated sewage being released into waterways, causing public health hazards.

Mapping and details concerning operators of water and wastewater utility providers may be found in Section 5.9.6.

Medical, Education, and Response Facilities

A landslide could significantly disrupt medical, education, and response facilities and operations at various levels. These impacts are especially pronounced in the immediate aftermath, where response efforts, infrastructure damage, and communication breakdowns can severely hamper functions. Impacts may include:

- **Damage to Facility:** Landslides can damage or destroy facilities, causing a significant drop or cessation of services.
- **Response Disruptions:** Emergency response, including search and rescue operations and medical assistance may be severely impacted due to the road closures.
- **Communication Breakdowns:** Landslides can damage communication networks, including internet and phone services, preventing effective communication and hindering the dissemination of critical information.
- **Budget Strains:** The cost of responding to and recovering from a landslide can put significant pressure on budgets.

Mapping concerning medical, education, and response facilities may be found in Section 3.9: Community Lifelines and Critical Infrastructure.

Communication Systems

No comprehensive mapping of communications systems was available for review to compare against known landslide hazard areas. However, it is assumed that communications lines and towers are in known hazard areas. Landslides can disrupt this vital communications system, affecting reliability and functionality. Some of the key vulnerabilities include:

- **Physical Damage to Infrastructure:** Soil movement can cause physical damage to communication infrastructure such as cell towers, antennas, satellite dishes, and power lines. This damage can result in interruptions or complete failure of communication services.
- **Power Outages:** Soil movement can lead to power outages by knocking down power lines or damaging electrical substations. Communication systems that rely on electricity, such as landline phones, internet routers, and cellular towers, may cease to function during power outages.
- **Structural Instability:** Soil movement can cause structural instability in communication towers and buildings housing communication equipment. If these structures are not properly reinforced, they may collapse or sustain damage, disrupting communication services.

The cost to repair communications networks can vary widely depending on the extent of the damage, the size of the network, and the specific technologies involved. Repair costs may include expenses for labor, equipment replacement or repair, materials, and any additional resources required to restore the network to full functionality. Estimated repair cost from the U.S. Department of Homeland Security Cybersecurity and Infrastructure Security Agency may be found in Section 5.8.6.

Environmental and Agricultural Impacts

Landslides in Rio Arriba County are anticipated to have a limited impact on the agricultural community. However, a disruption in transportation networks could hamper the ability to transport commodities in a timely manner.

Although difficult to quantify, the potential environmental impacts can include habitat damage and degradation of water quality from an influx of soils or debris.

Jurisdictional Concerns:

As of this plan there is a deficit of community specific data to help quantify both vulnerability and historic impact. Additionally, no comprehensive mapping of slide prone areas has been completed by any participating jurisdiction. However, over the life of this plan the MPC will work to quantify the local level impacts of hazard occurrences to citizens, vulnerable populations, structures, and infrastructure to better inform both this living LHMP and future planning efforts. The following initial vulnerabilities and potential impacts have been identified on a jurisdictional level:

- **Chama:** With 16.5% of citizens living in poverty, the occurrence of a landslide may have a disproportionate impact on citizens of the community due to underinsurance. Additionally, community access and response activities could be impacted slide debris impacting community roads.

Cascading Impacts

Cascading impacts often result when one a hazard event triggers one or more differing hazard events or loss of community lifelines. Cascading impacts associated with earthquakes may include:

- Fires from various causes, including downed power lines and broken gas pipelines
- Infrastructure failure
- Dam failure
- Power outages
- Hazardous materials release

Consequence Analysis

This consequence analysis lists the potential impacts of a hazard on various elements of a community. The impact of each hazard is evaluated in terms of disruption of operations, recovery challenges, and overall wellbeing to all Rio Arriba County residents and first responder personnel. The consequence analysis supplements the hazard profile by analyzing specific impacts.

Table 86: Landslide Consequence Analysis

Subject	Potential Impacts
Impact on the Public	Landslides may cause injury or death to people from vehicle accidents, falling objects, or structural failure. Ground movement may result in broken service lines or pipelines, triggering the release of hazardous materials or waste materials.
Impact on Responders	The extent of the damage to infrastructure such as roads and bridges and communications can greatly impact first responders' ability to access or transport victims. Equipment, facilities, or other assets may be damaged and restrict first responders' capacity to respond to calls for assistance.
Continuity of Operations	Local jurisdictions maintain continuity plans which can be enacted as necessary based on the situation. Landslides could potentially impact critical infrastructure resulting in power outages, access to roadways or public transportation, damage to facilities or infrastructure, including alternate locations.
Delivery of Services	Delivery of services may be impacted by dangerous transportation conditions, causing food, water, and resource systems to be delayed or halted.
Property, Facilities, and Infrastructure	Unreinforced masonry structures are inherently vulnerable to external forces. All critical facilities and transportation corridors and pipelines can be impacted. Ground movement can lead to the collapse of buildings and bridges, and disrupt utility services.
Impact on Environment	Landslides have the potential to trigger secondary hazards such as fire, hazardous material release, or dam failures. These secondary hazards can destroy habitats and environments, cause significant injury to animals or livestock, or contaminate certain components of the environment.
Economic Conditions	Landslides pose a fiscal impact on the local and county governments, even if some of those costs can be recouped through federal grant reimbursements. Local, county, and state resources may be drained by response and recovery efforts. Additionally, a severe landslide would affect the ability of businesses to maintain operations. If the private sector is not able to re-establish operations this would also impact the local economy.
Public Confidence in Governance	Governmental response, on all levels, requires direct actions that must be immediate and effective to maintain public confidence. If local government takes a long time to begin recovery operations, or for the public to see recovery operations, this will have a negative impact on the public's confidence in governance.

5.12.7 Future Development

Rio Arriba County, the Ohkay Owingeh, and participating jurisdictions are experiencing consistent population decline or a static population as people increasingly migrate from rural areas to urban centers. The rural-to-urban population movement has significant implications for all participating jurisdictions, including school closures and reduced economic activity. Based on population projections, this decreasing or static population trend is expected to continue in Rio Arriba County through 2050. While unlikely, any additional growth within landslide prone areas would place additional populations at risk. Should any population increase occur, potentially vulnerable populations could face disproportionate effects from a dam failure.

Closely tracking population data, but tending to lag population changes, housing data is a good indicator of changing demographics and growth. Rio Arriba County, the Ohkay Owingeh, and all participating jurisdictions have generally seen static to decreasing housing growth over the previous 20-year period. Future land use planning should be proactive to address future hazard conditions, and restrict development in known landslide prone areas.

5.12.8 Mitigation Opportunities

The following table presents examples of potential actions that can be instituted for mitigating the landslide hazard.

Table 87: Example Landslide Mitigation Actions

Category	Example Action
Planning and Regulation	Use GIS to identify and map landslide hazard areas.
	Develop and maintain a database to track community vulnerability to landslides.

Table 87: Example Landslide Mitigation Actions

	Locate utilities and critical facilities outside of areas susceptible to slides to decrease the risk of service disruption.
	Develop and implement a landslide management plan.
Infrastructure	Prevent landslides with proper bank stabilization, sloping or grading techniques, planting vegetation on slopes, terracing hillsides, or installing riprap boulders or geotextile fabric.
	Use bioengineered bank stabilization techniques.
Natural Systems	Plant native vegetation on slopes to enhance stability.
	Stabilize cliffs with terracing or plantings of grasses or other plants to hold soil together.
Education	Notify property owners located in high-risk areas.
	Offer GIS hazard mapping online for residents and design professionals
	Disclose the location of high-risk areas to buyers.

5.13 Severe Weather

5.13.1 Hazard Description

Severe weather comprises the hazardous and damaging weather effects often found in violent storm fronts and severe winter storms. They can occur together or separate, they are common and usually not hazardous, but on occasion they can pose a threat to life and property.

This plan defines severe weather as a combination of the following as defined by the National Oceanic and Atmospheric Administration (NOAA) and the National Weather Service (NWS):



- **Hail:** Precipitation in the form of irregular pellets or balls of ice more than 5 mm in diameter, falling from a cumulonimbus cloud.
- **Lightning:** A visible electrical discharge produced by a thunderstorm. The discharge may occur within or between clouds, between the cloud and air, between a cloud and the ground or between the ground and a cloud.
- **Thunderstorm Winds:** The same classification as high or strong winds but accompanies a thunderstorm. It is also referred to as a straight-line wind to differentiate from rotating or tornado associated wind. Additionally, these winds can rapidly create dust storms that severely impact visibility.

Severe weather has been so consistent throughout modern history that much of the vulnerability is mitigated. However, this section is not concerned with everyday wind, lightning, or mild precipitation. This section is concerned with common storm elements when they behave such that they pose a threat to property and life.

5.13.2 – Location and Extent

Severe weather can rapidly descend on an area, but in many cases is predictable. Most weather forecasts focus on changing conditions that may lead to the onset of severe storms. All of Rio Arriba County is susceptible to severe weather in the form of thunderstorm events, but occurrence is infrequent.

The NWS classifies thunderstorms, often the generator of hail, lightning and high winds, using the following categories.

- **Marginal:** Isolated severe weather, limited in duration and/or coverage and/or intensity
- **Slight:** Scattered severe storms possible, short-lived and/or not widespread, isolated intense storms possible
- **Enhanced:** Numerous severe storms possible, more persistent and/or widespread, a few intense
- **Moderate:** Widespread severe storms likely, long-lived, widespread and intense
- **High:** Widespread severe storms expected, long-lived, very widespread and particularly intense

In the United States, hail causes billions of dollars in damage to property each year. Vehicles, roofs of buildings and homes, and landscaping are most commonly damaged by hail. Hail has been known to cause injury and the occasional fatality to humans, often associated with traffic accidents.

Based on information provided by the National Weather Service concerning size, the following table describes potential damage impacts of the various sizes of hail.

Table 88: Hail Size Comparison and Damage Descriptions

Diameter (inches)	Size Description	Potential Damage Impacts
1/4	Pea Size	No damage
1/2	Mothball, peanut, USB Plug	Slight damage to vegetation
3/4	Penny Size	Increased damage to crops and vegetation
7/8	Nickel Size	Severe damage to crops and vegetation, damage begins to glass and plastic

Table 88: Hail Size Comparison and Damage Descriptions

Diameter (inches)	Size Description	Potential Damage Impacts
1	Quarter Size	Increased glass damage, damage begins to bodies of vehicles
1 1/4	Half Dollar Size	Large scale glass damage, begin roof damage, risk of injury to exposed persons
1 1/2	Ping Pong Ball Size	Large scale glass damage, begin roof damage, increased risk of injury to exposed persons
1 3/4	Golf Ball Size	Severe roof damage, risk of serious injuries to exposed persons
2	Lime or Medium Sized Hen Egg	Potential structural damage, risk of very severe injuries to exposed persons
2 1/2	Tennis Ball Size	Extensive structural damage, risk of very severe injuries or death to exposed persons

Source: National Weather Service

A recent report by the Insurance Information Institute says lightning strikes caused \$1,300,000,000 in damage across the United States in 2021. There is currently no scale to indicate the severity of a lightning strike, but data from NOAA indicates that there approximately 25,000,000 cloud-to-ground lightning strikes per year in the United States.

To measure wind speed and its correlating potential for damage, experts use the Beaufort scale as shown below.

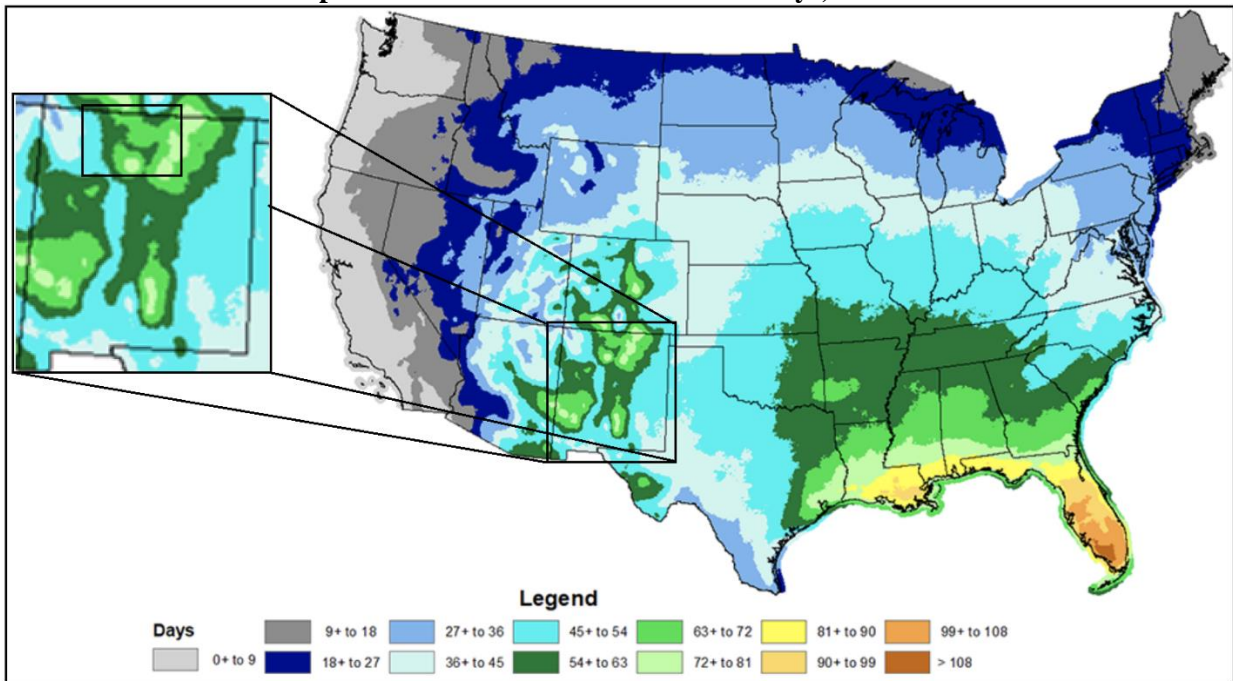
Table 89: Beaufort Scale

Beaufort Number	Wind Speed (mph)	Effects on Land
0	Under 1	Calm, smoke rises vertically
1	1-3	Smoke drift indicates wind direction, vanes do not move
2	4-7	Wind felt on face, leaves rustle, vanes begin to move
3	8-12	Leaves, small twigs in constant motion. Light flags extended.
4	13-18	Dust, leaves and loose paper raised up; small branches move
5	19-24	Small trees begin to sway
6	25-31	Large branches of trees in motion, whistling heard in wires
7	32-38	While trees in motion, resistance felt in walking against the wind
8	39-46	Twigs and small branches broken off trees
9	47-54	Slight structural damage occurs, slate blown from roofs
10	55-63	Seldom experienced on land, trees broken, structural damage occurs
11	64-72	Very rarely experienced on land, usually with widespread damage
12	73 or higher	Violence and destruction

Source: NOAA

The frequent nature of thunderstorms makes hail, lightning, and high wind a relatively common occurrence for Rio Arriba County. The following map, from NOAA, indicates annual mean thunderstorm days from 1993 to 2018.

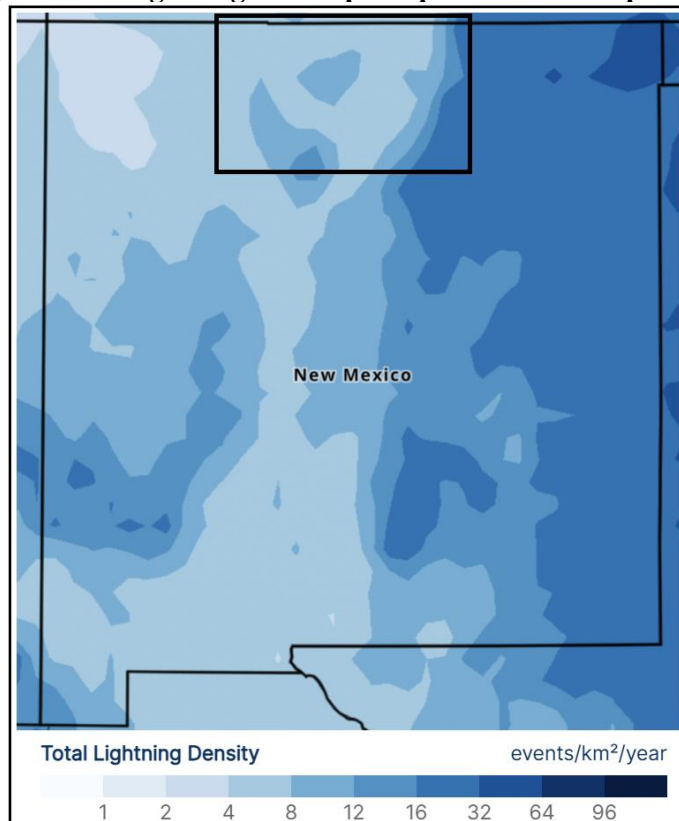
Map 35: Annual Mean Thunderstorm Days, 1993-2018



Source: NOAA

The following map, from Vaisala, indicates the average annual light events per square kilometer per year for Rio Arriba County:

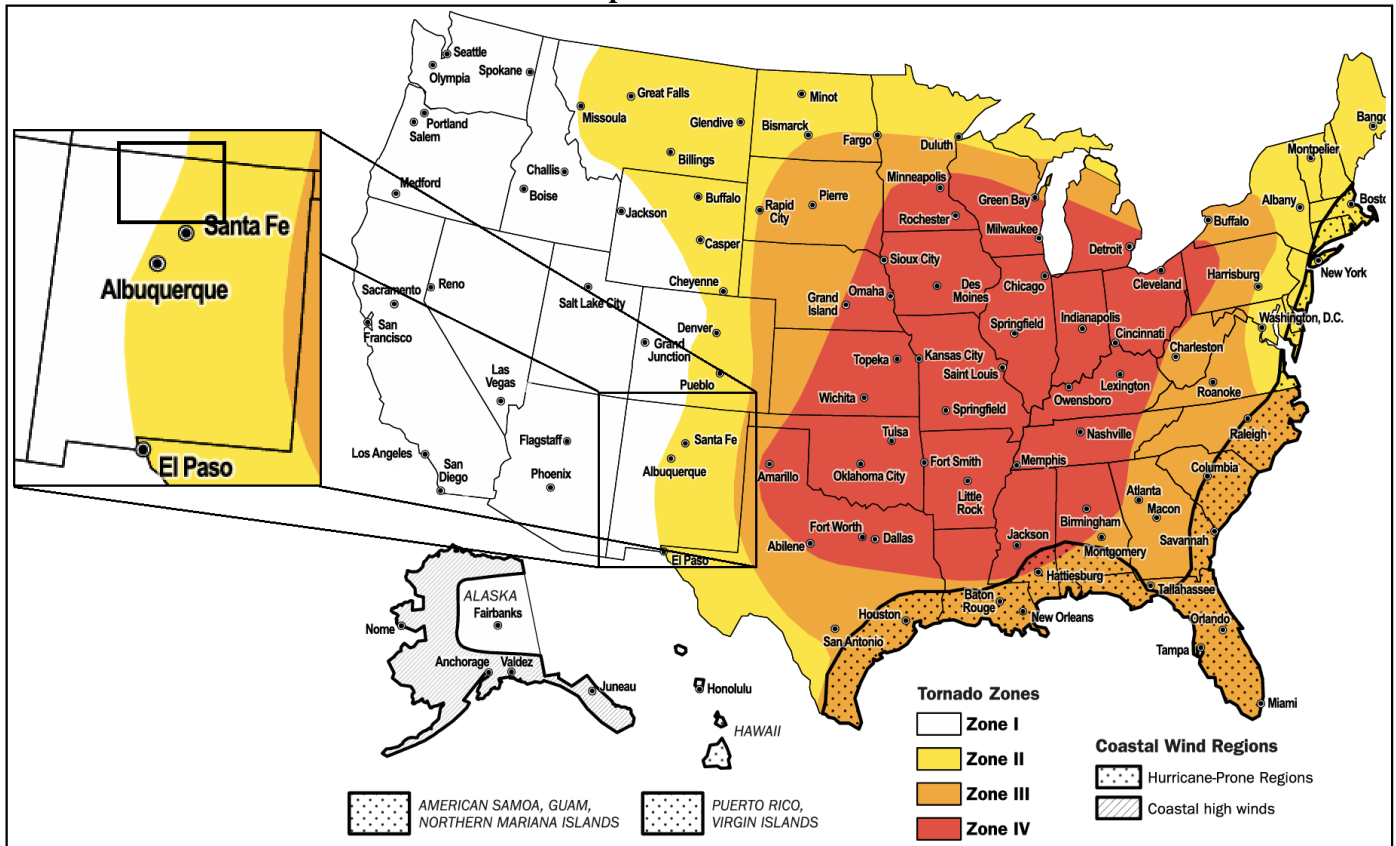
Map 36: Average Annual Lightning Events per Square Kilometer per Year, 2016 - 2023



Source: Vaisala

The following maps from FEMA indicate the highest possible expected wind speeds for Rio Arriba County.

Map 37: Wind Zones



Source: FEMA

The MPC views severe weather as both a local and county-wide hazard. Discussions with the MPC and a review of all available data indicated severe weather is a community concern for all participating jurisdictions. The following provides a narrative of the level of jurisdictional concern:

- **Rio Arriba County:** Severe weather identified as a community concern as citizens, structures, and infrastructure are vulnerable. Additionally, continuing climate change can result in a higher frequency of severe weather events and an increase in their intensity.
- **Chama:** Severe weather identified as a community concern as citizens, structures, and infrastructure are vulnerable. Additionally, continuing climate change can result in a higher frequency of severe weather events and an increase in their intensity.
- **Espanola:** Severe weather identified as a community concern as citizens, structures, and infrastructure are vulnerable. Additionally, continuing climate change can result in a higher frequency of severe weather events and an increase in their intensity.
- **Ohkay Owingeh:** Severe weather identified as a community concern as citizens, structures, and infrastructure are vulnerable. Additionally, continuing climate change can result in a higher frequency of severe weather events and an increase in their intensity.

5.13.3 Previous Occurrences

Historical events of significant magnitude or impact can result in a Presidential Disaster Declaration. Rio Arriba County has experienced six Presidential Disaster Declarations related to severe weather events, reflected in the following table:

Table 90: Rio Arriba County Presidentially Declared Disasters

Designation	Declaration Date	Incident Type	Individual Assistance	Public Assistance
DR-4197-NM	10/6/2014	Severe Storms, Flooding	\$6,276,380	-
DR-4152-NM	10/29/2013	Severe Storms, Flooding, Mudslides	\$41,827,081	-
DR-1659-NM	1/30/2006	Severe Storms, Flooding	\$34,407,619	-
DR-1301-NM	9/22/1999	Severe Storms, Flooding	\$1,968,330	-
DR-589-NM	6/23/1979	Severe Storms, Snowmelt, Flooding	-	-
DR-380-NM	5/11/1973	Severe Storms, Snowmelt, Flooding	-	-

Source: FEMA

-: Not reported

The President can declare an emergency for any occasion or instance when the President determines federal assistance is needed. Rio Arriba County has experienced no Emergency Declarations related to severe weather events.

In New Mexico, the governor has the authority to declare a state of emergency or disaster under various state statutes and provisions. The following New Mexico State of Emergencies have been declared related to severe weather events:

Table 91: Governor of New Mexico Rio Arriba Disaster Declarations, 2019 - 2024

Year	Executive Order	Incident Type
2019	2019-009	Severe Wind, Tornadoes, Hail, and Power Outages (statewide)

Additionally, the following table presents NCEI identifies severe weather and severe winter weather events and the resulting damage totals in Rio Arriba County from 1950 to 2024:

Table 92: NCEI Rio Arriba County Severe Weather Events

County	Event Type	Number of Days with Events	Property Damage	Deaths and Injuries
Rio Arriba	Hail	32	\$50,500	0
	Lightning	7	\$113,000	4
	Thunderstorm Winds	21	\$207,500	0

Source: NCEI

It is worth noting that damage estimates indicated by the NCEI are often artificially low. This underreporting is a result of the way the events are reported to the NCEI, often by the local and/or NWS office. When reporting an event, the NWS office does not have access to the actual damage assessment resulting from that event. As such, the report often details a very low amount or zero-dollar amount for damages. Additionally, deaths and injuries may be underreported as they may be a result of a concurrent event, such as a person driving unsafely during heavy rain and passing away.

Recent notable events include:

- **August 1, 2015:** A lightning strike led to a fatal motorcycle crash along U.S. Highway 64 near Hopewell Lake.

5.13.4 Probability of Future Events

Predicting the probability of severe weather occurrences is tremendously changing due to the large number of factors involved and the random nature of formation. Data and mapping from NOAA indicate that Rio Arriba County can expect between 45 - 81 severe weather events per year.

Based on historical occurrences, Rio Arriba County will continue to experience severe weather events on an annual basis. The following tables, using data from the NCEI, indicate the yearly probability of a severe weather component events, the number of deaths or injuries, and estimated property damage :

Table 93: Rio Arriba County NCEI Severe Weather Event Probability Summary

Event	Days with Event	Average Events per Year	Deaths / Injuries	Average Deaths / Injuries per Year	Property Damage	Average Property Damage per Year
Hail	32	1	0	0	\$50,500	\$673
Lightning	7	<1	4	<1	\$113,000	\$1,507
Thunderstorm Winds	21	<1	0	0	\$207,500	\$2,767

Source: NCEI

5.13.5 Projected Changes in Location, Intensity, Frequency, and Duration

Climate change can have several impacts on severe weather, although the precise details can vary depending on regional climate patterns and other factors. In general, it is believed that climate change can alter the timing and seasonality of Severe Weather. In some cases, this may mean more severe weather events occurring earlier or later in the year.

Climate change can lead to increased temperatures and moisture levels in the atmosphere, which can provide favorable conditions for the development of severe weather. This can result in a higher frequency of severe weather events and an increase in their intensity. As a result of increased temperatures, warmer air can hold more moisture, leading to increased rainfall during severe weather. This can elevate the risk of flash flooding, particularly in areas prone to heavy precipitation. Changes in atmospheric circulation patterns associated with climate change can lead to stronger winds within thunderstorms. This can result in more powerful wind gusts, increasing the risk of wind damage and downed trees and power lines.

Climate change can influence the conditions necessary for hail formation. Warmer temperatures at the surface and greater instability in the atmosphere can contribute to larger and more damaging hailstones. Additionally, changes in atmospheric conditions can affect the frequency and distribution of lightning strikes. More lightning can increase the risk of wildfires in dry regions.

It is important to note that while there is evidence linking climate change to changes in weather patterns that can influence severe weather, predicting specific events remains changing. Climate models provide valuable insights into long-term trends, but individual severe weather events are influenced by a complex interplay of factors.

5.13.6 Vulnerability and Impact

FEMA NRI

Using the FEMA NRI, and consisting of three input components (expected annual loss, social vulnerability, and community resilience), the first table was created indicating the potential risk to Rio Arriba County and all participating jurisdictions from severe weather. In order to gain an understanding of vulnerability, the second table details the estimated annual loss data for Rio Arriba County and participating jurisdictions. To help understand the risk and vulnerability participating jurisdictions data from the FEMA NRI was run on a census tract level. As the NRI does not generate data for individual jurisdictions, census tract analysis is the closest analogue available to understand individual jurisdiction conditions.

Table 94: Participating Jurisdiction Hail Risk Index

Jurisdiction	Census Tract	Risk Index	National Percentile	Events per Year
Rio Arriba County	All	Very Low	39.9	0.3
Chama	06093000200	Relatively Low	61.0	0.2
Espanola	06093001100	Relatively Moderate	74.6	0.8
Ohkay Owingeh	06093000800	Relatively Moderate	73.4	0.8

Source: FEMA NRI

Table 95: Participating Jurisdiction Hail Expected Annual Loss

Jurisdiction	Census Tract	EAL	National Percentile	Hail EAL
Rio Arriba County	All	Very Low	37.4	\$47,000
Chama	06093000200	Relatively Low	58.0	\$2,700

Table 95: Participating Jurisdiction Hail Expected Annual Loss

Jurisdiction	Census Tract	EAL	National Percentile	Hail EAL
Espanola	06093001100	Relatively Low	69.6	\$6,900
Ohkay Owingeh	06093000800	Relatively Low	69.1	\$6,600

Source: FEMA NRI

Table 96: Participating Jurisdiction Lightning Risk Index

Jurisdiction	Census Tract	Risk Index	National Percentile	Events per Year
Rio Arriba County	All	Relatively High	95.3	32.8
Chama	06093000200	Very High	99.7	33.1
Espanola	06093001100	Very High	99.9	30.8
Ohkay Owingeh	06093000800	Very High	100.0	28.5

Source: FEMA NRI

Table 97: Participating Jurisdiction Lightning Expected Annual Loss

Jurisdiction	Census Tract	EAL	National Percentile	Lightning EAL
Rio Arriba County	All	Relatively High	93.3	\$784,000
Chama	06093000200	Very High	99.6	\$76,000
Espanola	06093001100	Very High	99.5	\$72,000
Ohkay Owingeh	06093000800	Very High	99.9	\$124,000

Source: FEMA NRI

Table 98: Participating Jurisdiction Strong Wind Risk Index

Jurisdiction	Census Tract	Risk Index	National Percentile	Events per Year
Rio Arriba County	All	Very Low	14.1	0.1
Chama	06093000200	Relatively Low	31.1	0.1
Espanola	06093001100	Relatively Low	47.0	0.1
Ohkay Owingeh	06093000800	Relatively Moderate	56.3	0.1

Source: FEMA NRI

Table 99: Participating Jurisdiction Strong Wind Expected Annual Loss

Jurisdiction	Census Tract	EAL	National Percentile	Strong Wind EAL
Rio Arriba County	All	Very Low	14.9	\$46,000
Chama	06093000200	Relatively Low	28.8	\$2,400
Espanola	06093001100	Relatively Low	38.7	\$4,900
Ohkay Owingeh	06093000800	Relatively Low	48.0	\$8,300

Population

Severe weather can have a wide range of effects on people, often posing significant risks to life, property, and general well-being. In the absence of proper shelter, hail, lightning, and high winds can cause serious injury. In general, if potentially exposed persons take shelter in a solid, well-constructed structure protection from these severe weather components would be provided. However, old or poorly constructed facilities may be more prone to damage, potentially increasing the impact on economically disadvantaged populations. Some of the potential effects of severe weather on people may include:

- **Death and Injury:** Severe weather can produce lightning and strong winds driving debris. Both of these elements can cause injuries or fatalities.
- **Power Outages:** Lightning strikes, strong winds, and falling trees can lead to power outages, disrupting daily life, and potentially affecting essential services, such as medical equipment and refrigeration.
- **Mental Health Impact:** Severe weather can be frightening and stressful, leading to anxiety and post-traumatic stress disorder in some individuals. The emotional toll of property damage and loss can also be significant.

- **Displacement:** People may need to evacuate their homes or be temporarily displaced due to storm damage, requiring emergency shelter and support.
- **Economic Costs:** Severe weather results in economic costs, including repair and recovery expenses, insurance claims, and potential loss of income due to property damage or work disruptions.
- **Public Safety Response:** Severe weather can strain public safety resources, including emergency services, law enforcement, and medical facilities.

At greater risk may be the vulnerable populations and equity priority communities, including the especially young, the elderly, and those below the poverty level. Hazard occurrences can exacerbate existing vulnerabilities and create new challenges.

All Rio Arriba County and participating jurisdiction populations are vulnerable to the impacts of severe weather. Please see Section 3.3: Population Data and Section 3.4: Socially Vulnerable and At-Risk Populations for data concerning jurisdictional populations.

Buildings and Structures

All buildings and structures within Rio Arriba County and participating jurisdictions can be impacted by severe weather. However, the location and construction of the facility will have a significant impact on the vulnerability. In general, older structures would be at higher risk of negative impacts. Some of the potential impacts include:

- **Electrical Infrastructure Damage:** Severe weather can damage electrical infrastructure, including power lines, transformers, and substations. This can result in widespread power outages, affecting homes, businesses, hospitals, and other critical facilities.
- **Communication Disruptions:** Severe weather can disrupt telecommunications infrastructure, including cell towers, data centers, and communication networks. This can impact emergency communication and coordination efforts.
- **Safety Risks:** Damage to infrastructure can pose safety risks to workers and the public. Fallen power lines, damaged buildings, and debris can be hazardous.
- **Building Damage:** High winds, large hail, and lightning strikes can cause damage to the building.

Governmental Operations

Severe weather can pose various risks to government operations. These risks can have significant economic and operational consequences, and can include:

- **Power Outages:** Severe weather can lead to power outages by damaging electrical infrastructure such as power lines and substations. Government buildings may lose power, affecting critical operations and services.
- **Flooding:** Heavy rainfall during severe weather can lead to flooding, which can damage government buildings and disrupt operations. Flood damage may require extensive repairs and cleanup.
- **Communication Disruptions:** Severe weather can damage communication equipment, including telephone lines and computer systems. This can hinder communication between government agencies and the public.
- **Transportation Disruptions:** Severe weather can make roads impassable due to flooding or debris. This can impact the ability of government employees to commute to work.
- **Budgetary Impact:** The costs associated with repairing and restoring government buildings and infrastructure after severe weather can strain budgets.

Transportation and Electrical Infrastructure

In general, severe weather components do not have a large impact on transportation infrastructure, with the exception of power loss disrupting signaling and poor conditions impacting driving conditions.

Severe weather can have significant impacts on electrical utilities, leading to disruptions in power supply and potential damage to infrastructure. Severe weather can affect electrical utilities in the following ways:

- **Lightning Strikes:** Lightning is a common occurrence during severe weather and poses a substantial risk to electrical infrastructure. Lightning strikes can damage power lines, transformers, substations, and other critical components, leading to power outages.
- **Wind Damage:** High winds associated with severe weather can cause trees, branches, and other debris to fall onto power lines. This can result in downed power lines, structural damage to utility poles, and disruptions in electrical service.
- **Hailstorms:** Severe weather may produce hail, which can damage power lines, transformers, and other equipment. Hailstones can also lead to short circuits and insulation damage on electrical components.
- **Power Surges:** Lightning strikes, strong winds, and other storm-related events can lead to power surges in the electrical grid. These surges can damage electronic devices, appliances, and utility equipment connected to the power supply.

Mapping concerning transportation and electrical infrastructure may be found in Section 3.9: Community Lifelines and Critical Infrastructure. Information concerning the costs to repair or reconstruct transportation and electrical infrastructure may be found in Section 5.8.6.

Water and Wastewater Utilities

In general, severe weather components do not have a large impact on water and wastewater infrastructure and operations. However, the cascading impacts from an event such as power loss disrupting pumping and treatment capabilities or localized flooding from heavy overwhelming drainage systems may cause disruptions to operations.

Medical, Education, and Response Facilities

Severe weather can significantly impact emergency response infrastructure, creating challenges for first responders and organizations involved in managing and mitigating the effects of severe weather events. Severe weather can impact emergency response through:

- **Transportation Disruptions:** Debris on roads can hinder the ability of emergency vehicles to navigate and reach affected areas promptly. Hazardous road conditions may result in delays in response times.
- **School Closures:** Severe weather can lead to the closure of schools due to hazardous conditions. This can strain caregivers and result in lower work attendance.
- **Communication Disruptions:** Severe weather can disrupt communication networks, affecting the ability of emergency responders to coordinate and communicate effectively. Downed power lines and damage to communication infrastructure contribute to these disruptions.
- **Power Outages:** Severe weather can lead to power outages. Emergency response facilities, such as command centers and fire stations, may lose power, affecting their operational capabilities.
- **Exposure:** Emergency responders face increased health and safety risks in severe weather conditions. Exposure to hail, high winds, and lightning can impact the well-being of responders and affect their ability to provide effective assistance.
- **Resource Allocation Challenges:** Severe weather often requires the allocation of additional resources, including personnel, equipment, and supplies, to address immediate needs. This can strain emergency response organizations and impact their ability to respond to other concurrent incidents.
- **Increased Demand for Services:** Severe weather can result in an increased demand for emergency services, including medical assistance, search and rescue operations, and responses to accidents. Emergency response organizations may need to manage a higher volume of incidents simultaneously.

Communication Systems

All communication systems within Rio Arriba County are at risk to severe weather, which can disrupt vital communications system affecting reliability and functionality. Some of the key vulnerabilities include:

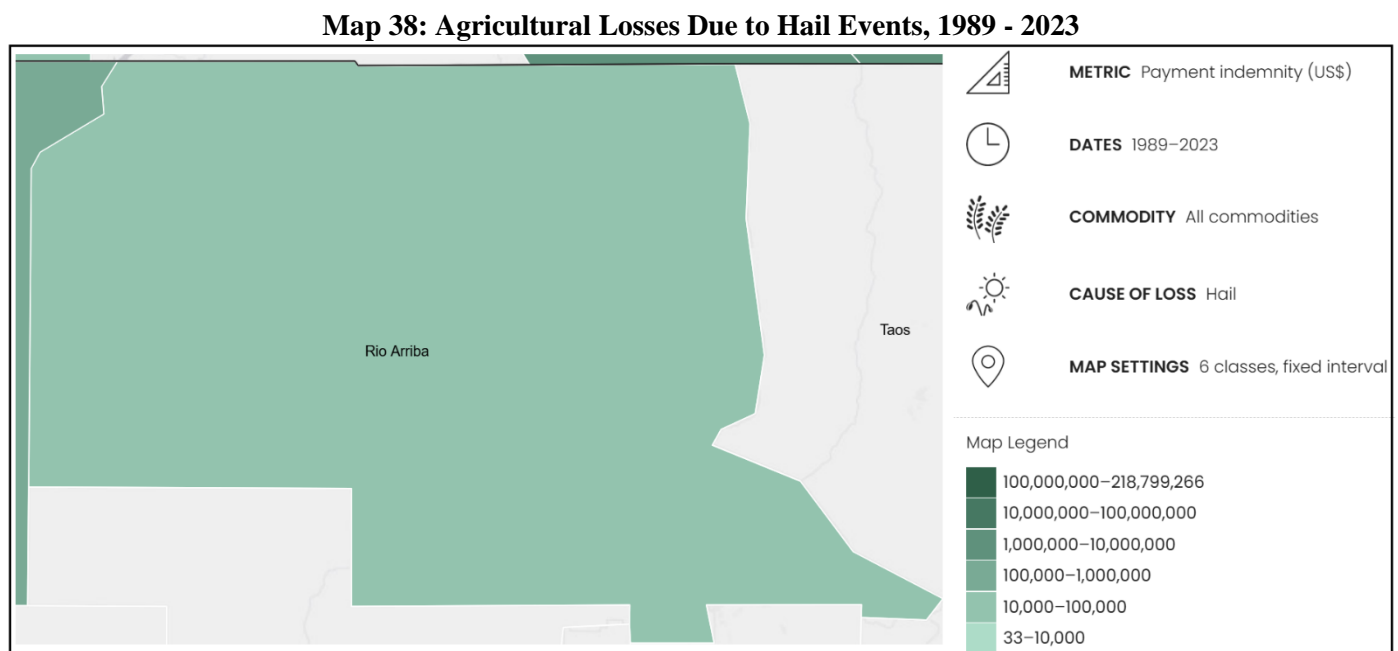
- **Physical Infrastructure Damage:** High winds, heavy rainfall, and other severe weather conditions can cause physical damage to communication infrastructure such as cell towers, antennas, cables, and data centers. This damage can result in network outages and disruptions.

- **Power Outages:** Severe storms often lead to power outages, which can affect the operation of communication networks. Without a stable power supply, cell towers, data centers, and other critical components may become non-functional, leading to service interruptions.
- **Lightning Strikes:** Lightning poses a threat to communication infrastructure. Direct strikes or induced surges can damage electronic equipment, leading to the need for repairs or replacements and causing downtime.
- **Signal Interference:** Severe storms can create electromagnetic interference that disrupts radio signals used in wireless communication. This interference can lead to poor signal quality, dropped calls, and slower data speeds.
- **Loss of Backhaul Connectivity:** Severe weather events can damage the backhaul infrastructure that connects various communication nodes. This backbone infrastructure is crucial for transmitting data between local and regional networks, and any disruption can impact overall network performance.
- **Communication Tower Instability:** High winds and extreme weather conditions can compromise the stability of communication towers. If towers are not designed to withstand severe weather, they may collapse, leading to network outages.
- **Network Congestion:** In the event of a disaster, communication networks may experience a surge in usage as people attempt to contact emergency services, friends, and family. This increased demand can lead to network congestion, making it difficult for users to connect.

The cost to repair communications networks can vary widely depending on the extent of the damage, the size of the network, and the specific technologies involved. Repair costs may include expenses for labor, equipment replacement or repair, materials, and any additional resources required to restore the network to full functionality. Estimated repair cost from the U.S. Department of Homeland Security Cybersecurity and Infrastructure Security Agency may be found in Section 5.8.6.

Environmental and Agricultural Impacts

Hail events can cause significant agricultural impacts. The following map from the United States Department of Agriculture details total county-wide agricultural losses, by county, due to hail events from 1989 - 2023:



Source: USDA

Severe weather can pose various risks to the environment. These risks can have both short-term and long-term impacts on natural ecosystems. Severe weather can produce heavy rainfall over a short period of time, leading to flash floods and riverine flooding. This can result in soil erosion, damage to aquatic habitats, and the displacement of aquatic organisms. Large hailstones can damage crops, vegetation, and natural habitats. Hail can strip leaves from trees and

plants, reducing their ability to photosynthesize and grow. It can also damage wildlife habitats. Severe weather often produces strong straight-line winds. These winds can uproot trees, damage forests, and disrupt animal habitats. They can also scatter debris and cause structural damage to buildings, which can lead to further environmental issues if hazardous materials are released. Lightning is a common occurrence during severe weather and can spark wildfires. These wildfires can have significant ecological impacts, including habitat destruction, loss of wildlife, and changes in the local ecosystem.

Jurisdictional Concerns:

As of this plan there is a deficit of community specific data to help quantify both vulnerability and historic impact. However, over the life of this plan the MPC will work to quantify the local level impacts of hazard occurrences to citizens, vulnerable populations, structures, and infrastructure to better inform both this living LHMP and future planning efforts. The following initial vulnerabilities and potential impacts have been identified on a jurisdictional level:

- **Chama:** With 16.5% of citizens living in poverty, severe weather and the associated property damage may disproportionately impact them due to underinsurance. Additionally, severe weather may impact tourism and impact popular community events like the Western Heritage Days and the Snoball Rally, lowering potential community revenue. With limited access and services, severe weather may cut the community off from necessary services due to limited road access
- **Espanola:** With 23.4% of citizens living in poverty, severe weather and the associated property damage may disproportionately impact them due to underinsurance. Additionally, severe weather may impact tourism and impact popular community events like the Valley Fiesta, lowering potential community revenue. With limited response services, severe weather may affect overall community response and recovery.
- **Ohkay Owingeh:** With 20.6% of citizens living in poverty, severe weather and the associated property damage may disproportionately impact them due to underinsurance. Additionally, severe weather may impact tourism and impact popular community events like the Turtle Dance, lowering potential community revenue. With limited response services, severe weather may affect overall community response and recovery.

Cascading Impacts

Cascading impacts often result when one a hazard event triggers one or more differing hazard events or loss of community lifelines. Cascading impacts associated with severe weather may include:

- Direct physical damage to buildings and structures:
- Transportation infrastructure disruption
- Power outages and electrical grid disruption
- Communication system disruption
- Transportation and supply chain disruptions
- Environmental and ecological damage
- Economic impacts and business closures
- Emergency services overload

Consequence Analysis

This consequence analysis lists the potential impacts of a hazard on various elements of a community. The impact of each hazard is evaluated in terms of disruption of operations, recovery challenges, and overall wellbeing to all Rio Arriba County residents and first responder personnel. The consequence analysis supplements the hazard profile by analyzing specific impacts.

Table 100: Severe Weather Consequence Analysis

Subject	Potential Impacts
Impact on the Public	Severe weather can cause extensive property damage, loss of utility service, and injury. Those most at-risk are low-income and homeless individuals without shelter.
Impact on Responders	First responders may be unable to access roadways due to flooding, trees, or debris. Exposure to lightning, flooding, and high winds may cause injuries to first responders.

Table 100: Severe Weather Consequence Analysis

Subject	Potential Impacts
	Vehicles and resources may be damaged, leading to impaired response activities. In addition, road conditions may become hazardous as a result of the by-products
Continuity of Operations	Local jurisdictions maintain continuity plans which can be enacted as necessary based on the situation. Severe Weather may impact an agency's ability to maintain continuity of operations due to power outages, flooding, and wind damage. If the activation of alternate facilities was required, travel may be difficult as well as computer/network access due to long-term power outages caused by severe weather.
Delivery of Services	Delivery of services may be impaired by flooding, obstruction, and damage to roadways and resources. The ability to deliver goods and services will be impacted locally, regionally, or statewide depending on the magnitude of the event. Goods, equipment, and vehicles may become damaged during transport.
Property, Facilities, and Infrastructure	Power lines and power generators are most at risk from severe weather and impacts could result in isolated power outages or full-scale blackouts. Building and vehicle damage can occur from hail and other debris created by severe weather. Properties and critical facilities also may face foundational and physical damage due to flooding, lightning strike, or excessive winds, delaying response and recovery operations.
Impact on Environment	Waste and debris from damaged treatment infrastructure or hazardous materials facilities could contaminate sources of water and food. Debris can impact and contaminate wildlife and natural areas. Lightning strikes may also ignite fires, leading to destruction of agricultural crops, critical ecosystems, and natural habitats.
Economic Conditions	Flooding, high winds, lightning, and hail can stress local resources. Even if some of the costs can be recouped through federal reimbursements (federal disaster declaration), there is a fiscal impact on the local government.
Public Confidence in Governance	Ineffective response can decrease the public's confidence in the ability to respond and govern. Governmental response across local, state, regional, and federal levels require direct actions that must be immediate and effective to maintain public confidence.

5.13.7 Future Development

Rio Arriba County, the Ohkay Owingeh, and participating jurisdictions are experiencing consistent population decline or a static population as people increasingly migrate from rural areas to urban centers. The rural-to-urban population movement has significant implications for all participating jurisdictions, including school closures and reduced economic activity. Based on population projections, this decreasing or static population trend is expected to continue in Rio Arriba County through 2050. While unlikely, any additional growth would place additional populations at risk. Should any population increase occur, potentially vulnerable populations could face disproportionate effects.

Closely tracking population data, but tending to lag population changes, housing data is a good indicator of changing demographics and growth. Rio Arriba County, the Ohkay Owingeh, and all participating jurisdictions have generally seen static to decreasing housing growth over the previous 20-year period. Future land use planning should be proactive to address future hazard conditions. Current building codes provide for sound construction practices to mitigate potential impacts of severe weather. A continued enforcement of building codes is expected to decrease future vulnerability.

5.13.8 Mitigation Opportunities

The following table presents examples of potential actions that can be instituted for mitigating the extreme heat hazard.

Table 101: Example Severe Weather Mitigation Actions

Category	Example Action
Planning and Regulation	Review building codes and structural policies to ensure they are adequate to protect older structures from wind damage.
	Require tie-downs with anchors and ground anchors appropriate for the soil type for manufactured homes.
	Incorporate passive ventilation in the site design., which use a series of vents in exterior walls or at exterior windows to allow outdoor air to enter the home in a controlled way.

Table 101: Example Severe Weather Mitigation Actions

	Establish standards for all utilities regarding tree pruning around lines.
	Inspect utility poles to ensure they meet specifications and are wind resistant.
	Ensure the development and enforcement of building codes.
Infrastructure	Install lightning protection devices and methods, such as lightning rods and grounding, on communications infrastructure and other critical facilities.
	Install and maintain surge protection on critical electronic equipment.
	Retrofit buildings with load-path connectors to strengthen the structural frames.
	Avoid placing flag poles or antennas near buildings.
	Protect traffic lights and other traffic controls from high winds.
	Add building insulation to walls and attics.
Natural Systems	Properly maintain stream and river channels to ensure flow.
	Use living fences (e.g., rows of trees or other vegetation) to limit blowing dust and debris.
Education	Develop a lightning brochure for distribution by recreation equipment retailers or outfitters in mountainous areas.
	Educate design professionals to include wind mitigation during building design.
	Instruct property owners on how to properly install temporary window coverings.
	Produce and distribute family and traveler emergency preparedness information.
	Organize outreach to vulnerable populations, including establishing and promoting accessible shelters in the community.

5.14 Severe Winter Weather

5.14.1 Hazard Description

Severe winter weather encompasses multiple effects caused by winter storms and conditions. Included are strong winds, ice storms, heavy or prolonged snow, sleet, and extreme temperatures. Winter storms can be increasingly hazardous in areas and regions that only see winter storms intermittently.

This plan defines severe winter weather as a combination of the following effects as defined by NOAA and the NWS.



- **Ice Storm:** An ice storm is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Significant accumulations of ice pull down trees and utility lines resulting in loss of power and communication and can make travel extremely dangerous. Significant ice accumulations are usually accumulations of ¼" or greater.
- **Heavy Snow:** This generally means snowfall accumulating to 4" or more in depth in 12 hours or less; or snowfall accumulating to 6" or more in depth in 24 hours or less.
- **Winter Storm:** Hazardous winter weather in the form of heavy snow, freezing rain, or heavy sleet. It may also include extremely low temperatures and increased wind.
- **Cold Wave/Extreme Cold:** As described by NWS, a cold wave is a rapid fall in temperature within a 24-hour period requiring substantially increased protection to agriculture, industry, commerce, and social activities. As evidenced by past incidents across the U.S., extreme cold can cause impact to human life and property.

5.14.2 – Location and Extent

Severe winter weather occurs regularly throughout Rio Arriba County. These events occur on a large geographic scale, often affecting multiple counties, regions, and states. Winter storms typically form with some warning and are often anticipated. Like other large storm fronts, the severity of a storm is not as easily predicted due to myriad factors that can influence its impact. Although meteorologists estimate the amount of snowfall a winter storm will drop, it is not known exactly how much snow will fall, whether or not it will form an ice storm, or how powerful the winds will be until the storm is already affecting a community.

The Northeast Snowfall Impact Scale is a scale used to assess and rank the impact of snowfall events in the northeastern United States, but allows for an idea of intensity for Rio Arriba County. It was developed by NOAA to provide a standardized way of measuring the societal and economic impacts of snowstorms. The scale takes into account factors such as snowfall amount, population density, and the area affected by the storm to determine its impact. The scale has five categories, each with its own associated impacts:

Table 102: Snowfall Impact Scale

Category	Description	Impacts
1	Notable	Light to moderate snowfall. Limited impacts on transportation and daily life. Typically localized to small areas.
2	Significant	Moderate to heavy snowfall. Widespread impacts on transportation, including delays and disruptions. Some school and business closures. Widespread power outages are rare.
3	Major	Heavy snowfall, often exceeding one foot or more. Significant transportation disruptions, including major highway closures. Widespread school and business closures. Power outages may occur, especially in areas with wet, heavy snow.
4	Crippling	Extreme snowfall, often exceeding two feet or more. Severe and prolonged transportation disruptions, including highway closures.

Table 102: Snowfall Impact Scale

Category	Description	Impacts
		Widespread school and business closures for an extended period. Widespread and prolonged power outages, especially in areas with ice accumulation.
5	Extreme	Exceptional snowfall, often exceeding three feet or more. Complete paralysis of transportation systems, including major highways and airports. Extended school and business closures. Widespread and prolonged power outages with significant damage to the electrical infrastructure.

Source: NOAA

The scale provides information for emergency management, public safety agencies, and the public to understand the potential impacts of a snowstorm and to prepare accordingly. It helps to quantify and communicate the severity of winter weather events, especially where snowfall can have a major impact on daily life and the economy.

Ice storms are characterized by the accumulation of freezing rain or freezing drizzle, which coats surfaces with a layer of ice. These storms can have significant impacts on transportation, infrastructure, and the environment. Ice storms occur when there's a layer of warm air above a layer of cold air near the surface. Precipitation falls as rain in the warm layer and then freezes upon contact with surfaces at or below freezing temperatures in the cold layer. The most common type of precipitation during an ice storm is freezing rain. This is rain that falls as a liquid but freezes upon contact with cold surfaces, forming a layer of ice.

The Sperry–Piltz Ice Accumulation Index is an ice accumulation and ice damage prediction index that, when combined with NWS data, predicts the projected footprint, total ice accumulation, and resulting potential damage from approaching ice storms.

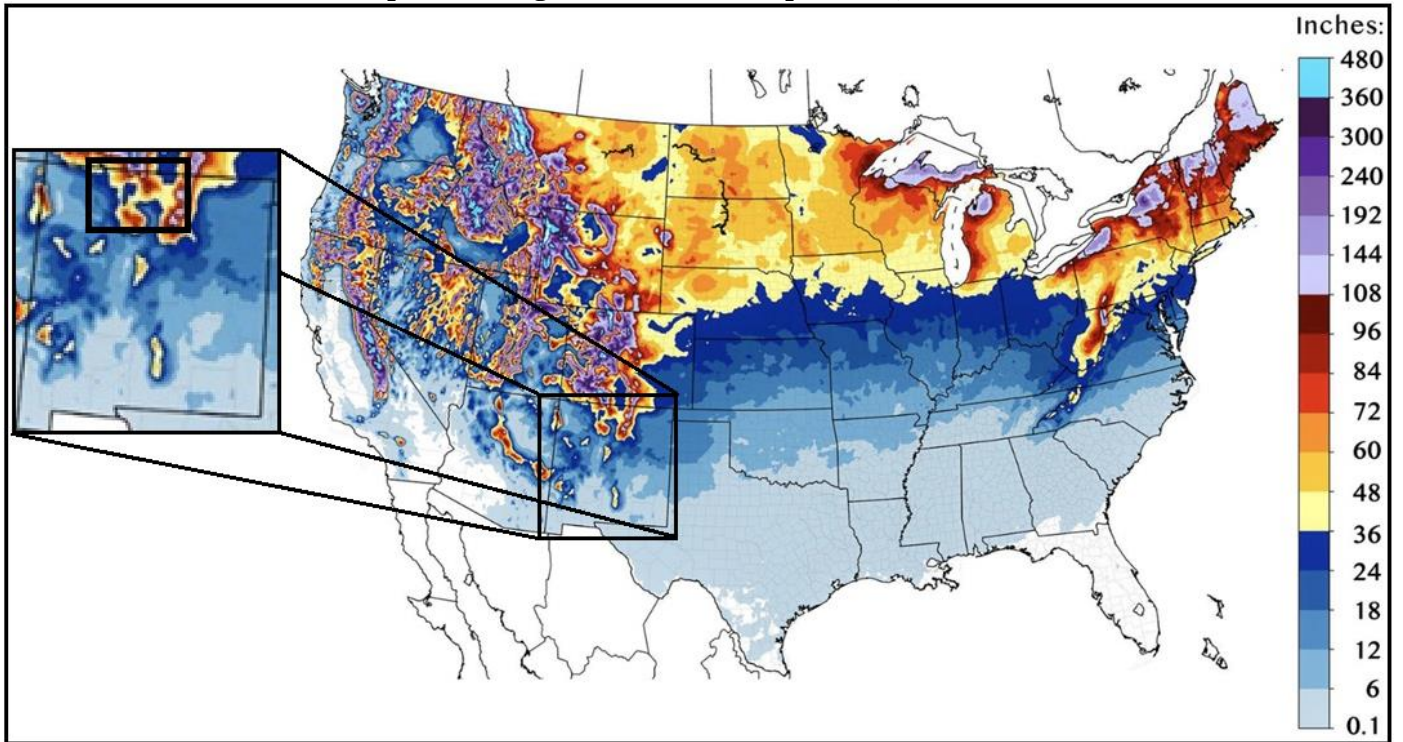
Figure 11: Sperry–Piltz Ice Accumulation Index

ICE DAMAGE INDEX	DAMAGE AND IMPACT DESCRIPTIONS
0	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
1	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
2	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
3	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting 1 – 5 days.
4	Prolonged & widespread utility interruptions with extensive damage to main distribution feeder lines & some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
5	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters needed.

Source: Sperry–Piltz Ice Accumulation Index

The following map from the NOAA National Operational Hydrologic Remote Sensing Center indicates the average annual snowfall for Rio Arriba County from 2010 - 2019:

Map 39: Average Annual Snowfall per Year, 2010 - 2019



Source: NOAA National Operational Hydrologic Remote Sensing Center

The MPC views severe winter weather as both a local and county-wide hazard. Discussions with the MPC and a review of all available data indicated severe weather is a community concern for all participating jurisdictions. The following provides a narrative of the level of jurisdictional concern:

- **Rio Arriba County:** Severe winter weather identified as a community concern as citizens, structures, and infrastructure are vulnerable. Additionally, continuing climate change may increase in their intensity.
- **Chama:** Severe winter weather identified as a community concern as citizens, structures, and infrastructure are vulnerable. Additionally, continuing climate change may increase in their intensity.
- **Espanola:** Severe winter weather identified as a community concern as citizens, structures, and infrastructure are vulnerable. Additionally, continuing climate change may increase in their intensity.
- **Ohkay Owingeh:** Severe winter weather identified as a community concern as citizens, structures, and infrastructure are vulnerable. Additionally, continuing climate change may increase in their intensity.

5.14.3 Previous Occurrences

Historical events of significant magnitude or impact can result in a Presidential Disaster Declaration. Rio Arriba County has experienced one Presidential Disaster Declaration related to severe winter weather events, reflected in the following table:

Table 103: Rio Arriba County Presidentially Declared Disasters

Designation	Declaration Date	Incident Type	Individual Assistance	Public Assistance
DR-1962-NM	3/24/2011	Severe Winter Storm, and Extreme Cold Temperature	\$1,801,838	-

Source: FEMA

-: Not reported

The President can declare an emergency for any occasion or instance when the President determines federal assistance is needed. Rio Arriba County has experienced no Emergency Declarations related to severe winter weather events.

In New Mexico, the governor has the authority to declare a state of emergency or disaster under various state statutes and provisions. The following New Mexico State of Emergencies have been declared related to severe winter weather events:

Table : Governor of New Mexico Rio Arriba Disaster Declarations, 2019 - 2024

Year	Executive Order	Incident Type
2022	2022-002	Snow
2019	2019-008	Severe Winter Storms (statewide)

Source: NMDHSEM

Additionally, the following table presents NCEI identifies severe weather and severe winter weather events and the resulting damage totals in Rio Arriba County from 1950 to 2024:

Table 104: NCEI Rio Arriba County Severe Weather Events

County	Event Type	Number of Days with Events	Property Damage	Deaths and Injuries
Rio Arriba	Blizzard	0	\$0	0
	Extreme Cold	2	\$0	0
	Ice Storm	0	\$0	0

Source: NCEI

It is worth noting that damage estimates indicated by the NCEI are often artificially low. This underreporting is a result of the way the events are reported to the NCEI, often by the local and/or NWS office. When reporting an event, the NWS office does not have access to the actual damage assessment resulting from that event. As such, the report often details a very low amount or zero-dollar amount for damages. Additionally, deaths and injuries may be underreported as they may be a result of a concurrent event, such as a person driving unsafely during heavy rain and passing away.

5.14.4 Probability of Future Events

Predicting the probability of severe weather occurrences is tremendously changing due to the large number of factors involved and the random nature of formation. Data and mapping from NOAA indicate that Rio Arriba County can expect, depending on location within the county, 18” – 84” of snow per year.

Based on historical occurrences, Rio Arriba County will continue to experience severe weather events on an annual basis. The following tables, using data from the NCEI, indicate the yearly probability of a severe weather component events, the number of deaths or injuries, and estimated property damage :

Table 105: Rio Arriba County NCEI Severe Weather Event Probability Summary

Event	Days with Event	Average Events per Year	Deaths / Injuries	Average Deaths / Injuries per Year	Property Damage	Average Property Damage per Year
Blizzard	0	0	0	0	\$0	\$0
Extreme Cold	2	<1	0	0	\$0	\$0
Ice Storm	0	0	0	0	\$0	\$0

Source: NCEI

5.14.5 Projected Changes in Location, Intensity, Frequency, and Duration

Climate change can lead to greater variability in precipitation patterns. This may result in more erratic winter storms with periods of heavy snowfall followed by rain or freezing rain. These mixed precipitation events can make winter storms more changing to predict and can lead to a greater risk of ice accumulation. Additionally, the region may experience milder winters as average temperatures rise due to climate change. While this could lead to a decrease in the frequency of traditional snowstorms, it may also increase the likelihood of winter storms that produce mixed precipitation, including freezing rain and sleet. Warmer temperatures can lead to a higher snowfall threshold, meaning that storms that would have produced snow in the past may now bring more rain or a mix of precipitation types. This can affect the accumulation of snow in the state. Changes in atmospheric circulation patterns associated with climate

change can influence the tracks of winter storms. This could lead to a shift in the amounts of heavy snowfall, ice, and other winter weather hazards.

5.14.6 Vulnerability and Impact FEMA NRI

Using the FEMA NRI, and consisting of three input components (expected annual loss, social vulnerability, and community resilience), the first table was created indicating the potential risk to Rio Arriba County and all participating jurisdictions from severe weather. In order to gain an understanding of vulnerability, the second table details the estimated annual loss data for Rio Arriba County and participating jurisdictions. To help understand the risk and vulnerability participating jurisdictions data from the FEMA NRI was run on a census tract level. As the NRI does not generate data for individual jurisdictions, census tract analysis is the closest analogue available to understand individual jurisdiction conditions.

Table 106: Participating Jurisdiction Cold Wave Risk Index

Jurisdiction	Census Tract	Risk Index	National Percentile	Events per Year
Rio Arriba County	All	Relatively Moderate	80.1	0.1
Chama	35039000500	Relatively High	92.0	0.1
Espanola	35039940700	Relatively High	93.5	0.1
Ohkay Owingeh	35039944100	Relatively High	96.9	0.1

Source: FEMA NRI

Table 107: Participating Jurisdiction Cold Wave Expected Annual Loss

Jurisdiction	Census Tract	EAL	National Percentile	Cold Wave EAL
Rio Arriba County	All	Relatively Moderate	76.1	\$260,000
Chama	35039000500	Relatively Moderate	89.9	\$26,000
Espanola	35039940700	Relatively Moderate	89.5	\$25,000
Ohkay Owingeh	35039944100	Relatively High	94.4	\$46,000

Source: FEMA NRI

Table 108: Participating Jurisdiction Ice Storm Risk Index

Jurisdiction	Census Tract	Risk Index	National Percentile	Events per Year
Rio Arriba County	All	Very Low	3.3	0
Chama	35039000500	Very Low	4.6	0
Espanola	35039940700	Very Low	5.2	0
Ohkay Owingeh	35039944100	Very Low	8.2	0

Source: FEMA NRI

Table 109: Participating Jurisdiction Ice Storm Expected Annual Loss

Jurisdiction	Census Tract	EAL	National Percentile	Ice Storm EAL
Rio Arriba County	All	Very Low	2.8	\$840
Chama	35039000500	Very Low	3.9	\$81
Espanola	35039940700	Very Low	3.7	\$76
Ohkay Owingeh	35039944100	Very Low	5.7	\$133

Source: FEMA NRI

Table 110: Participating Jurisdiction Winter Weather Risk Index

Jurisdiction	Census Tract	Risk Index	National Percentile	Events per Year
Rio Arriba County	All	Relatively Moderate	64.1	11.5
Chama	35039000500	Relatively High	93.8	13.4
Espanola	35039940700	Relatively Moderate	80.8	4
Ohkay Owingeh	35039944100	Relatively High	88.1	4

Source: FEMA NRI

Table 111: Participating Jurisdiction Winter Weather Expected Annual Loss

Jurisdiction	Census Tract	EAL	National Percentile	Winter Weather EAL
Rio Arriba County	All	Relatively Moderate	59.1	\$69,000
Chama	35039000500	Relatively High	92.1	\$15,000
Espanola	35039940700	Relatively Moderate	72.1	\$4,100
Ohkay Owingeh	35039944100	Relatively Moderate	82.9	\$7,300

Source: FEMA NRI

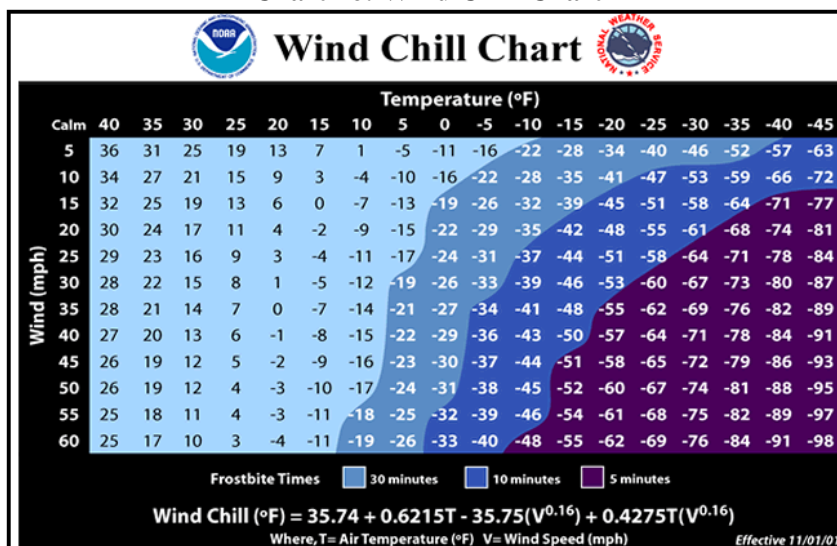
Population

Sever winter weather, and the extremely cold temperatures that often accompany it, is a threat to anyone exposed to them. Extreme cold can cause frostbite and hypothermia. Bitterly cold temperatures can also burst water and create an excessive demand on providers to deliver energy for household heating. There are also fire dangers associated with home heating. Heavy snow and/or ice can paralyze communities. Roads can become hazardous which may cause accidents, disrupted flow of supplies, and challenges in the delivery of emergency and medical services. Additional impacts on people and the community may include:

- **Injuries and Fatalities:** Slippery sidewalks, roads, and driveways can lead to slip and fall accidents, vehicle crashes, and pedestrian injuries. Exposure to extreme cold temperatures can cause frostbite, hypothermia, and cold-related illnesses, which can be life-threatening.
- **Power Outages:** Heavy snow, ice, and freezing rain can bring down power lines and disrupt electricity supply. Power outages can lead to heating and lighting challenges, particularly in extreme cold conditions.
- **Transportation Disruptions:** Winter storms can make roads and highways treacherous, leading to travel delays, accidents, and stranded motorists. Public transportation services may be disrupted, affecting commuters and essential travel.
- **Stranded or Isolated Communities:** Severe winter weather can leave communities isolated and cut off from emergency services and supplies. Residents may need to shelter in place or rely on local resources until conditions improve.
- **Health Risks:** Exposure to extreme cold can lead to a range of health risks, including frostbite, hypothermia, and cold-related illnesses. Individuals with pre-existing health conditions may face exacerbated risks.
- **Increased Heating Costs:** Cold weather can result in higher heating costs, which can be a financial burden for many households. Low-income individuals and families may struggle to afford adequate heating.
- **Disruption of Essential Services:** Severe winter weather can disrupt essential services such as healthcare, emergency response, and utilities. Hospitals may face increased patient volumes due to weather-related injuries and illnesses.

When extremely cold temperatures are accompanied by strong winds the result can be potentially lethal wind chills. Wind chill is the temperature your body feels when the air temperature is combined with the wind speed and is based on the rate of heat loss from exposed skin caused by the effects of wind and cold. As the speed of the wind increases, it can carry heat away from your body much more quickly, causing skin temperature to drop. The wind chill chart shows the difference between the actual air temperature and the perceived temperature due to wind, and amount of time until frostbite occurs.

Chart 26: Wind Chill Chart



Source: NOAA

All Rio Arriba County and participating jurisdiction populations are vulnerable to the impacts of severe weather. Please see Section 3.3: Population Data and Section 3.4: Socially Vulnerable and At-Risk Populations for data concerning jurisdictional populations.

Buildings and Structures

All buildings and structures within Rio Arriba County and participating jurisdictions can be impacted by severe winter weather. However, the location and construction of the facility will have a significant impact on the vulnerability. In general, older structures would be at higher risk of negative impacts. Some of the potential impacts include:

- **Electrical Infrastructure Damage:** Severe winter weather can damage electrical infrastructure, including power lines, transformers, and substations. This can result in widespread power outages, affecting homes, businesses, hospitals, and other critical facilities.
- **Communication Disruptions:** Severe winter weather can disrupt telecommunications infrastructure, including cell towers, data centers, and communication networks. This can impact emergency communication and coordination efforts.
- **Safety Risks:** Damage to infrastructure can pose safety risks to workers and the public. Fallen power lines, damaged buildings, and debris can be hazardous.
- **Building Damage:** Heavy snow or ice loads can cause damage to the building.

Governmental Operations

Severe winter weather can pose various risks to government operations. These risks can have significant economic and operational consequences, and can include:

- **Power Outages:** Severe winter weather can lead to power outages by damaging electrical infrastructure such as power lines and substations. Government buildings may lose power, affecting critical operations and services.
- **Flooding:** Heavy snow, or rapid melting of snow during severe winter weather can lead to flooding, which can damage government buildings and disrupt operations. Flood damage may require extensive repairs and cleanup.
- **Communication Disruptions:** Severe winter weather can damage communication equipment, including telephone lines and computer systems. This can hinder communication between government agencies and the public.
- **Transportation Disruptions:** Severe winter weather can make roads impassable due to snow or ice. This can impact the ability of government employees to commute to work.

- **Budgetary Impact:** The costs associated with repairing and restoring government buildings and infrastructure after severe winter weather can strain budgets.

Transportation and Electrical Infrastructure

Severe winter weather can have significant impacts on road infrastructure, creating changing conditions for transportation and necessitating proactive measures for maintenance and safety. Winter storms can impact road infrastructure through:

- **Snow Accumulation:** Snowfall can accumulate on road surfaces, creating slippery and hazardous conditions for drivers. Accumulated snow can reduce road visibility and make travel difficult.
- **Ice Formation:** Freezing temperatures can lead to the formation of ice on roadways, increasing the risk of accidents and making roads slippery. Black ice, which is nearly invisible, poses a particular hazard.
- **Snowdrifts:** Strong winds during winter storms can lead to the formation of snowdrifts on roads, especially in open areas. These drifts can obstruct visibility and impede traffic flow.
- **Road Surface Damage:** The freeze-thaw cycle, where melted snow refreezes, can lead to the formation of ice patches and potholes on road surfaces. This cycle can contribute to the deterioration of road infrastructure over time.
- **Freeze-Thaw Cycling:** Alternating freezing and thawing can cause the expansion and contraction of water within pavement cracks, leading to the formation and enlargement of potholes.
- **Snowplow and Deicing Operations:** Snowplows and deicing operations are necessary to clear roads and improve driving conditions. However, the use of salt and chemicals for deicing can contribute to corrosion and deterioration of road surfaces and infrastructure.
- **Infrastructure Stress:** Bridges and overpasses are particularly susceptible to ice formation due to the lack of ground contact. Winter storms can stress these structures, potentially leading to structural issues over time.

Significant cost can be incurred for snow removal from transportation routes. In smaller jurisdictions with fewer resources and equipment, the cost may be on the lower end of the spectrum, ranging from a few thousand dollars to around \$10,000 per snow event. In larger counties or urban areas with extensive road networks and higher population densities, the cost can be much higher, potentially ranging from \$10,000 to \$50,000 or more per snow event.

In general, the priority for snow removal is based on traffic volume, speed limits and road surface types. Preference is generally given in the following order:

- State trunklines
- Primary roads
- Major local roads
- Residential / subdivision streets

Severe winter weather can impact electrical utilities in various ways, potentially leading to disruptions in service. These impacts include:

- **Power Outages:** Low temperatures can strain electrical systems, leading to increased demand for heating systems. This heightened demand can overload power grids, resulting in power outages.
- **Equipment Failure:** Electrical equipment, such as cables and switches, may experience higher stress during extremely cold weather, increasing the likelihood of equipment failures.
- **Icing on Power Lines:** Ice accumulation on power lines can lead to increased weight, potentially causing lines to sag or break. This can result in power outages and safety hazards.

Mapping concerning transportation and electrical infrastructure may be found in Section 3.9: Community Lifelines and Critical Infrastructure. Information concerning the costs to repair or reconstruct transportation and electrical infrastructure may be found in Section 5.8.6.

Water and Wastewater Utilities

In general, severe winter weather components do not have a large impact on water and wastewater infrastructure and operations. However, the cascading impacts from an event such as power loss disrupting pumping and treatment capabilities, localized flooding from heavy overwhelming drainage systems, or frozen pipes in water distribution systems, can cause system disruptions.

Medical, Education, and Response Facilities

Severe winter weather can significantly impact emergency response infrastructure, creating challenges for first responders and organizations involved in managing and mitigating the effects of severe winter weather events. Winter storms can impact emergency response through:

- **Transportation Disruptions:** Snow and ice accumulation on roads can hinder the ability of emergency vehicles to navigate and reach affected areas promptly. Hazardous road conditions may result in delays in response times.
- **School Closures:** Severe winter weather can lead to the closure of schools due to hazardous conditions. This can strain caregivers and result in lower work attendance.
- **Communication Disruptions:** Severe winter weather can disrupt communication networks, affecting the ability of emergency responders to coordinate and communicate effectively. Downed power lines and damage to communication infrastructure contribute to these disruptions.
- **Power Outages:** Severe winter weather can lead to power outages. Emergency response facilities, such as command centers and fire stations, may lose power, affecting their operational capabilities.
- **Exposure:** Emergency responders face increased health and safety risks in severe winter weather conditions. Exposure to hail, high winds, extreme cold, snow, and ice can impact the well-being of responders and affect their ability to provide effective assistance.
- **Resource Allocation Challenges:** Severe winter weather often requires the allocation of additional resources, including personnel, equipment, and supplies, to address immediate needs. This can strain emergency response organizations and impact their ability to respond to other concurrent incidents.
- **Increased Demand for Services:** Severe winter weather can result in an increased demand for emergency services, including medical assistance, search and rescue operations, and responses to accidents. Emergency response organizations may need to manage a higher volume of incidents simultaneously. Severe winter weather can increase the demand for emergency shelters, particularly in cases of widespread power outages. Setting up and managing these shelters can strain resources.

Communication Systems

All communication systems within Rio Arriba County are at risk to severe winter weather. Severe winter weather can disrupt vital communications system, affecting reliability and functionality. Some of the key vulnerabilities include:

- **Physical Infrastructure Damage:** Heavy snow or ice conditions can cause physical damage to communication infrastructure such as cell towers, antennas, cables, and data centers. This damage can result in network outages and disruptions.
- **Power Outages:** Severe winter storms often lead to power outages, which can affect the operation of communication networks. Without a stable power supply, cell towers, data centers, and other critical components may become non-functional, leading to service interruptions.
- **Signal Interference:** Severe winter storms can create electromagnetic interference that disrupts radio signals used in wireless communication. This interference can lead to poor signal quality, dropped calls, and slower data speeds.
- **Loss of Backhaul Connectivity:** Severe winter weather events can damage the backhaul infrastructure that connects various communication nodes. This backbone infrastructure is crucial for transmitting data between local and regional networks, and any disruption can impact overall network performance.
- **Communication Tower Instability:** Heavy snow and ice loads can compromise the stability of communication towers. If towers are not designed to withstand severe weather, they may collapse, leading to network outages.

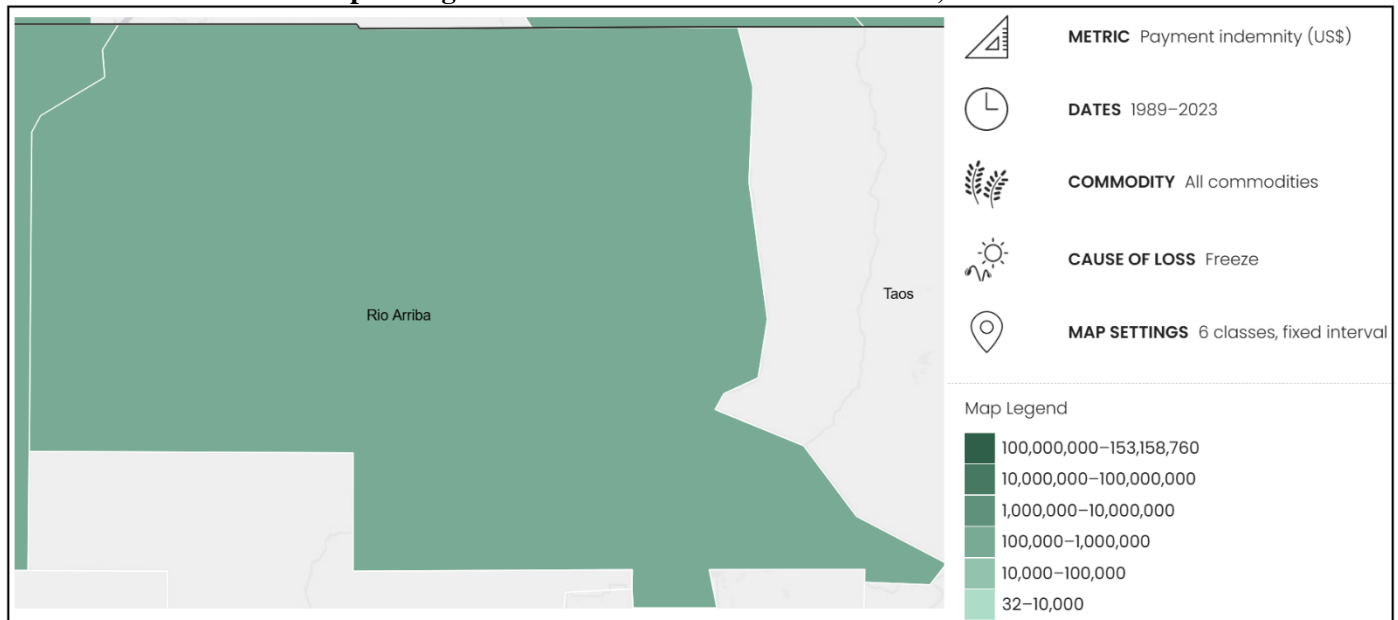
- **Network Congestion:** In the event of a disaster, communication networks may experience a surge in usage as people attempt to contact emergency services, friends, and family. This increased demand can lead to network congestion, making it difficult for users to connect.

The cost to repair communications networks can vary widely depending on the extent of the damage, the size of the network, and the specific technologies involved. Repair costs may include expenses for labor, equipment replacement or repair, materials, and any additional resources required to restore the network to full functionality. Estimated repair cost from the U.S. Department of Homeland Security Cybersecurity and Infrastructure Security Agency may be found in Section 5.8.6.

Environmental and Agricultural Impacts

Severe winter weather conditions can cause significant agricultural impacts. The following map from the United States Department of Agriculture details total county-wide agricultural losses, by county, due to freeze events from 1989 - 2023:

Map 40: Agricultural Losses Due to Freeze Events, 1989 - 2023



Source: USDA

Severe winter weather can have various impacts on the environment, particularly in regions prone to cold and snowy winters. These impacts can affect ecosystems, wildlife, and natural resources and can include habitat disruption, reduction of food sources, changes in migration patterns, and damage to foliage (especially if a spring storm). Additionally, the use of salt and de-icing chemicals on roads and sidewalks can have negative environmental impacts. These chemicals can find their way into nearby water bodies, leading to water pollution and harm to aquatic ecosystems. Snowmelt can also introduce pollutants from roadways and urban areas into rivers and streams, leading to reduced water quality. Elevated sediment levels and changes in water temperature can also affect aquatic life.

Jurisdictional Concerns:

As of this plan there is a deficit of community specific data to help quantify both vulnerability and historic impact. However, over the life of this plan the MPC will work to quantify the local level impacts of hazard occurrences to citizens, vulnerable populations, structures, and infrastructure to better inform both this living LHMP and future planning efforts. The following initial vulnerabilities and potential impacts have been identified on a jurisdictional level:

- **Chama:** With 16.5% of citizens living in poverty, severe winter weather and the associated property damage may disproportionately impact them due to underinsurance. Additionally, severe weather may impact tourism and impact popular community events like the Western Heritage Days and the Snoball Rally, lowering potential

community revenue. With limited access and services, severe weather may cut the community off from necessary services due to limited road access

- **Espanola:** With 23.4% of citizens living in poverty, severe winter weather and the associated property damage may disproportionately impact them due to underinsurance. Additionally, severe weather may impact tourism and impact popular community events Electric Light Festival, lowering potential community revenue. With limited response services, severe weather may affect overall community response and recovery.
- **Ohkay Owingeh:** With 20.6% of citizens living in poverty, severe winter weather and the associated property damage may disproportionately impact them due to underinsurance. Additionally, severe weather may impact tourism and impact popular community events like the Christmas Celebration, lowering potential community revenue. With limited response services, severe weather may affect overall community response and recovery.

Cascading Impacts

Cascading impacts often result when one a hazard event triggers one or more differing hazard events or loss of community lifelines. Cascading impacts associated with severe weather may include:

- Direct physical damage to buildings and structures:
- Transportation infrastructure disruption
- Power outages and electrical grid disruption
- Communication system disruption
- Transportation and supply chain disruptions
- Environmental and ecological damage
- Economic impacts and business closures
- Emergency services overload

Consequence Analysis

This consequence analysis lists the potential impacts of a hazard on various elements of a community. The impact of each hazard is evaluated in terms of disruption of operations, recovery challenges, and overall wellbeing to all Rio Arriba County residents and first responder personnel. The consequence analysis supplements the hazard profile by analyzing specific impacts.

Table 112: Severe Winter Weather Consequence Analysis

Subject	Potential Impacts
Impact on the Public	Freezing temperatures coupled with heavy snow accumulation can cause dangerous travel conditions, leading to accidents and road closures. Downed power lines can lead to a loss of electricity and heat, with the young and the elderly especially vulnerable. Extremely cold temperatures may lead to hypothermia and death.
Impact on Responders	Dangerous road conditions create transportation challenges for first responders. First responders will need to control their own exposure to the elements for prolonged periods of time and will need to continuously seek heat and shelter to stay warm. Equipment may also be damaged or destroyed due to cold temperatures, heavy wind, ice, and heavy snowfall, which may lead to a decrease in response capabilities.
Continuity of Operations	Local jurisdictions maintain continuity plans which can be enacted as necessary. Severe winter weather may impact an agency's ability to maintain operations due to power outages and transportation difficulties. If the activation of alternate facilities was required, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.
Delivery of Services	The ability to deliver services can be impacted locally, regionally, or statewide depending on the severity of the severe winter weather event. Dangerous road conditions may lead to roadway and bridge closures, as well as transit service disruptions. Businesses and places of commerce may completely shut down, which leads to the disruption of goods and services.

Table 112: Severe Winter Weather Consequence Analysis

Subject	Potential Impacts
Property, Facilities, and Infrastructure	Transportation, governmental operations, and communications may be heavily disrupted. Roads and bridges may be heavily impacted by severe winter weather, and may be completely obstructed by downed trees, powerlines, and snow accumulation. Snow and ice can impact access to homes and critical facilities such as hospitals, schools, and supermarkets. Power loss can lead to disruption of critical infrastructure and technology.
Impact on Environment	Heavy snow and ice accumulation can weigh down and damage vegetation, tree limbs, and power lines. Flooding may also occur after the rapid melting of a heavy snowfall, causing bodies of water to flood, damaging the surrounding areas. Exposure to extreme winter weather may result in animal death. Chemicals used to treat roadways may contaminate natural environments and water reservoirs if used in large quantities.
Economic Conditions	Severe winter weather poses a fiscal impact on the governments, even if some of those costs can be recouped through federal grant reimbursements. Local, county, and state resources may be drained by a severe winter weather event.
Public Confidence in Governance	The public's confidence in governance is affected by immediate local and state response through direct and effective actions. Efficiency in response and recovery operations is critical in keeping public confidence high.

5.14.7 Future Development

Rio Arriba County, the Ohkay Owingeh, and participating jurisdictions are experiencing consistent population decline or a static population as people increasingly migrate from rural areas to urban centers. The rural-to-urban population movement has significant implications for all participating jurisdictions, including school closures and reduced economic activity. Based on population projections, this decreasing or static population trend is expected to continue in Rio Arriba County through 2050. While unlikely, any additional growth would place additional populations at risk. Should any population increase occur, potentially vulnerable populations could face disproportionate effects.

Closely tracking population data, but tending to lag population changes, housing data is a good indicator of changing demographics and growth. Rio Arriba County, the Ohkay Owingeh, and all participating jurisdictions have generally seen static to decreasing housing growth over the previous 20-year period. Future land use planning should be proactive to address future hazard conditions. Current building codes provide for sound construction practices to mitigate potential impacts of severe winter weather. A continued enforcement of building codes is expected to decrease future vulnerability.

5.14.8 Mitigation Opportunities

The following table presents examples of potential actions that can be instituted for mitigating the extreme heat hazard.

Table 113 : Example Severe Winter Weather Mitigation Actions

Category	Example Action
Planning and Regulation	Review building codes and structural policies to ensure they are adequate to protect older structures from snow loads.
	Require tie-downs with anchors and ground anchors appropriate for the soil type for manufactured homes.
	Incorporate passive ventilation in the site design to allow outdoor air to enter the home in a controlled way.
	Establish standards for all utilities regarding tree pruning around lines.
	Inspect utility poles to ensure they meet specifications and are ice resistant.
	Ensure the development and enforcement of building codes for roof snow loads.
Infrastructure	Protect traffic lights and other traffic controls from ice.
	Add building insulation to walls and attics.
Natural Systems	Property maintain stream and river channels to ensure flow.

Table 113 : Example Severe Winter Weather Mitigation Actions

	Use snow fences or “living snow fences” (e.g., rows of trees or other vegetation) to limit blowing and drifting of snow over critical roadway segments.
Education	Develop a winter weather brochure for distribution by recreation equipment retailers or outfitters in mountainous areas.
	Educate design professionals to include snow mitigation during building design.
	Instruct property owners on how to properly install temporary window coverings before a storm.
	Produce and distribute family and traveler emergency preparedness information about severe winter weather hazards.
	Organize outreach to vulnerable populations, including establishing and promoting accessible heating centers in the community.

5.15 Wildfires

5.15.1 Hazard Description

The National Weather Service defines a wildfire as any free burning uncontrollable wildland fire not prescribed for the area which consumes the natural fuels and spreads in response to its environment. They can occur naturally and through human action. Population de-concentration in the U.S. has resulted in rapid development in the outlying fringe of urban areas and in rural areas with attractive recreational and aesthetic amenities, especially forests. This expansion has increased the likelihood that wildfires will threaten life and property.



According to the National Park Service there are three classifications of wildfires:

- **Surface Fire:** Burning which may spread rapidly and ignite leaf litter, fallen branches and other fuels located at ground level.
- **Ground Fire:** Burning of organic matter in the soil beneath the surface.
- **Crown Fire:** Burning through the top layer (canopy) of trees. Crown fires, which can be very intense and difficult to contain, require strong winds, steep slopes, and large amounts of fuel to burn.

Wildfires are strongly influenced by multiple factors, including:

- **Weather:** Factors such as relative humidity, wind speed, ambient temperature and precipitation all influence the formation and growth of wildfires.
- **Topography:** Natural features, such as canyons or ridges, can increase the spread rate of a fire by funneling or drawing heated air and fire.
- **Fuel Type, Distribution and Moisture:** Available fuels, the spacing and density of available fuels, and fuel moisture content can determine spread rates and intensity of wildfires.
- **Drought Conditions:** Drought tends to increase both the likelihood and severity of wildfires.

Fire science distinguishes between wildland fires and wildland urban interface (WUI) fires. The primary difference between a wildland fire and a WUI fire lies in their location and the type of areas they impact:

- **Wildland Fire:**
 - **Definition:** A wildland fire occurs in undeveloped, natural areas such as forests, grasslands, and shrublands. It is driven by natural fuels like trees, grass, brush, and dead vegetation.
 - **Characteristics:** These fires are often started by natural causes (lightning) or human activity (campfires, equipment use). They can spread rapidly depending on fuel, weather conditions (wind and temperature), and topography.
 - **Impact Area:** Wildland fires primarily affect forests and other natural ecosystems, causing habitat loss, ecosystem changes, and environmental damage, though they can also impact air quality over a large region.
- **WUI Fire:**
 - **Definition:** A WUI fire occurs where wildland areas meet or intermingle with human development. It involves not only natural vegetation but also structures (homes, businesses, infrastructure).
 - **Characteristics:** These fires are especially dangerous because they can ignite homes, buildings, and other man-made structures, often in suburban or rural areas where homes are built near forests or brush.
 - **Impact Area:** WUI fires are particularly destructive to property and can result in large-scale evacuations and property loss. They are challenging for firefighters because of the dual threat to both natural landscapes and human communities.

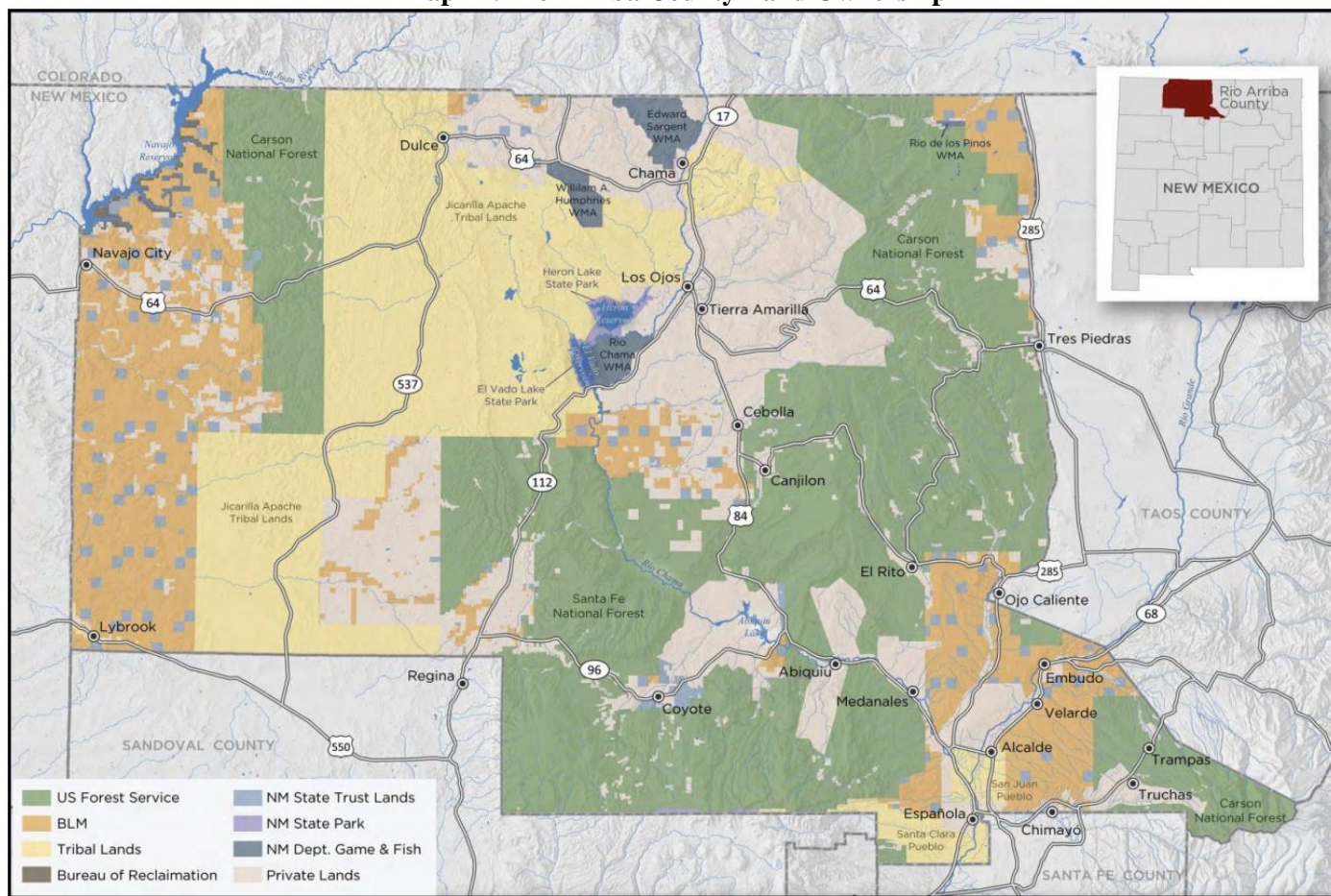
5.15.2 – Location and Extent

Land ownership plays a crucial role in wildfire management, where multiple agencies manage large tracts of land. Ownership determines which agency has the primary responsibility for fire prevention, firefighting, and post-fire recovery. Large wildfires often require coordination between federal, state, county, and local firefighting teams. Here's how different types of land ownership impact wildfire management:

- **Federal Land:**
 - Responsibility: Federal agencies like the U.S. Forest Service, Bureau of Land Management, and National Park Service are responsible for managing wildfires on federal lands.
 - Firefighting Resources: These agencies often have extensive resources for fire suppression, including trained personnel, equipment, and aerial support. They coordinate with each other for large-scale fires that cross multiple jurisdictions.
 - Policies: Federal policies, like prescribed burns and fuel reduction programs, help manage wildfire risk. However, policies may vary depending on the agency's objectives, such as forest preservation, recreational use, or habitat conservation, influencing how aggressively fires are fought.
- **State Land**
 - Responsibility: State agencies, such as the New Mexico State Forestry Division, are responsible for wildfires on state lands and often assist in fire suppression on neighboring lands.
 - Coordination: State agencies frequently collaborate with federal, county, and local firefighting teams, especially in areas where state land borders other jurisdictions.
 - Funding: State budgets influence the resources available for firefighting. During intense wildfire seasons, states may need to request additional federal funds or assistance to handle large fires.
- **County Land**
 - Local Fire Departments: Counties often rely on local fire departments or volunteer fire departments for initial fire response on county lands.
 - Limited Resources: Many county fire agencies have fewer resources than federal or state agencies, meaning they might depend on state or federal assistance for large fires.
 - Fire Codes and Ordinances: Counties can set fire prevention rules, like burn bans or building codes in fire-prone areas, which impact local wildfire risk.
- **Private Land**
 - Landowner Responsibility: Private landowners bear responsibility for maintaining defensible space around structures, following local fire ordinances, and reducing fire hazards on their property.
 - Coordination for Protection: Private lands are often close to public lands, so fire prevention and suppression strategies need coordination to protect both areas. Landowners may participate in cooperative agreements with federal or state agencies for shared fire protection efforts.
 - Limited Access to Resources: Private landowners may have limited resources for wildfire suppression and rely heavily on nearby public agencies for help in case of a wildfire.

The following map, from the Rio Arriba County Community Wildfire Protection Plan, details land ownership within Rio Arriba County:

Map 41: Rio Arriba County Land Ownership



Source: Rio Arriba County Community Wildfire Protection Plan

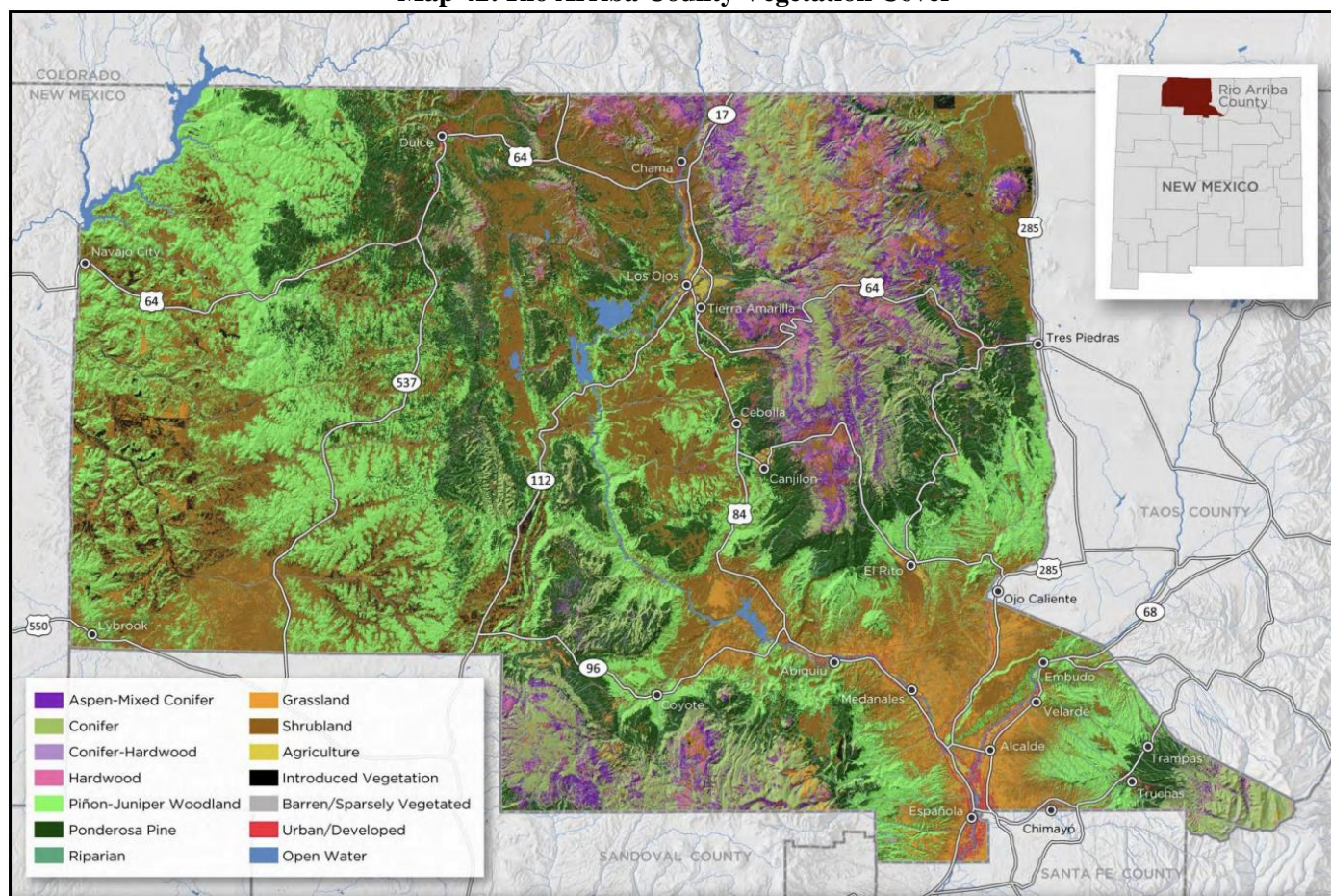
Vegetation types are closely related to wildfire occurrence because they directly influence the availability of fuel, the intensity of the fire, and its potential spread. Different vegetation types have distinct characteristics in terms of flammability, moisture content, and fuel load, all of which determine how easily they can catch fire and how a wildfire behaves. The following provides an overview of how specific vegetation types impact wildfire occurrence:

- **Grasslands:** Dominated by fine, fast-drying fuels like grasses, they have a relatively low fuel load but dry out quickly and ignite easily. Fires in grasslands tend to spread rapidly but burn with lower intensity because the available fuel is less dense. The fast-moving nature of grass fires can make them dangerous, especially in windy conditions.
- **Shrublands:** These areas consist of dense shrubs, small trees, and brush with a high content of oils and resins, which are highly flammable. Chaparral is particularly common in New Mexico and other Mediterranean climates. Fires in chaparral ecosystems are intense, producing extreme heat and flames that can rapidly spread. These fires often exhibit "crown fire" behavior, where the fire moves through the canopy, jumping from shrub to shrub.
- **Forests:** Forests provide heavy fuel loads in the form of trees, dead wood, leaf litter, and underbrush. The type of forest plays a significant role in fire behavior. Coniferous Forests, particularly with species like pines and firs, tend to have higher resin content, making them highly flammable. They also shed needles that dry out and accumulate on the forest floor, increasing fire risk. Deciduous Forests typically have lower flammability due to higher moisture content in leaves and less resin. However, during dry seasons, they can still support wildfires, especially if there's significant leaf litter. Forest fires can vary from low-intensity surface fires that burn ground-level fuels to high-intensity crown fires that spread through the tree canopy.

- **Dry Forests:** These ecosystems, such as pinyon-juniper woodlands or oak woodlands, are characterized by low-density tree cover, and can have significant understory fuels, especially in drought conditions. Fires in these areas are moderate to high intensity and can spread quickly if the understory is dense or dry.
- **Urban and Agricultural Areas:** While urban areas are not typically thought of as wildland, many are located near or within WUI zones, where wildfires from surrounding natural vegetation can spread into developed areas. Fires in these areas can spread from wildlands into structures, significantly increasing the damage potential. Vegetation in agricultural lands can also burn, especially during dry periods.

The following map, from the Rio Arriba County Community Wildfire Protection Plan, details vegetation cover throughout the county:

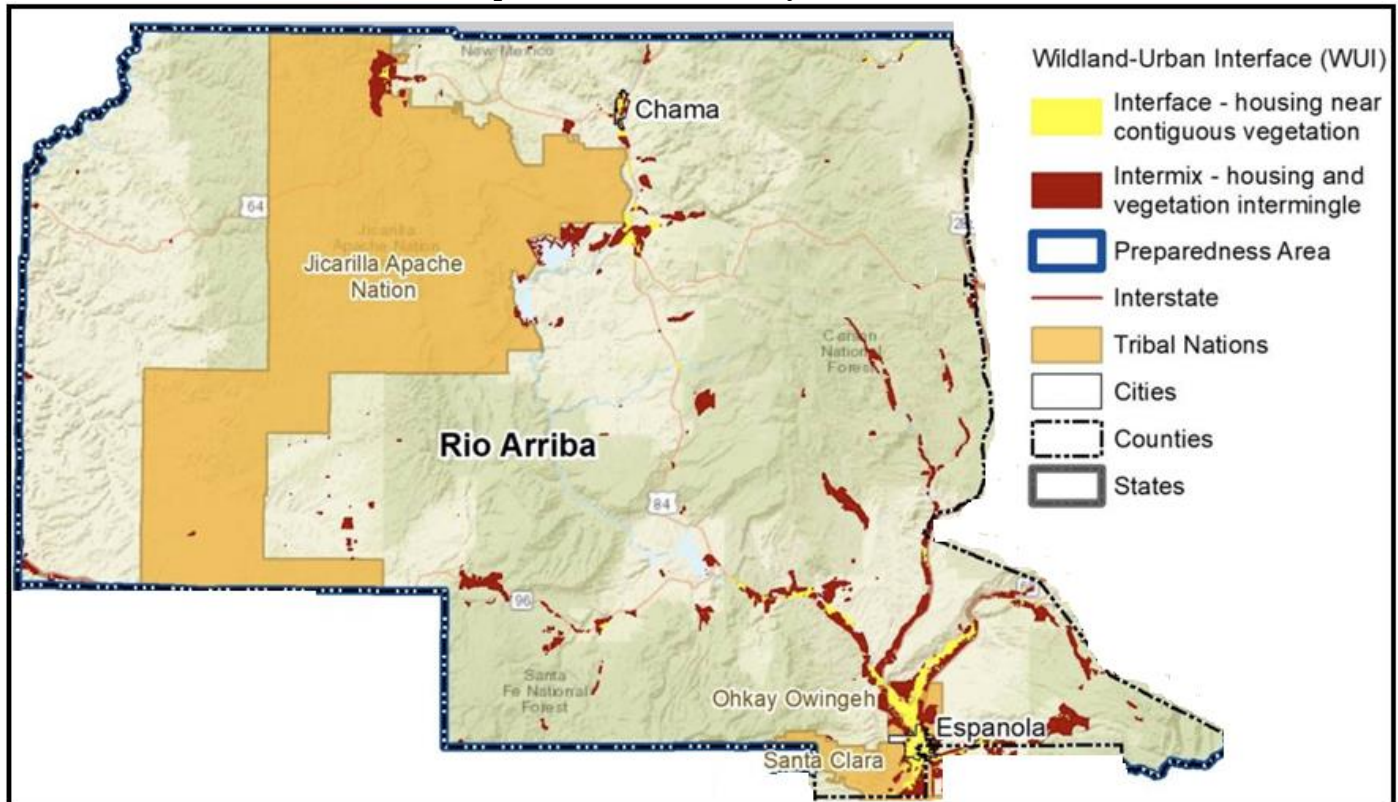
Map 42: Rio Arriba County Vegetation Cover



Source: Rio Arriba County Community Wildfire Protection Plan

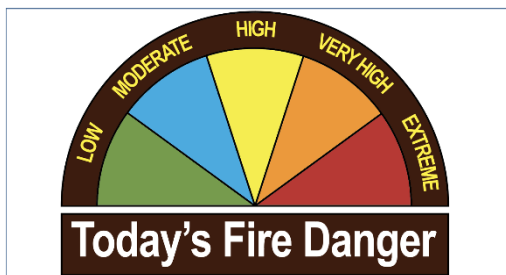
The WUI is the area where human improvements such as homes, ranches and farms come in contact with the wildlands. The WUI creates an environment in which fire can move readily between structure and vegetation fuels, often resulting in massive fires, or conflagrations, that may lead to widespread evacuations. The expansion of the WUI in recent decades has significant implications for wildfire management and its impact. There are two types of WUI, intermixed and interface. Intermix WUI are areas where housing and vegetation intermingle, and interface WUI are areas with housing in the vicinity of dense, contiguous wildland vegetation. The following map illustrates WUI areas throughout the Rio Arriba County:

Map 43: Rio Arriba County WUI Areas



Source: State of New Mexico

The duration of a wildfire depends on the weather conditions, how dry it is, the availability of fuel to spread, and the ability of responders to contain and extinguish the fire. Historically, some wildfires have lasted only hours, while other fires have continued to spread and grow for an entire season. They spread quickly and often begin unnoticed until they have grown large enough to signal by dense smoke. If fuel is available, and high wind speeds hit, a wildfire can spread over a large area in a very short amount of time. These factors make the difference between small upstart fires easily controlled by local fire services to fires destroying thousands of acres requiring multiple state and federal assets for containment and suppression.



The National Fire Danger Rating System allows fire managers to estimate today's or tomorrow's fire danger for a given area. It combines the effects of existing and expected states of selected fire danger factors into one or more qualitative or numeric indices that reflect an area's fire protection needs. It links an organization's readiness level (or pre-planned fire suppression actions) to the potential fire problems of the day. The following is a brief explanation of the different fire danger levels based on criteria established by the National Fire Danger Rating System.

Table 114: National Fire Danger Rating System

Rating	Description
Low	Fuels do not ignite easily from small embers, but a more intense heat source, such as lightning, may start fires in duff or dry rotten wood. Fires in open, dry grasslands may burn easily a few hours after a rain, but most wood fires will spread slowly, creeping or smoldering. Control of fires is generally easy.
Moderate	Fires can start from most accidental causes, but the number of fire starts is usually pretty low. If a fire does start in an open, dry grassland, it will burn and spread quickly on windy days. Most wood fires will spread slowly to moderately. Average fire intensity will be

Table 114: National Fire Danger Rating System

Rating	Description
	moderate except in heavy concentrations of fuel, which may burn hot. Fires are still not likely to become serious and are often easy to control.
High	Fires can start easily from most causes and small fuels (such as grasses and needles) will ignite readily. Unattended campfires and brush fires are likely to escape. Fires will spread easily, with some areas of high intensity burning on slopes or concentrated fuels. Fires can become serious and difficult to control unless they are put out while they are still small.
Very High	Fires will start easily from most causes. The fires will spread rapidly and have a quick increase in intensity, right after ignition. Small fires can quickly become large fires and exhibit extreme fire intensity, such as long-distance spotting and fire whirls. These fires can be difficult to control and will often become much larger and longer-lasting fires.
Extreme	Fires of all types start quickly and burn intensely. All fires are potentially serious and can spread very quickly with intense burning. Small fires become big fires much faster than at the "very high" level. Spot fires are probable, with long-distance spotting likely. These fires are very difficult to fight and may become very dangerous and often last for several days.

Source: Wildfire Fire Assessment System

The severity of wildfire depends on several quickly changing environmental factors. It is impossible to strategically estimate the severity of a wildfire as these factors, including drought conditions and wind speed, have such a great influence on the wildfire conditions. The Characteristic Fire Intensity Scale within the Southern Wildfire Risk Assessment Summary Report specially identifies areas where significant fuel hazards and associated dangerous fire behavior potential exist based on a weighted average of four percentile weather categories.

The following table details the range of wildfire intensity:

Table 115: Characteristic Fire Intensity Scale

Class	Description
Class 1- Very Low	Very small, discontinuous flames, usually less than 1 foot in length; very low rate of spread; no spotting. Fires are typically easy to suppress by firefighters with basic training and non-specialized equipment.
Class 2- Low	Small flames, usually less than two feet long; small amount of very short-range spotting possible. Fires are easy to suppress by trained firefighters with protective equipment and specialized tools.
Class 3- Moderate	Flames up to 8 feet in length; short-range spotting is possible. Trained firefighters will find these fires difficult to suppress without support from aircraft or engines, but dozer and plows are generally effective. Increasing potential for harm or damage to life and property.
Class 4 - High	Large Flames, up to 30 feet in length; short-range spotting common; medium range spotting possible. Direct attack by trained firefighters, engines, and dozers are generally ineffective, indirect attack may be effective. Significant potential for harm or damage to life and property
Class 5- Very High	Very large flames up to 150 feet in length; profuse short-range spotting, frequent long-range spotting; strong fire-induced winds. Indirect attack marginally effective at the head of the fire. Great potential for harm or damage to life and property.

Source: Southern Wildfire Risk Assessment Summary Report

A Red Flag Warning is an alert issued by the National Weather Service to indicate that critical fire weather conditions are either occurring or expected shortly. A Red Flag Warning is typically issued when the following conditions are met:

- **Low relative humidity (often below 15%):** Dry air makes vegetation more likely to ignite and sustain fire.
- **High winds (usually sustained winds above 25 mph):** Winds can quickly spread embers and flames, helping fires move faster and become more intense.
- **Dry vegetation:** Vegetation such as grass, shrubs, and trees become highly flammable when moisture levels are low, creating ideal conditions for fires to ignite and spread.

- **High temperatures:** Hot weather exacerbates dryness and lowers fuel moisture, increasing fire potential.

When a Red Flag Warning is issued, it means that the potential for wildfire ignition and rapid spread is extremely high. The warning often leads to heightened preparedness among firefighting agencies and advisories for the public to avoid activities that could spark fires, such as outdoor burning or using machinery that could create sparks.

The State Forestry Division's Fire Policy and Procedures established the Wildland Fire Readiness Levels as a method for dictating the overall preparedness levels for the Division. District Foresters and District Fire Management Officers shall assess the following criteria in determining readiness levels:

- Current and long-range forecasted weather
- Current and forecasted fire behavior
- Current and trend of five-day average energy release component
- Comparison of current and trend of the seasonal ERC chart
- Southwest Area preparedness levels
- Individual agency or district fire activity

Because of the extreme geographical and topographical differences in the State, the districts may be at different levels of fire readiness throughout the year. District Foresters and District Fire Management Officers shall determine fire readiness levels for their respective districts as determined by the following criteria and notify the State Fire Management Officer of the situation.

Fire Readiness Level 1:

- Most areas have low fire danger.
- Fire activity is light (occasional A, B, and C class fires) and all wildland fires are of short duration, usually lasting only one burning period.
- Moisture content in light fuels is high and heavy fuels are moist.
- State resources and interagency dispatch center cooperators are capable of handling fire incidents with minimum staffing levels.
- Initial attack forces are suppressing wildland fires.
- There is little or no commitment of State resources besides volunteer fire departments.
- Energy release component -5 day mean average is consistently below 30.

Fire Readiness Level 2:

- Fire danger is moderate.
- Class A, B, and C fires may occur and the potential exists for escapes to become larger but only have a potential duration of two burning periods.
- Heavy fuels are drying; frontal system winds increase the potential for rapid fire spread over a 36 to 48 hour period.
- State and volunteer fire department resources with limited assistance from the individual dispatch centers are capable of handling the situation.
- Fire department cooperators provide initial attack.
- High wind warnings and "Red Flag" alerts the National Weather Service issues are indicators that the districts may need additional resources.
- Energy release component 5-day mean average is consistently between 30 and 45.

Fire Readiness Level 3:

- Generally, all agencies are experiencing high fire danger.
- Numerous A, B, and C class fires, with a high potential for wildland fires to become Class D or larger in size, that may require additional resources.

- Light fuels are cured and heavy fuels are rapidly drying.
- Fires are escaping initial attack on a consistent basis and require extended attack support.
- The initial attack dispatch centers are requesting additional resources to increase initial attack capabilities.
- Federal cooperators provide critical initial attack and extended attack support during fire suppression.
- FEMA Fire Suppression Grants apply to urban/interface fires. The State Forester initiates FEMA Presidential Emergency Declaration requests.
- Energy release component 5 day mean average is consistently between 45 and 60.

Fire Readiness Level 4:

- Division and cooperating agencies are experiencing very high or greater fire danger.
- Numerous A, B, C, and D class fires that have the potential to exhaust dispatch area, State, Southwest Area, and national resources are common within the region.
- Division personnel implement and enforce fire restrictions.
- The Division may have Type 1 and Type 2 Incident Management Teams committed to incidents under this readiness level within the State.
- Energy release component -5 day mean average is consistently between 60 and 80.

Fire Readiness Level 5:

- All criteria for Fire Readiness Level 4 plus the following additional criteria are met:
- Fire danger is extreme throughout the State and region.
- Several dispatch centers and agencies are experiencing major fires and national resources are exhausted.
- Air resources are in short supply.
- Fire restrictions require closures.
- Emergency Operations Center is activated.
- Area Command has been implemented.
- High potential for catastrophic fires exists.
- Extreme fire behavior, scarce resources, and extremely unsafe working conditions for fire fighters hinder efforts of Type 1 and 2 Incident Management Teams.
- A multi-agency Coordination (MAC) Group is allocating resources to high priority fires.
- Energy release component 5 day average is consistently at or above 80.

The MPC views wildfire as a local, county-wide, and regional hazard. Discussions with the MPC and a review of all available data indicated wildfire is a community concern for all participating jurisdictions. The following provides a narrative of the level of jurisdictional concern:

- **Rio Arriba County:** Wildfire identified as a community concern as citizens, structures, and infrastructure are vulnerable. Additionally, continuing climate change resulting in higher temperatures and increased occurrence of drought conditions is likely to exacerbate this concern.
- **Chama:** Wildfire identified as a community concern as citizens, structures, and infrastructure are vulnerable. Additionally, continuing climate change resulting in higher temperatures and increased occurrence of drought conditions is likely to exacerbate this concern.
- **Espanola:** Wildfire identified as a community concern as citizens, structures, and infrastructure are vulnerable. Additionally, continuing climate change resulting in higher temperatures and increased occurrence of drought conditions is likely to exacerbate this concern.

- **Ohkay Owingeh:** Wildfire identified as a community concern as citizens, structures, and infrastructure are vulnerable. Additionally, continuing climate change resulting in higher temperatures and increased occurrence of drought conditions is likely to exacerbate this concern.

5.15.3 Previous Occurrences

Historical events of significant magnitude or impact can result in a Presidential Disaster Declaration. Rio Arriba County has experienced one Presidential Disaster Declaration related to wildfire events:

Table 116: Rio Arriba County Presidentially Declared Disasters

Designation	Declaration Date	Incident Type	Individual Assistance	Public Assistance
DR-4795-NM	06/202/2024	New Mexico South Fork and Salt Fire	\$7,628,322	-

The President can declare an emergency for any occasion or instance when the President determines federal assistance is needed. Emergency Declarations supplement State and local or Indian tribal government efforts in providing emergency services, such as the protection of lives, property, public health, and safety, or to lessen or avert the threat of a catastrophe. The following table details wildfire Emergency Declarations for Rio Arriba County.

Table 117: Rio Arriba County Emergency Declarations

Designation	Declaration Date	Incident Type	Public Assistance
EM-3154-NM	5/10/2000	New Mexico Fire	-

Source: FEMA

The Governor, or the Governor's Authorized Representative, may submit a request for a fire management assistance declaration as required. FEMA will approve declarations for fire management assistance when it is determined that a fire or fire complex on public or private forest land or grassland threatens such destruction as would constitute a major disaster. The MPC reviewed the historical fire management declarations to assist in hazard identification. The following table details fire management declarations for Rio Arriba County:

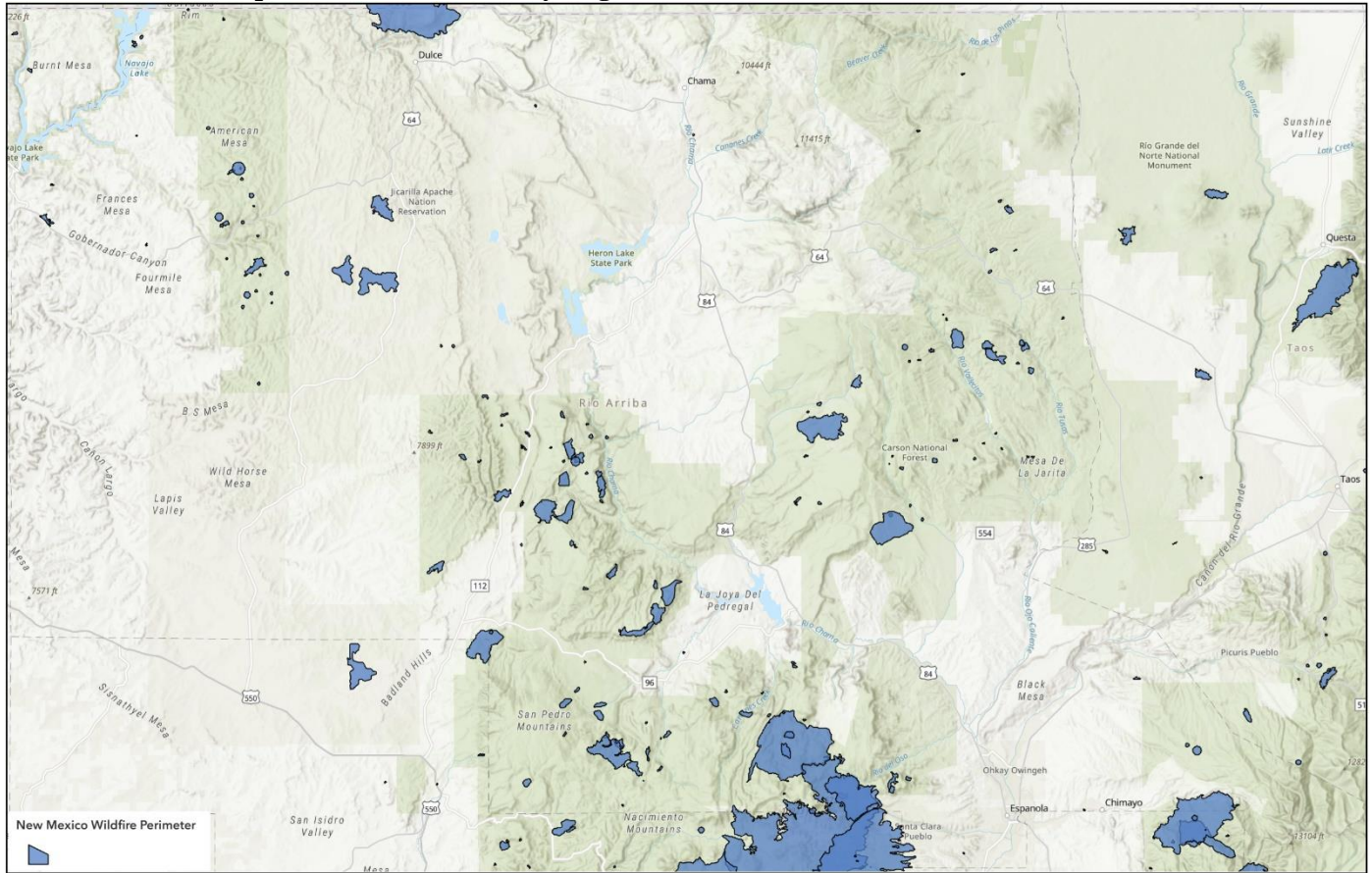
Table 118: Rio Arriba Fire Management Declarations

Designation	Declaration Date	Incident Type	Public Assistance
FM-2993-NM	6/26/2011	New Mexico Las Conchas Fire	\$1,651,694
FM-2408-NM	5/23/2002	New Mexico Borrego Fire	\$958,865
FM-1329-NM	5/13/2000	New Mexico Wildfire	\$5,652,344

Source: FEMA

The following map details historic wildfire perimeters for Rio Arriba County from 2019 – 2023:

Map 44: Rio Arriba County Region Historic Wildfire Perimeters, 2019 - 2023



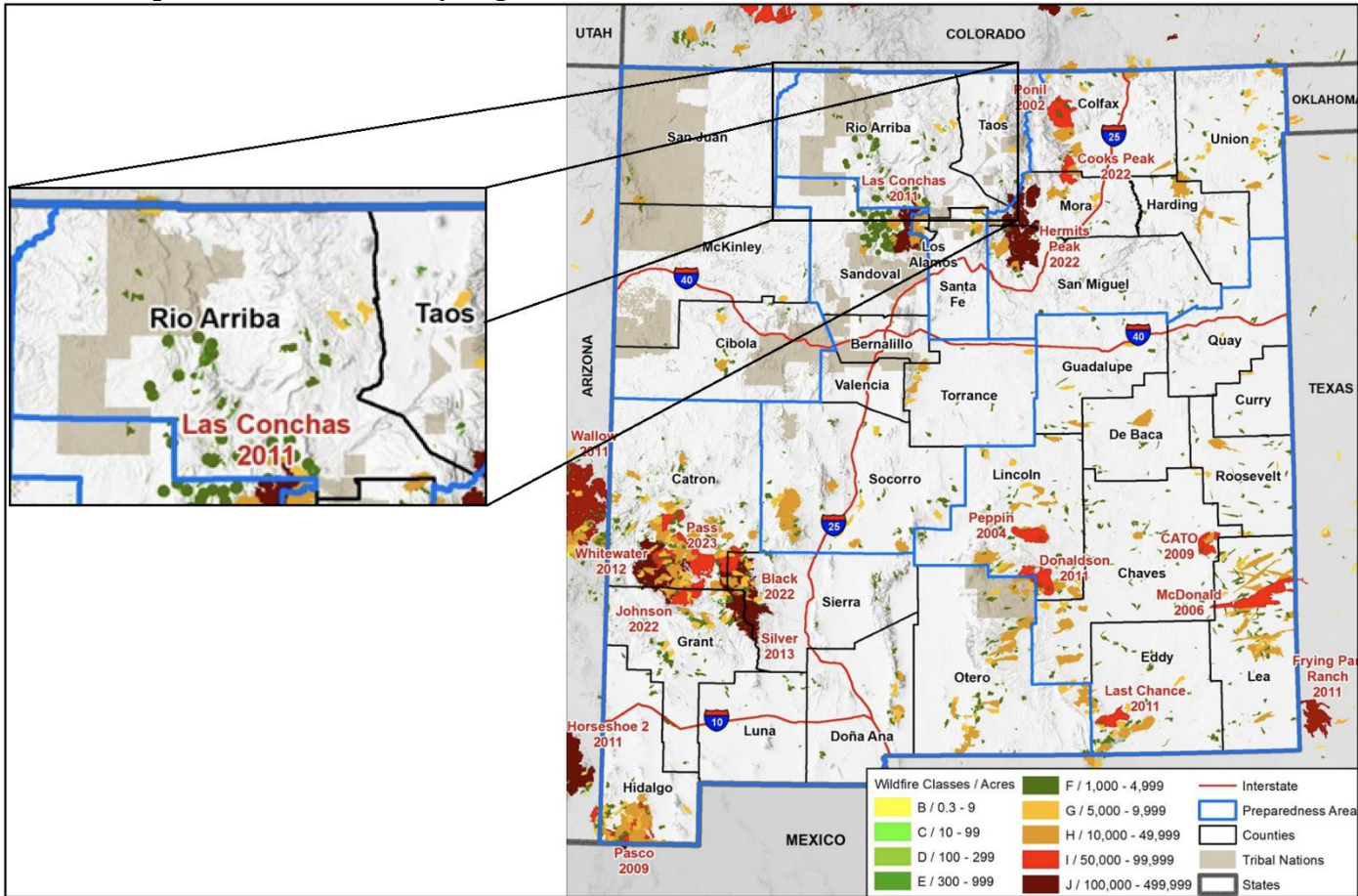
Source: State of New Mexico

Wildfires are classified by size into specific categories, referred to as Classes A through G, based on the total area burned. These classifications help firefighting agencies prioritize resources and communicate fire activity effectively, and are categorized as follows:

- Class A: 0 to 0.25 acres
- Class B: 0.26 to 9.9 acres
- Class C: 10 to 99 acres
- Class D: 100 to 299 acres
- Class E: 300 to 999 acres
- Class F: 1,000 to 4,999 acres
- Class G: 5,000 to 9,999 acres
- Class H: 10,000 to 49,999 acres
- Class I: 50,000 to 99,999 acres

The following map sourced from the 2023 State of New Mexico Hazard Mitigation Plan details historic wildfire boundaries, by class, for the Rio Arriba County region from 1950 – 2023:

Map 45: Rio Arriba County Region Historic Wildfire Perimeters (Acres Burned), 1950 - 2023



Source: 2024 State of New Mexico Hazard Mitigation Plan

Rio Arriba County has experienced several significant wildfires in its history, with the Las Conchas Fire being the most notable.

- **Las Conchas Fire (2011):** This wildfire began on June 26, 2011, and became one of the largest in New Mexico's history. It burned approximately 156,593 acres, including portions of Rio Arriba County, Santa Fe National Forest, and neighboring tribal lands such as the Santa Clara Pueblo. The fire destroyed 63 homes and 49 outbuildings, caused extensive ecological damage, and resulted in \$40.9 million in suppression costs. It significantly impacted cultural and archaeological sites, particularly in the Bandelier National Monument area, and exacerbated flood risks in affected watersheds due to hydrophobic soil conditions.
- **Cerro Grande Fire (2000):** Though primarily associated with Los Alamos County, this fire spread into Rio Arriba County. It burned 47,650 acres, destroyed hundreds of structures, and caused extensive damage to forests and cultural landmarks. It was ignited as a prescribed fire by the National Park Service but quickly escaped control.

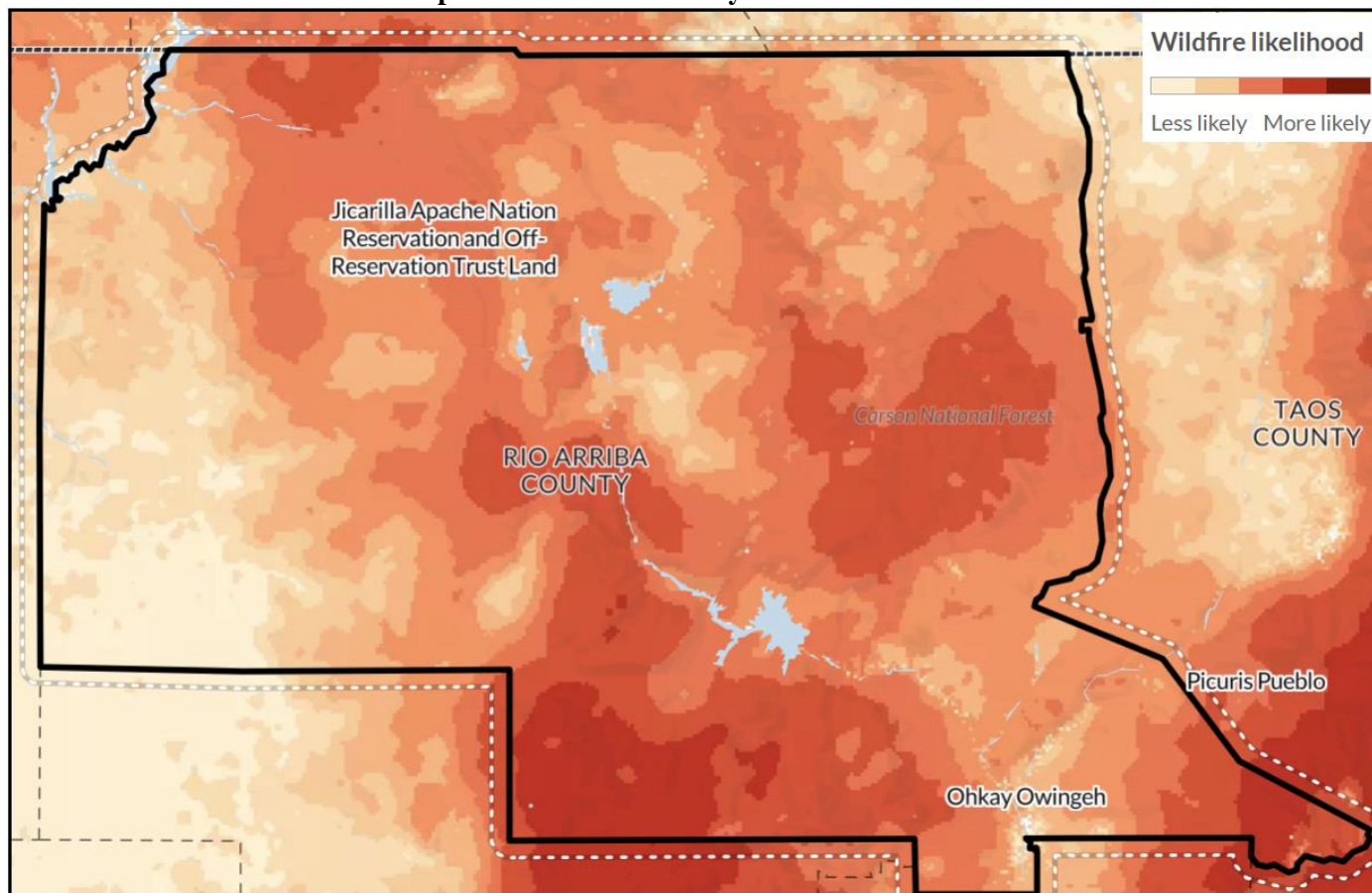
5.15.4 Probability of Future Events

NOAA's Wildfire Risk to Communities mapping, which uses the best available science to identify risk, was used to help determine the probability of future wildfires within Rio Arriba County. Wildfire likelihood is the probability of a wildfire occurring based on fire behavior modeling across thousands of simulations of possible fire seasons. In each simulation, factors contributing to the probability of a fire occurring, including weather, topography, and ignitions, are varied based on patterns derived from observations in recent decades. Wildfire likelihood is not predictive and does not reflect any currently forecasted weather or fire danger conditions. For communities, tribal areas, and counties, Wildfire Likelihood is summarized and ranked for the risk calculation area. This includes a 2.4 km buffer around populated areas to incorporate the risk of embers. Wildfire likelihood classification is based on the following national percentile rank:

- **Low:** <40th percentile
- **Medium:** >40th and <70th percentile
- **High:** >70th and <90th percentile
- **Very High:** >90th percentile

According to NOAA's Wildfire Risk to Communities Rio Arriba County has, on average, greater wildfire likelihood than 82% of counties in the US. The following map indicates the likelihood of a wildfire within Rio Arriba County:

Map 46: Rio Arriba County Wildfire Likelihood



Source: NOAA's Wildfire Risk to Communities

5.15.5 Projected Changes in Location, Intensity, Frequency, and Duration

Climate change can result in a significant increase in the likelihood and severity of wildfires. The occurrence of more frequent and longer lasting droughts due to climate change can increase the availability of fuels for wildfires through the drying of vegetation. Additionally, both the increased occurrence and continued decline of native species due to lack of precipitation can cause the proliferation of invasive species which can provide quick-burning fuels that contribute to the start and spread of fire.

Climate change may impact the frequency and magnitude of wildfire in the following ways:

- **Increased Frequency:** Warmer temperatures and prolonged periods of drought associated with climate change create conditions that favor more frequent wildfires. Extended fire seasons are becoming the new norm in many regions.
- **Greater Intensity:** Higher temperatures and drier conditions can lead to more intense wildfires. These fires burn hotter and spread more rapidly, making them more challenging to control and extinguish.

- **Longer Fire Seasons:** Climate change is extending the length of fire seasons, leading to earlier starts and later endings. This puts additional stress on firefighting resources and increases the risk of wildfires overlapping with other disasters.
- **Altered Precipitation Patterns:** Changes in precipitation patterns, including more intense rainfall events followed by extended dry periods, can promote the growth of vegetation, which can then become fuel for wildfires during subsequent dry periods.
- **Drought Conditions:** Prolonged droughts associated with climate change reduce soil moisture levels and the availability of water sources. Dry conditions increase the susceptibility of vegetation to ignition.
- **Vegetation Changes:** Climate change can alter the distribution and composition of vegetation, such as the expansion of drought-tolerant species. This can change fuel availability and make ecosystems more fire prone.
- **Insect Infestations:** Warmer temperatures can lead to increased insect infestations in forests. Infested and dead trees provide additional fuel for wildfires.
- **Wildfire Behavior:** Climate change can lead to changes in wildfire behavior, including the development of fire whirls, more extreme fire behavior events, and increased spotting (the spread of embers ahead of the main fire).

While both population and housing levels have remained static, or slightly decreased, in Rio Arriba County any continued expansion into WUI areas significantly increases the risk and potential damage from wildfires for several reasons, including:

- **Proximity to Natural Fuels:** As development spreads into previously undeveloped wildland areas, homes and infrastructure are built in close proximity to natural fuels which can ignite during a wildfire. Natural landscapes in WUI zones are often dense with vegetation, providing a continuous fuel source that allows fires to spread quickly from wildland areas to residential zones. This increases the likelihood of structure ignition, as homes are surrounded by flammable vegetation.
- **Increased Human Activity:** Human activities, such as outdoor recreation, construction, and the use of equipment, are more common in WUI areas, and these activities can inadvertently start fires
- **Difficulty in Fire Suppression:** WUI fires are harder to control because firefighting efforts must focus on both the natural landscape and protecting homes and infrastructure. Firefighters face the dual challenge of containing the wildfire and defending structures, which can divert resources and increase the complexity of suppression efforts. Narrow or inaccessible roads in WUI areas can make it difficult for firefighting equipment and personnel to reach homes at risk, delaying response times.

In Rio Arriba County, various forest management projects are being implemented to help mitigate the future risk and severity of wildfires. These projects combine techniques such as prescribed burns, thinning of dense forests, and the development of defensible space around communities. The following are some of the key forest management strategies and projects being used:

- **Prescribed Burns:** Controlled burns, or prescribed fires, are intentionally set under specific weather conditions to reduce excess vegetation that can fuel larger wildfires. These burns help mimic the natural fire cycles that were historically suppressed, leading to less fuel buildup. Both Cal Fire and the U.S. Forest Service have expanded the use of prescribed burns, targeting areas that have accumulated significant fuel loads.
- **Fuel Thinning:** Thinning involves the removal of smaller trees, deadwood, and brush to reduce the density of forests. By decreasing the amount of available fuel, thinning can lower the intensity of potential fires. Thinning projects are particularly common in the WUI areas, where dense vegetation near communities poses a significant fire risk.
- **Mechanical Fuel Reduction:** In some areas where prescribed burns are not feasible, mechanical methods such as cutting and removing dead or overgrown vegetation are employed. This includes removing hazardous trees, logging dead trees, and clearing brush. This strategy is particularly effective in northern New Mexico and areas with large tree populations, where mechanical fuel reduction projects can make a substantial difference in decreasing fire intensity.
- **Collaborative Forest Management Programs:** Public and private agencies work together on collaborative forest management programs to share resources and implement broader fire mitigation strategies.

5.15.6 Vulnerability and Impact

FEMA NRI

Using the FEMA NRI, and consisting of three input components (expected annual loss, social vulnerability, and community resilience), the first table was created indicating the potential risk to Rio Arriba County and all participating jurisdictions from wildfire. In order to gain an understanding of vulnerability, the second table details the estimated annual loss data for Rio Arriba County and participating jurisdictions. To help understand the risk and vulnerability participating jurisdictions data from the FEMA NRI was run on a census tract level. As the NRI does not generate data for individual jurisdictions, census tract analysis is the closest analogue available to understand individual jurisdiction conditions.

Table 119: Participating Jurisdiction Wildfire Risk Index

Jurisdiction	Census Tract	Risk Index	National Percentile	Chance per Year
Rio Arriba County	All	Relatively Moderate	95.6	0.270%
Chama	06093000200	Relatively High	98.0	0.138%
Espanola	06093001100	Relatively High	96.8	0.288%
Ohkay Owingeh	06093000800	Relatively High	98.3	0.321%

Source: FEMA NRI

Table 120: Participating Jurisdiction Wildfire Expected Annual Loss

Jurisdiction	Census Tract	EAL	National Percentile	Wildfire EAL
Rio Arriba County	All	Relatively Moderate	94.6	\$3,200,000
Chama	06093000200	Relatively High	97.5	\$335,000
Espanola	06093001100	Relatively High	95.5	\$153,000
Ohkay Owingeh	06093000800	Relatively High	97.5	\$330,000

Source: FEMA NRI

Population

Wildfires have profound and far-reaching impacts on people, affecting physical health, mental well-being, and socio-economic conditions. These impacts can vary depending on the severity, location, and preparedness of the communities affected. Key wildfire impacts include:

- **Health Impacts**
 - Smoke inhalation: Wildfire smoke contains fine particulate matter that can penetrate deep into the lungs and exacerbate respiratory and cardiovascular problems. It is especially dangerous for people with pre-existing conditions like asthma, COPD, or heart disease. Exposure to smoke can cause short-term issues like coughing, throat irritation, and difficulty breathing, as well as long-term health effects from prolonged exposure.
 - Burn injuries: Direct exposure to flames or heat during evacuations or firefighting efforts can result in serious burn injuries.
 - Mental health: Survivors of wildfires often experience stress, anxiety, depression, and post-traumatic stress disorder, especially those who have lost homes, loved ones, or livelihoods.
- **Economic and Financial Impacts**
 - Property damage: Wildfires can destroy homes, businesses, and infrastructure, leading to significant financial losses. Insurance premiums in wildfire-prone areas often increase, and many homeowners struggle to rebuild after losing their property.
 - Loss of livelihoods: Wildfires can disrupt local economies, particularly in agricultural and forestry-based communities. Employment in affected areas may decline, and businesses may close either temporarily or permanently.
 - Cost of relocation: In cases of long-term displacement, families must bear the costs of relocation, housing, and rebuilding, which can be a financial burden, especially for low-income households.
- **Evacuations and Displacement**

- Evacuations: Wildfires often force mass evacuations, leaving people displaced from their homes for extended periods. Evacuations can be stressful, especially if there is little warning, leading to rushed departures where families leave behind essential belongings or pets.
- Long-term displacement: In severe cases, entire communities may be permanently displaced if homes are destroyed or if areas are deemed too hazardous to return to, leading to loss of community and social networks.
- **Social and Community Disruption**
 - Community dislocation: Wildfires can cause permanent damage to communities, forcing people to relocate and resulting in the breakdown of social networks and support systems.
 - Loss of heritage: In some cases, wildfires destroy culturally significant sites, landmarks, and natural heritage, such as forests and ecosystems that communities may depend on or cherish.

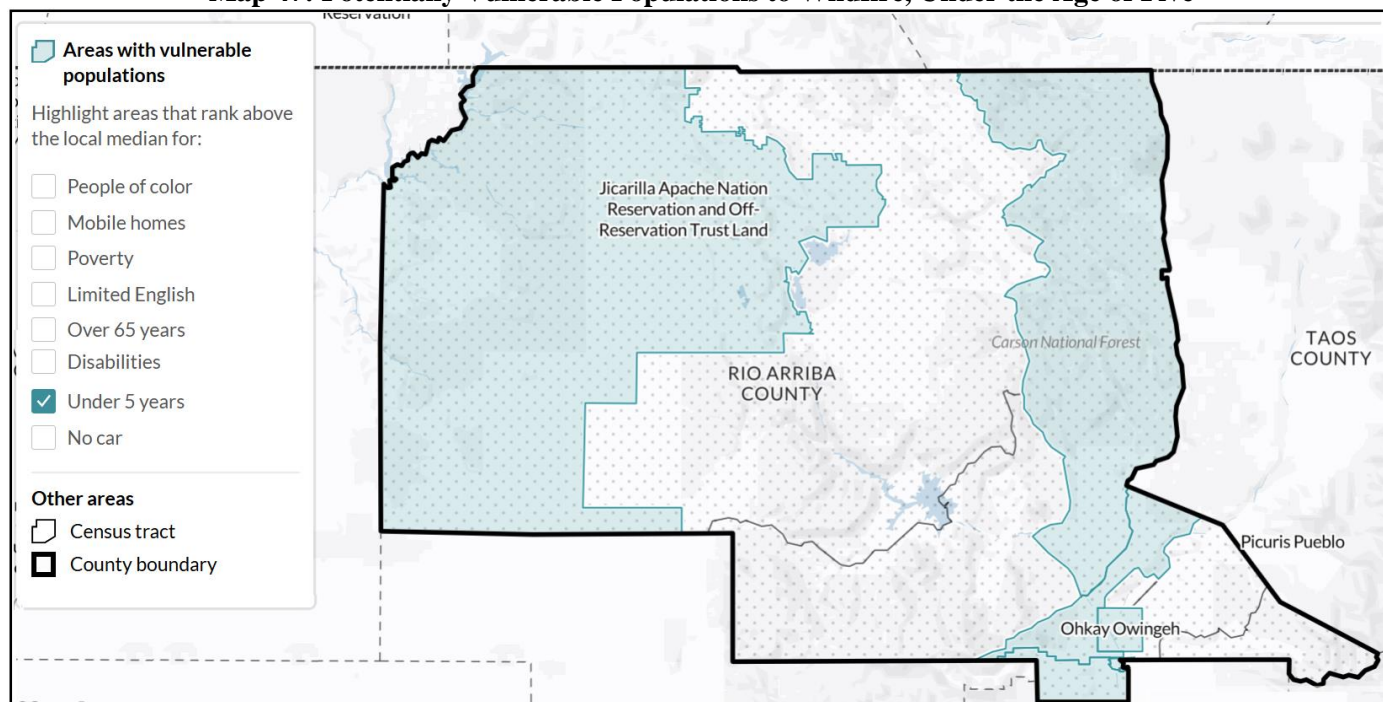
Wildfires can disproportionately affect vulnerable populations due to their limited resources, reduced mobility, and pre-existing health or socio-economic challenges. These groups often include the elderly, disabled individuals, low-income households, children, and those with chronic health conditions. Ways that wildfires may have a greater impact on these populations include:

- **Health Vulnerabilities**
 - Respiratory and cardiovascular risks: Vulnerable populations, such as the elderly, children, and those with pre-existing respiratory or heart conditions, are more susceptible to the harmful effects of wildfire smoke. The fine particulate matter from the smoke can exacerbate asthma, bronchitis, and heart disease, leading to increased hospitalizations and, in severe cases, mortality.
 - Limited healthcare access: Vulnerable groups often have less access to healthcare services, which can delay critical treatment during or after wildfire exposure. Health facilities may be overwhelmed during wildfire events, and transportation to care facilities may be hindered by road closures or evacuations.
- **Challenges with Evacuation**
 - Mobility issues: Elderly individuals, people with disabilities, and those without access to vehicles may struggle to evacuate quickly. They may depend on public transportation, community aid, or emergency services, which can be delayed or overburdened during a wildfire emergency.
 - Language barriers: Immigrant communities or non-English speakers may not fully understand emergency alerts or evacuation instructions, making it harder for them to react swiftly. This can increase the risk of delayed evacuation, which is particularly dangerous in fast-moving wildfires.
 - Poverty and housing instability: Low-income families are less likely to have the means to evacuate, such as access to a car or money for temporary shelter. They may also live in less resilient housing, which is more vulnerable to wildfire damage.
- **Economic Disparities**
 - Loss of homes and belongings: Vulnerable populations are often more likely to live in fire-prone or poorly constructed homes that are less resistant to wildfires. They may lack adequate insurance coverage to rebuild or replace what is lost, which can lead to long-term displacement and financial hardship.
 - Job loss and economic disruption: After a wildfire, vulnerable populations are more likely to experience prolonged economic disruption. Many people in low-wage jobs or agriculture may face unemployment if the local economy is disrupted, or if their place of work is destroyed. Recovery can take months or years, leaving them with few financial safety nets.
- **Increased Long-Term Vulnerability**
 - Difficulty in recovery: Vulnerable populations often face more significant challenges during the recovery phase of wildfires. They may lack insurance, savings, or government support to rebuild homes, replace belongings, or relocate. This can lead to prolonged displacement or homelessness, further exacerbating their vulnerabilities.

- Disruption of social networks: Vulnerable groups rely heavily on community networks for support during and after disasters. Wildfires may displace communities, breaking apart these networks and leaving people isolated during their recovery process.
- **Disparities in Resource Allocation**
 - Limited access to relief aid: Vulnerable populations may struggle to access emergency relief services due to logistical, language, or bureaucratic barriers. They may not be prioritized for resource distribution, further exacerbating their difficulties in recovering from wildfire impacts.

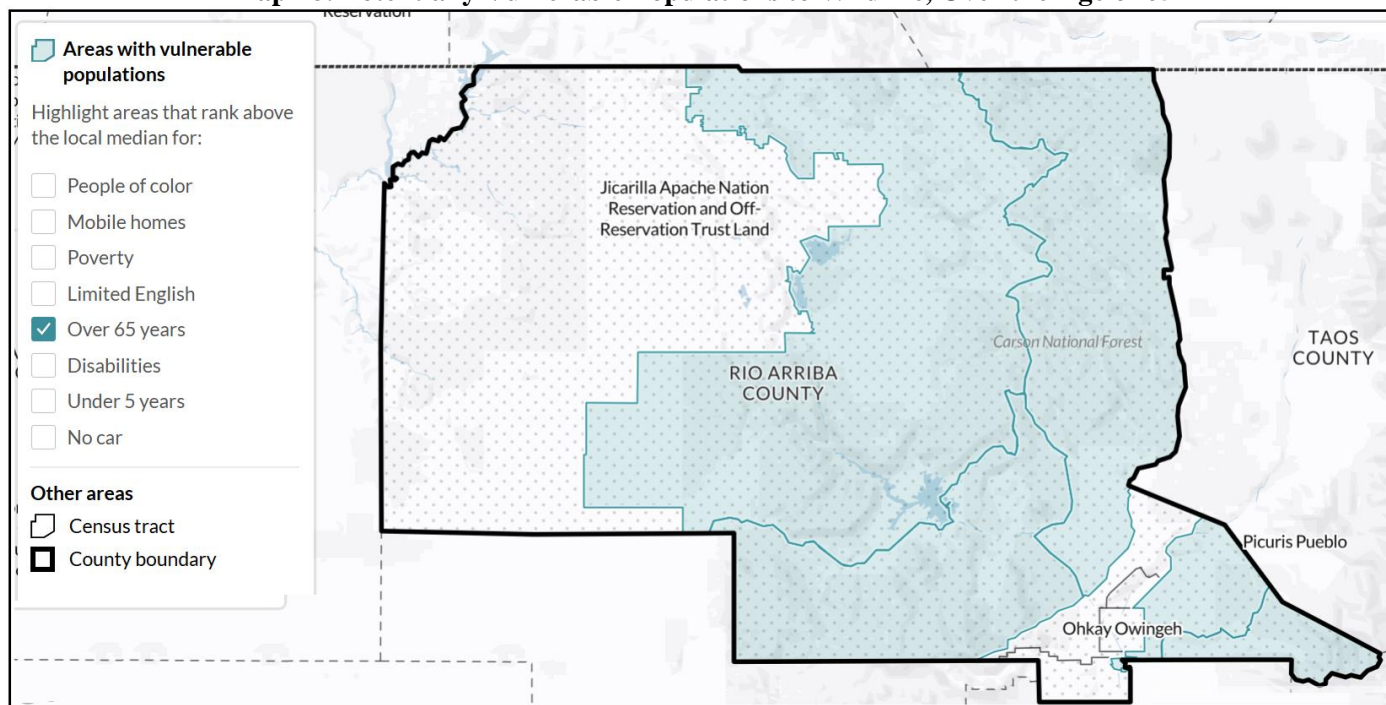
The following maps show the location of vulnerable populations compared to wildfire risk. Census tracts are highlighted that have values equal to or greater than the community median:

Map 47: Potentially Vulnerable Populations to Wildfire, Under the Age of Five



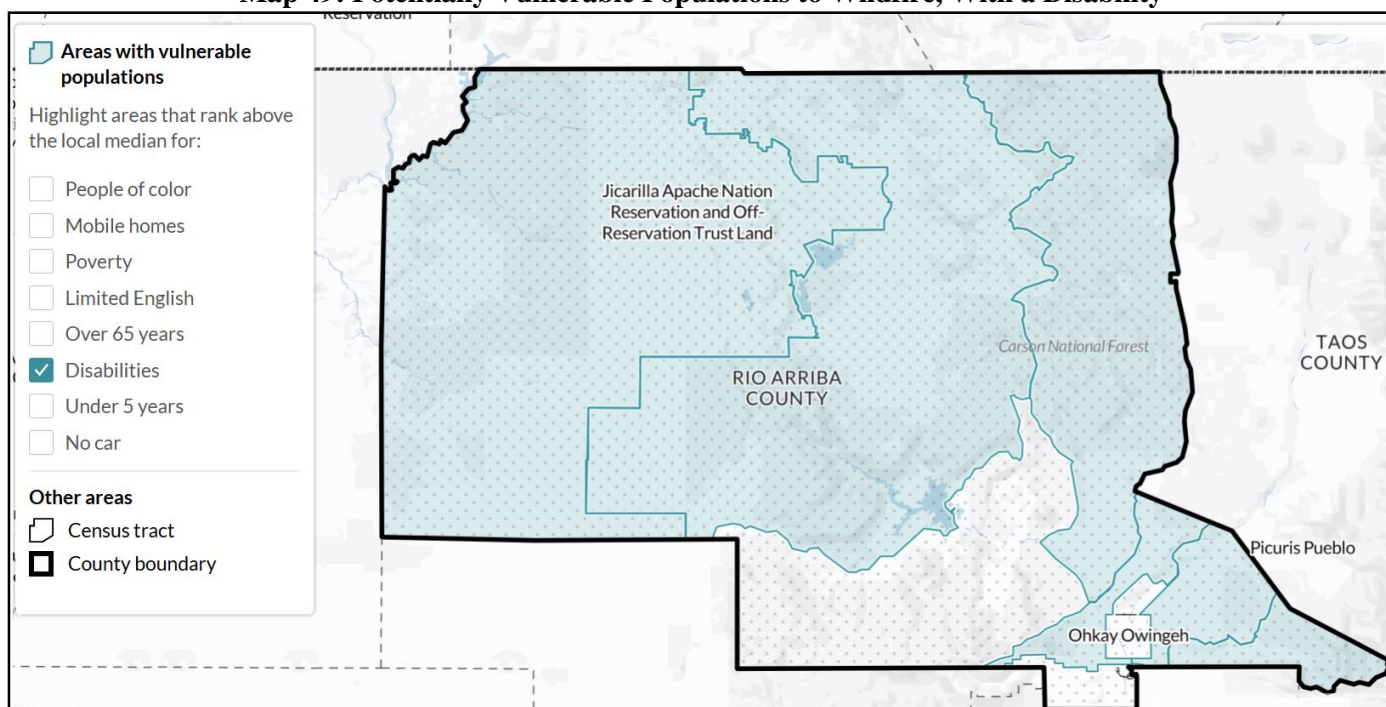
Source: NOAA's Wildfire Risk to Communities

Map 48: Potentially Vulnerable Populations to Wildfire, Over the Age of 65



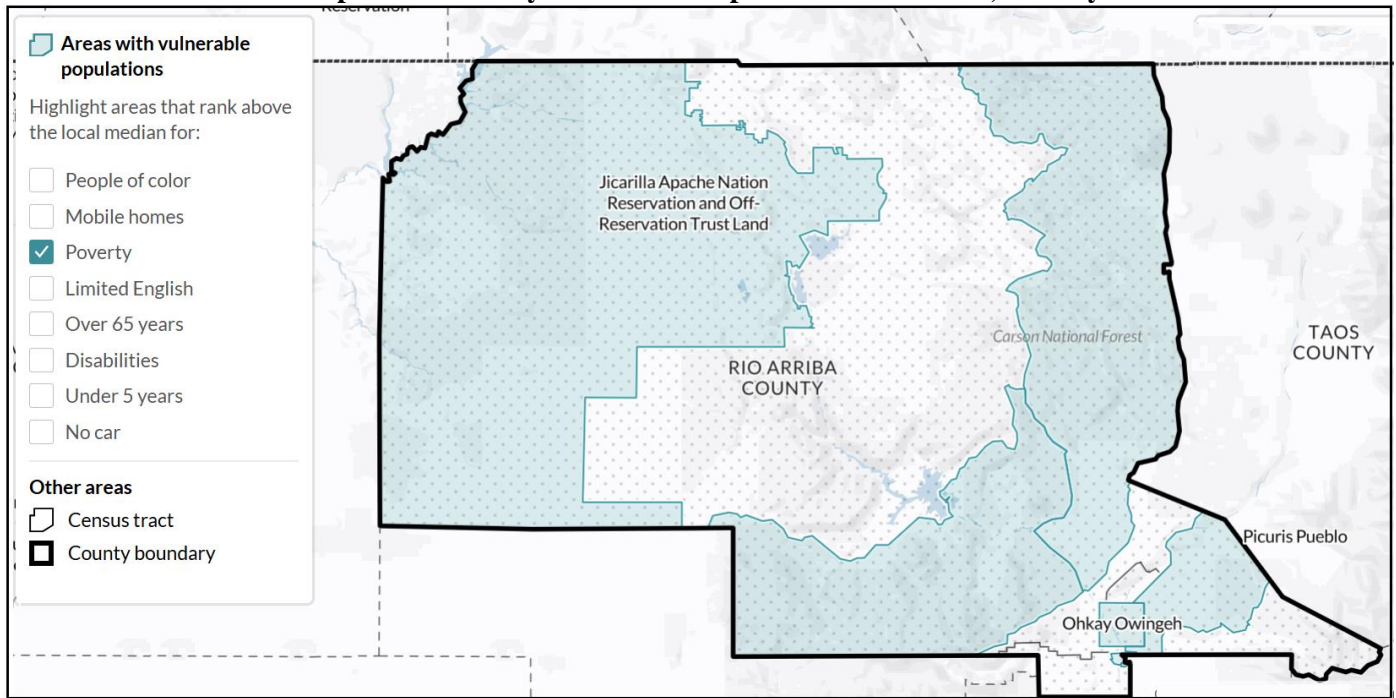
Source: NOAA's Wildfire Risk to Communities

Map 49: Potentially Vulnerable Populations to Wildfire, With a Disability



Source: NOAA's Wildfire Risk to Communities

Map 50: Potentially Vulnerable Populations to Wildfire, Poverty



Source: NOAA's Wildfire Risk to Communities

All Rio Arriba County and participating jurisdiction populations are vulnerable to the impacts of wildfires. Please see Section 3.3: Population Data and Section 3.4: Socially Vulnerable and At-Risk Populations for data concerning jurisdictional populations.

Buildings and Structures

Buildings and structures are vulnerable to wildfires primarily due to their location, materials, and surrounding environment. These factors determine how easily a structure may ignite, sustain damage, or be destroyed by fire. Here's how these vulnerabilities manifest:

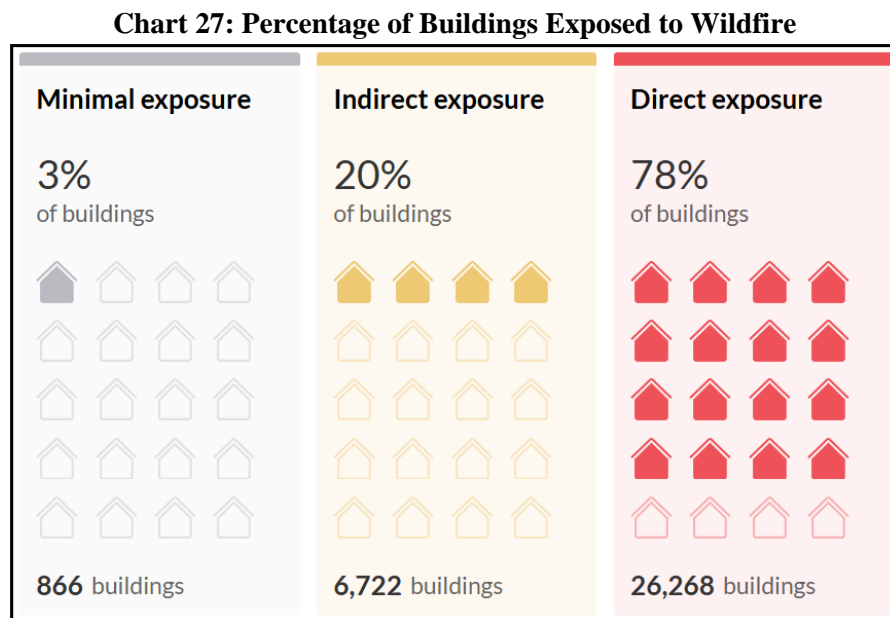
- **Proximity to Vegetation:** Homes located in the WUI are particularly vulnerable as they are closer to dense vegetation that serves as fuel for wildfires. If the vegetation (trees, shrubs, dry grasses) is not properly managed around the property, fire can easily spread to homes.
- **Flammable roofing materials:** Roofs made from materials like wood shingles are highly flammable and can easily ignite from embers. Non-flammable materials like metal, tile, or asphalt are more resistant to fire.
- **Siding and exterior walls:** Homes with wood siding or other combustible materials are more vulnerable to fire than homes built with fire-resistant materials like stucco, brick, or concrete.
- **Windows:** Single-pane windows are more likely to break during a wildfire due to heat exposure, allowing embers and flames to enter the building. Double-pane or tempered glass windows offer more protection.
- **Eaves and vents:** Eaves and vents can allow embers to enter the attic or other vulnerable spaces in the home. If they are not properly screened or fireproofed, they become entry points for embers to ignite the structure.
- **Decks and porches:** Wooden decks and porches are highly susceptible to wildfire if they are not made from fire-resistant materials or if they have combustible items stored underneath them.
- **Lack of defensible space:** Defensible space is the buffer zone between a building and surrounding vegetation. If this space is not cleared of flammable materials (like dry leaves, dead trees, or fire-prone plants), a wildfire can spread rapidly to a home. Homes without sufficient defensible space are much more likely to ignite during a fire.
- **Combustible materials near the home:** Storing firewood, propane tanks, or other flammable items near the structure increases vulnerability, as these materials can easily catch fire and ignite the building.

- **Distance from fire services:** Homes located far from fire stations or without adequate road access may experience delayed emergency response times, leaving them more vulnerable to destruction.
- **Neglected maintenance:** Homes that are not well-maintained, such as those with clogged gutters full of leaves or overgrown vegetation, are more likely to catch fire. Regular maintenance, such as clearing gutters and removing dead vegetation, is essential to reducing wildfire vulnerability.

When homes and buildings ignite in a wildfire the damage can be severe. Wildfire impacts on structures typically include:

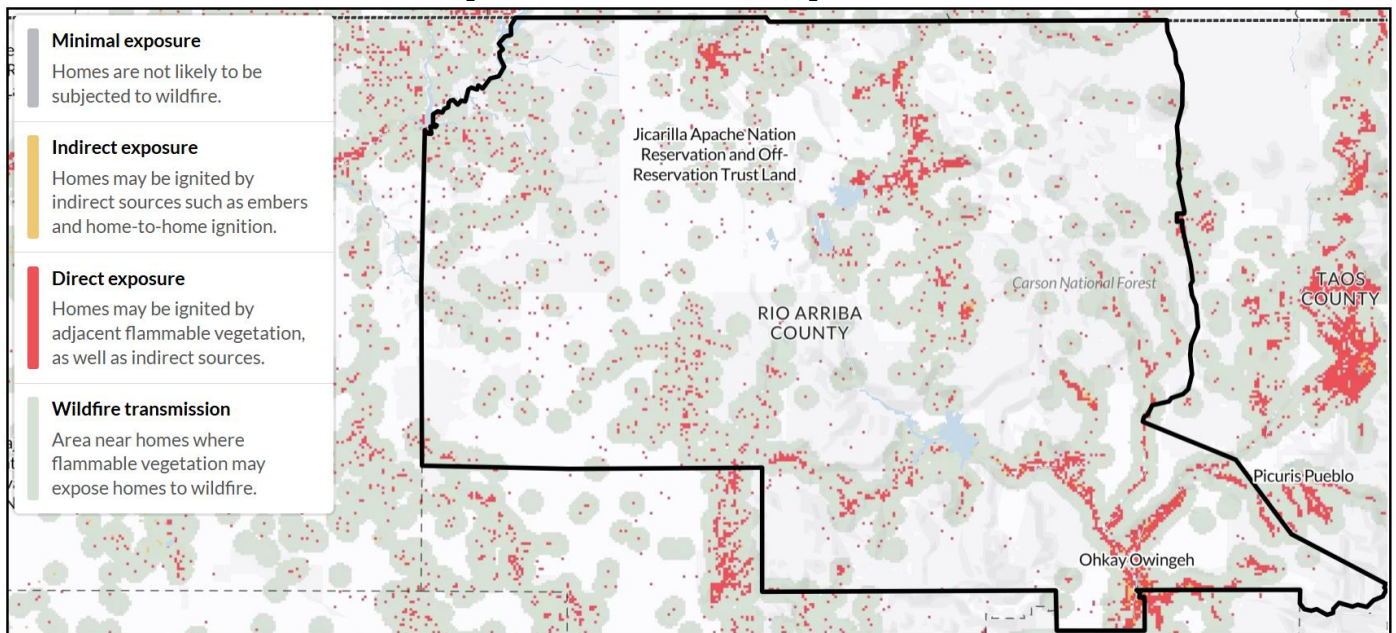
- **Complete destruction:** Buildings can be completely consumed by flames, leaving nothing but the foundation.
- **Partial damage:** Fire can damage parts of the building, such as roofs, walls, or outdoor structures, necessitating costly repairs.
- **Smoke damage:** Even if a structure does not burn down, smoke can infiltrate the building, causing significant damage to the interior, furniture, and electronics.
- **Water damage:** In the process of firefighting, water can cause additional damage to structures, particularly if fire suppression efforts are extensive.

According to NOAA’s Wildfire Risk to Communities 78% of Rio Arriba County’s buildings are directly exposed to wildfires:



Source: NOAA’s Wildfire Risk to Communities

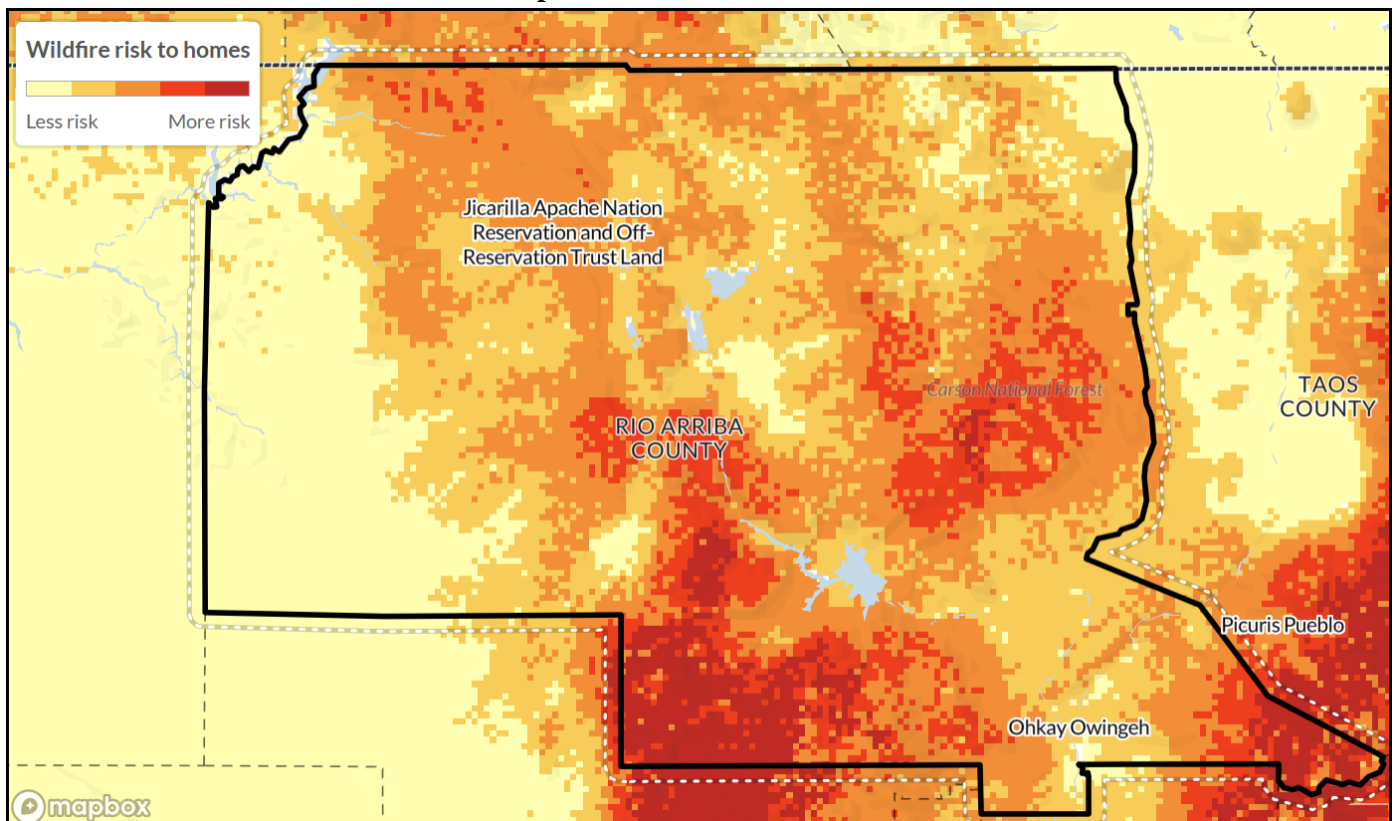
Map 51: Homes in Wildfire Exposure Areas



Source: NOAA's Wildfire Risk to Communities

Summarizing available data, the following map details the overall risk to homes from wildfires in Rio Arriba County and for all participating jurisdictions:

Map 52: Wildfire Risk to Homes



Source: NOAA's Wildfire Risk to Communities

Governmental Operations

Wildfires can pose various risks to government operations. These risks can have significant economic and operational consequences, and can include:

- **Power Outages:** Severe weather can lead to power outages by damaging electrical infrastructure such as power lines and substations. Government buildings may lose power, affecting critical operations and services.
- **Flooding:** Heavy rainfall after a wildfire can lead to flooding, which can damage government buildings and disrupt operations. Flood damage may require extensive repairs and cleanup.
- **Communication Disruptions:** Wildfires can damage communication equipment, including telephone lines and computer systems. This can hinder communication between government agencies and the public.
- **Transportation Disruptions:** Wildfires can make roads impassable due to debris, smoke, heat, and potentially after event flooding or landslides. This can impact the ability of government employees to commute to work.
- **Budgetary Impact:** The costs associated with repairing and restoring government buildings and infrastructure after a wildfire can strain budgets.

Transportation and Electrical Infrastructure

In general, wildfires do not have a large impact on transportation infrastructure, with the exception of power loss disrupting signaling, road closures due to events, and poor conditions impacting driving conditions.

Wildfires can have severe and widespread impacts on electric infrastructure, disrupting power distribution and causing long-term damage. Here are some key ways wildfires affect electric infrastructure:

- **Damage to Transmission Lines and Power Poles**
 - Direct fire damage: Wildfires can burn through wooden power poles and even damage steel or aluminum transmission towers due to extreme heat. Transmission lines are especially vulnerable in heavily forested or remote areas where wildfires tend to occur.
 - Melting of cables and equipment: High temperatures can cause transmission lines and electrical equipment to melt or warp, leading to failures or shutdowns.
 - Power outages: Wildfires can lead to widespread power outages by directly damaging transmission lines or transformers. In some cases, utilities may also proactively shut off power (public safety power shutoffs, or PSPS) to prevent the ignition of fires by downed or sparking power lines.
- **Smoke and Soot Contamination**
 - Conductivity of smoke: Smoke and ash from wildfires can increase the conductivity of the air, leading to short circuits or arcing in power lines, especially in high-voltage systems.
 - Soot buildup: Wildfire soot can accumulate on insulators and electrical equipment, reducing efficiency and causing potential equipment failures if not cleaned.
- **Substation and Equipment Vulnerability**
 - Heat and embers: Substations, transformers, and electrical panels can be damaged by heat or flying embers. Damage to substations can have a particularly large impact since they are key distribution points for electricity.
 - Component failures: Equipment such as switches, transformers, and circuit breakers may suffer from thermal stress or fire-related damage, leading to breakdowns and costly repairs.
- **Challenges for Utility Workers**
 - Delayed repairs: Repair crews face significant challenges during and after wildfires. Access to damaged areas can be restricted due to ongoing fires, road closures, or unsafe conditions, delaying repairs.
 - Safety hazards: Workers may be exposed to unsafe conditions, including the risk of encountering smoldering areas or downed power lines.
- **Disruptions to Power Generation Facilities**
 - Hydroelectric plants: Wildfires in watersheds that supply hydroelectric plants can disrupt water flow, reducing power generation capacity.

- Thermal power plants: Plants using coal, natural gas, or other fuel sources may also face interruptions if transportation of fuel is hindered due to wildfires or if nearby infrastructure is damaged.

During period of strong winds and dry conditions New Mexico electric utilities have the authority to shut off electric power to protect public safety, since power supply systems have the potential to ignite wildfires (a public safety power shutoff). In general terms, these shutoffs are instituted to lower the potential of a downed electrical line sparked wildfire. Conditions that may trigger a shutoff include:

- Red flag warning from the National Weather Service
- Low humidity
- High winds
- Situational determination by on the ground crews

Mapping concerning transportation and electrical infrastructure may be found in Section 3.9: Community Lifelines and Critical Infrastructure. Information concerning the costs to repair or reconstruct transportation and electrical infrastructure may be found in Section 5.8.6.

Water and Wastewater Utilities

In general, severe weather and severe winter weather components do not have a large impact on water and wastewater infrastructure and operations. However, the cascading impacts from an event such as power loss disrupting pumping and treatment capabilities, localized flooding from heavy overwhelming drainage systems, or frozen pipes in water distribution systems, causing water outages and expensive repairs when pipes burst.

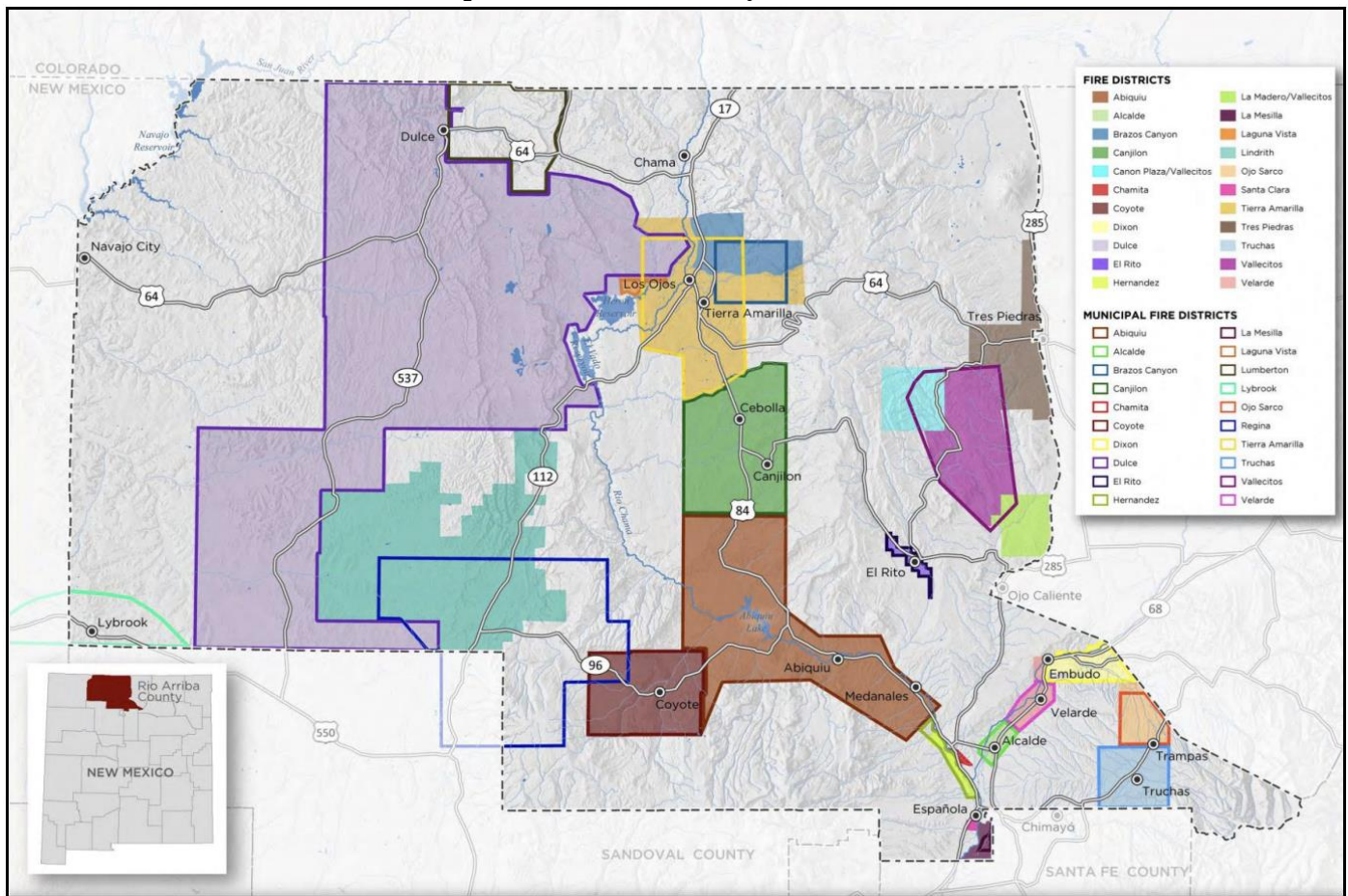
Medical, Education, and Response Facilities

Severe weather and severe winter weather can significantly impact emergency response infrastructure, creating challenges for first responders and organizations involved in managing and mitigating the effects of severe weather events. Winter storms can impact emergency response through:

- **Transportation Disruptions:** Debris on roads and road closures can hinder the ability of emergency vehicles to navigate and reach affected areas promptly. Hazardous road conditions may result in delays in response times.
- **School Closures:** Wildfires can lead to the closure of schools due to hazardous conditions. This can strain caregivers and result in lower work attendance.
- **Communication Disruptions:** Wildfires can disrupt communication networks, affecting the ability of emergency responders to coordinate and communicate effectively. Downed power lines and damage to communication infrastructure contribute to these disruptions.
- **Power Outages:** Wildfires can lead to power outages. Emergency response facilities, such as command centers and fire stations, may lose power, affecting their operational capabilities.
- **Exposure:** Emergency responders face increased health and safety risks during wildfire events. Exposure to fire, ash, particulate matter, and high temperatures can impact the well-being of responders and affect their ability to provide effective assistance.
- **Resource Allocation Challenges:** Wildfires often requires the allocation of additional resources, including personnel, equipment, and supplies, to address immediate needs. This can strain emergency response organizations and impact their ability to respond to other concurrent incidents.
- **Increased Demand for Services:** Wildfires can result in an increased demand for emergency services, including medical assistance, and search and rescue operations. Emergency response organizations may need to manage a higher volume of incidents simultaneously. Wildfires can also increase the demand for emergency shelters, particularly in cases of widespread evacuations.
-

The following map details fire departments and districts throughout Rio Arriba County:

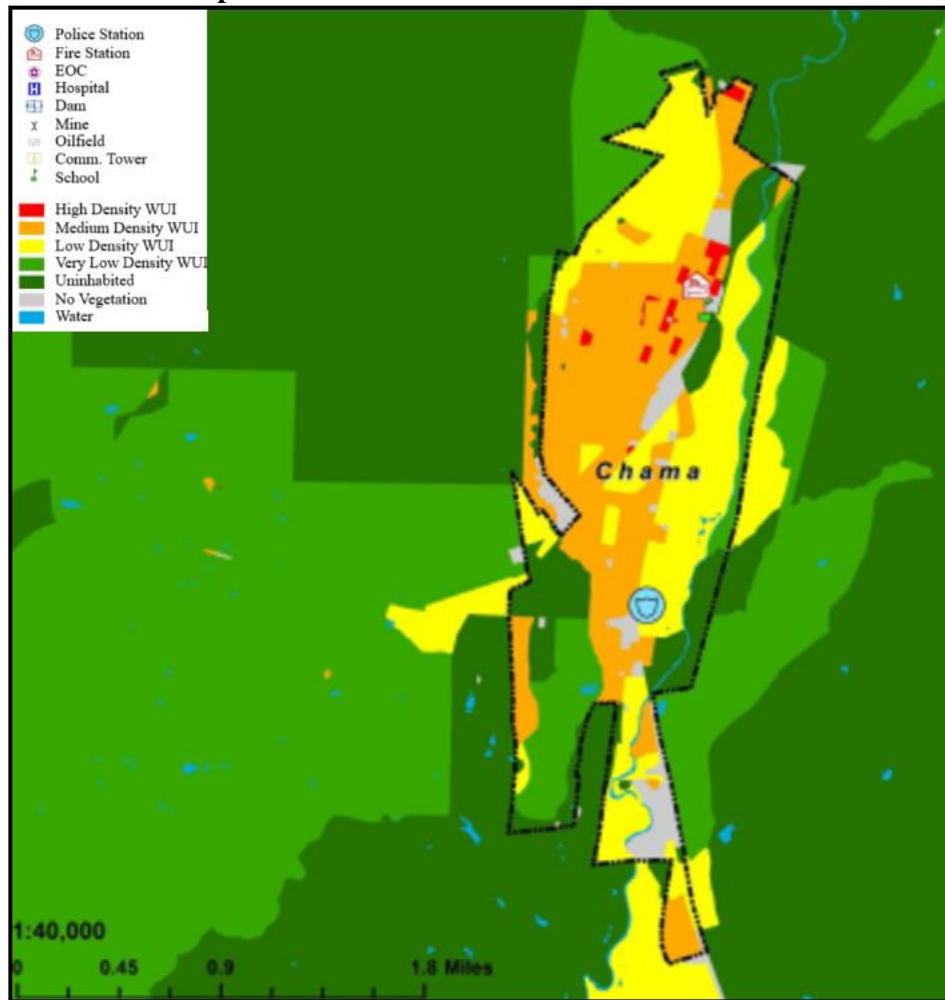
Map 53: Rio Arriba County Fire Districts



Source: Rio Arriba County Community Wildfire Protection Plan

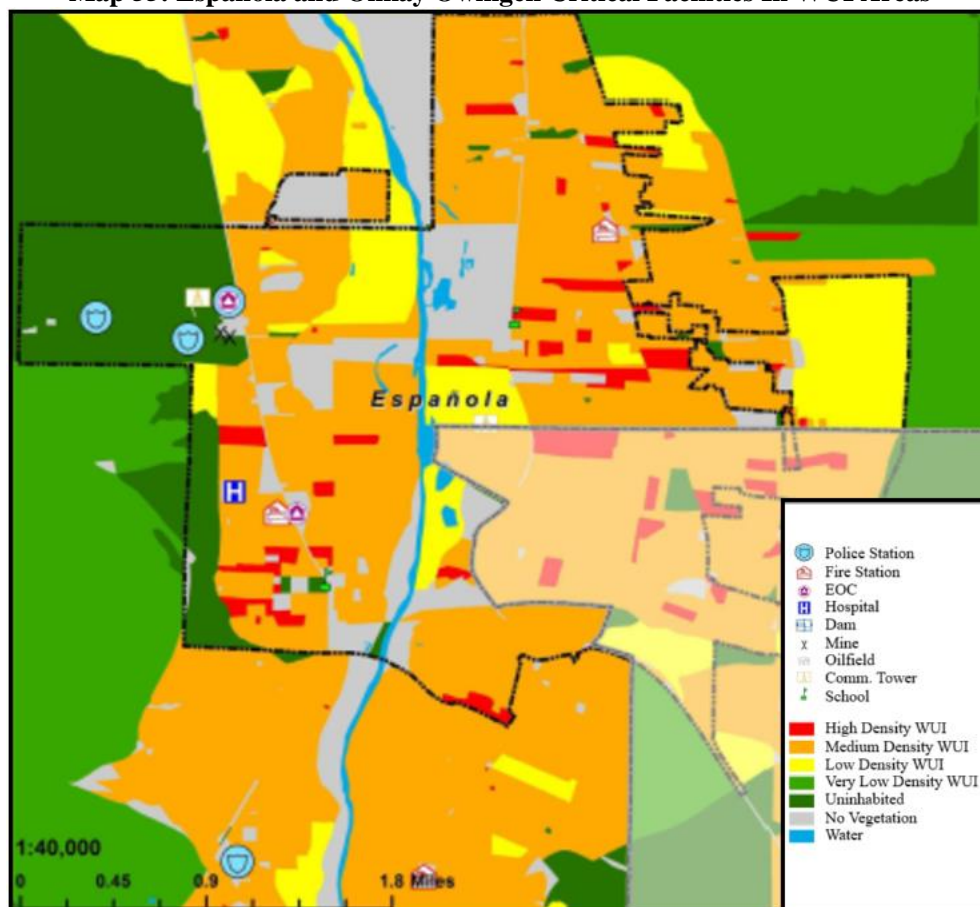
The following maps detail critical facility locations mapped to the FEMA mapped WUI areas:

Map 54: Chama Critical Facilities In WUI Areas



Source: Rio Arriba County and BOLDplanning

Map 55: Espanola and Ohkay Owingeh Critical Facilities In WUI Areas



Source: Rio Arriba County and BOLDplanning

Communication Systems

All communication systems within Rio Arriba County are at risk to wildfire events. Wildfires can disrupt vital communications system, affecting reliability and functionality. Some of the key vulnerabilities include:

- **Physical Infrastructure Damage:** Wildfires can cause physical damage to communication infrastructure such as cell towers, antennas, cables, and data centers. This damage can result in network outages and disruptions.
- **Power Outages:** Wildfires often lead to power outages, which can affect the operation of communication networks. Without a stable power supply, cell towers, data centers, and other critical components may become non-functional, leading to service interruptions.
- **Communication Tower Instability:** Wildfires can compromise the stability of communication towers. If towers are not designed to withstand severe weather, they may collapse, leading to network outages.
- **Network Congestion:** In the event of a disaster, communication networks may experience a surge in usage as people attempt to contact emergency services, friends, and family. This increased demand can lead to network congestion, making it difficult for users to connect.

The cost to repair communications networks can vary widely depending on the extent of the damage, the size of the network, and the specific technologies involved. Repair costs may include expenses for labor, equipment replacement or repair, materials, and any additional resources required to restore the network to full functionality. Estimated repair cost from the U.S. Department of Homeland Security Cybersecurity and Infrastructure Security Agency may be found in Section 5.8.6.

Environmental and Agricultural Impacts

Wildfires have significant and often devastating effects on the environment. These impacts can be both immediate and long-lasting, affecting air quality, ecosystems, water resources, soil stability, and wildlife. Wildfires release large quantities of smoke, which contains fine particulate matter, carbon monoxide, and other harmful pollutants. These particles can travel long distances, reducing air quality far from the fire itself, and can cause respiratory issues, especially for vulnerable populations. Wildfires contribute to climate change by releasing significant amounts of carbon dioxide (CO₂), methane (CH₄), and other greenhouse gases stored in vegetation and trees, intensifying global warming.

Fires can decimate forests, grasslands, and other plant ecosystems. The loss of vegetation can result in habitat destruction for countless species, reducing biodiversity and altering the structure of the ecosystem. Recovery can take decades, depending on the severity of the fire and the resilience of the vegetation. Wildfires can degrade soil by burning away organic matter, making it less fertile. Intense heat can also cause soil to become hydrophobic (water-repellent), increasing the risk of erosion and reducing water infiltration, which impacts plant regrowth.

After a wildfire, ash, debris, and eroded soil can be washed into rivers and streams during rainstorms, contaminating water supplies. This can affect both aquatic ecosystems and human water sources, requiring extensive treatment. The destruction of vegetation disrupts the local hydrological cycle by reducing transpiration (the release of water vapor from plants). This can result in lower humidity levels, reduced rainfall, and potentially, longer drought periods.

Animals are often killed directly by fire, especially those that are less mobile (like reptiles, amphibians, and small mammals) or those caught in fast-moving fires. Wildfires destroy habitats, which can lead to displacement, loss of food sources, and increased competition for remaining resources. This can cause population declines in already vulnerable species. Wildfires can disrupt key ecosystem services such as pollination, seed dispersal, and predator-prey relationships, affecting the balance of the ecosystem.

With the loss of vegetation, the soil becomes more susceptible to erosion. Without plants to stabilize the soil, rain and wind can easily carry away topsoil, which is crucial for plant regrowth and nutrient cycling. In steep areas, the loss of vegetation can lead to landslides during subsequent rain events. These slides can cause further destruction to the landscape, waterways, and infrastructure.

Wildfires can create opportunities for invasive species to take hold. Invasive plants, often better adapted to disturbed environments, may outcompete native species in the post-fire landscape, leading to long-term changes in ecosystem composition and reducing biodiversity. Some ecosystems, like certain forests and grasslands, are adapted to periodic fire and even rely on it for regeneration. However, the increasing intensity and frequency of wildfires, driven by climate change, can overwhelm these ecosystems, preventing recovery and pushing them beyond their adaptive capacity.

Jurisdictional Concerns:

As of this plan there is a deficit of community specific data to help quantify both vulnerability and historic impact. However, over the life of this plan the MPC will work to quantify the local level impacts of hazard occurrences to citizens, vulnerable populations, structures, and infrastructure to better inform both this living LHMP and future planning efforts. The following initial vulnerabilities and potential impacts have been identified on a jurisdictional level:

- **Chama:** All populations would be at risk to a wildfire event. Due to limited road systems, an evacuation of citizens would be problematic. The presence of vulnerable populations, including the elderly, the very young, citizens with a disability, and citizens in poverty would further exacerbate timely evacuation. Compounding the issues, these limited road systems, along with limited local capabilities, would make the timely attack of an identified fire difficult. As the majority of the jurisdiction is in areas identified as either WUI interface or WUI intermix, all structures and identified critical facilities are at risk.
- **Espanola:** All populations would be at risk to a wildfire event. Due to smaller capacity road systems, an evacuation of citizens would be problematic, especially if the fire blocked main arterials including the interstate. The presence of vulnerable populations, including the elderly, the very young, citizens with a disability, and citizens in poverty would further exacerbate timely evacuation. Compounding the issues, these limited road systems, along with limited local capabilities, would make the timely attack of an identified fire difficult. As

the majority of the jurisdiction is in areas identified as either WUI interface or WUI intermix, all structures and identified critical facilities are at risk.

- **Ohkay Owingeh:** All populations would be at risk to a wildfire event. Due to limited road systems, an evacuation of citizens would be problematic. The presence of vulnerable populations, including the elderly, the very young, citizens with a disability, and citizens in poverty would further exacerbate timely evacuation. As the majority of the jurisdiction is in areas identified as either WUI interface or WUI intermix, all structures and identified critical facilities are at risk.

Cascading Impacts

Cascading impacts often result when one a hazard event triggers one or more differing hazard events or loss of community lifelines. Cascading impacts associated with wildfires may include:

- Direct physical damage to buildings and structures:
- After event flooding, landslides, and mudslides
- Transportation infrastructure disruption
- Power outages and electrical grid disruption
- Communication system disruption
- Transportation and supply chain disruptions
- Environmental and ecological damage
- Economic impacts and business closures
- Emergency services overload

Consequence Analysis

This consequence analysis lists the potential impacts of a hazard on various elements of a community. The impact of each hazard is evaluated in terms of disruption of operations, recovery challenges, and overall wellbeing to all Rio Arriba County residents and first responder personnel. The consequence analysis supplements the hazard profile by analyzing specific impacts.

Table 121: Wildfire Consequence Analysis

Subject	Potential Impacts
Impact on the Public	People located in the immediate area of the fire face the risk injury or death if not evacuated in time. Once evacuated, they may face a lengthy period of relocation. Fires can release toxic components which can cause adverse health effects including respiratory and cardiovascular system impacts. Psychological and psychiatric concerns may arise due to exposure to the traumatic event. Young children and the elderly are especially vulnerable to health issues stemming from fire and smoke exposure.
Impact on Responders	Fire, police, and emergency responders may be called to evacuate people from the fire area, close roads, create fire breaks, attend to the injured, and direct traffic. Firefighters are at a higher risk of smoke inhalation, burns, and health problems due to working in close proximity to fires and the subsequent smoke.
Continuity of Operations	Local jurisdictions maintain continuity plans which can be enacted as necessary based on the situation. Wildfires may impact an agency's ability to maintain continuity of operations due to impacts on critical infrastructure.
Delivery of Services	Fires can cause disruption of services, including the ability to deliver goods and services. Impacts on operations could lead to a reduction or cessation of services. Goods and facilities may be damaged or destroyed by fire, smoke, or extremely high temperatures.
Property, Facilities, and Infrastructure	Fire can damage or completely destroy property and critical facilities, as well as lead to interruption of the power supply system. A fire of significant strength can cause major damage to buildings or farmland. Large fires may also interrupt transportation systems such as train and bus lines, creating a challenge for public transit and evacuation.

Table 121: Wildfire Consequence Analysis

Subject	Potential Impacts
Impact on Environment	Fires can have significant impact to the environment by spreading pollution, damaging agricultural crops, and disturbing the wildlife and natural areas. Water and soil pollution caused by fire can cause longer term threats to ecosystem health. Fire damage may also affect soil formation, nutrient cycling, and carbon sequestration and storage.
Economic Conditions	Fires can cause a fiscal impact on the local government, even if costs can be recouped by federal grants. Agriculture is a major component of the local, county and local economy, and major fires could cause significant impact. Costs may be associated with loss of income, damage to property, and firefighting can be significant.
Public Confidence in Governance	Governmental response, on all levels, state and local, would require direct action that must be immediate and effective to maintain public confidence.

5.15.7 Future Development

Rio Arriba County, the Ohkay Owingeh, and participating jurisdictions are experiencing consistent population decline or a static population as people increasingly migrate from rural areas to urban centers. The rural-to-urban population movement has significant implications for all participating jurisdictions, including school closures and reduced economic activity. Based on population projections, this decreasing or static population trend is expected to continue in Rio Arriba County through 2050. While unlikely, any additional growth would place additional populations at risk. Should any population increase occur, potentially vulnerable populations could face disproportionate effects.

Closely tracking population data, but tending to lag population changes, housing data is a good indicator of changing demographics and growth. Rio Arriba County, the Ohkay Owingeh, and all participating jurisdictions have generally seen static to decreasing housing growth over the previous 20-year period. Future land use planning should be proactive to address future hazard conditions. Current building codes provide for sound construction practices to mitigate potential impacts of wildfires.

In Rio Arriba County, various fuel management projects are being implemented to help mitigate the future risk and severity of wildfires. These projects combine techniques such as prescribed burns, thinning of vegetation, and the development of defensible space around communities.

5.15.8 Mitigation Opportunities

Public Comment: *Wildfire is our greatest hazard and forest thinning and controlled burns are the best mitigation approaches.*

The following table presents examples of potential actions that can be instituted for mitigating the volcanic activity hazard.

Table 122: Example Wildfire Weather Mitigation Actions

Category	Example Action
Planning and Regulation	Use GIS mapping of wildfire hazard areas to facilitate analysis and planning decisions through comparison with zoning, development, infrastructure, etc.
	Use zoning and/or a special wildfire overlay district to designate high-risk areas and specify the conditions for the use and development of specific areas.
	Promote conservation of open space or wildland-urban boundary zones to separate developed areas from high-hazard areas.
	Set guidelines for annexation and service extensions in high-risk areas
	Address fire mitigation through access, signage, fire hydrants, water availability, vegetation management, and special building construction standards.
	Establish wildfire mitigation planning requirements for large scale developments or planned unit developments.
	Enclose the foundations of homes and other buildings in wildfire-prone areas, rather than leaving them open and potentially exposing undersides to blown embers or other materials.

Table 122: Example Wildfire Weather Mitigation Actions

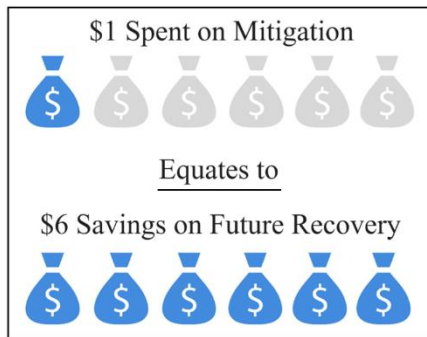
Category	Example Action
	Encourage the use of functional shutters on windows
	Use fire resistant roofing and building materials in remodels, upgrades, and new construction.
Infrastructure	Install roof coverings, sheathing, flashing, skylights, roof and attic vents, eaves, and gutters that conform to ignition-resistant construction standards.
	Protect propane tanks or other external fuel sources.
	Create buffers around residential and non-residential structures through the removal or reduction of flammable vegetation, including vertical clearance of tree branches.
	Perform arson prevention cleanup activities in areas of abandoned or collapsed structures, accumulated trash or debris, and with a history of storing flammable materials where spills or dumping may have occurred.
	Prevent or alleviate wildfires by proper maintenance and separation of power lines as well as efficient response to fallen power lines.
	Require and maintain safe access for fire apparatus to wildland-urban interface neighborhoods and properties.
Natural Systems	Perform maintenance including fuel management techniques such as pruning and clearing dead vegetation, selective logging, cutting high grass, planting fire-resistant vegetation, and creating fuel/fire breaks (i.e., areas where the spread of wildfires will be slowed or stopped by the removal of fuels).
	Use prescribed burning to reduce fuel loads that threaten public safety and property.
	Cut firebreaks into public wooded areas in the wildland-urban interface.
	Develop a vegetation management plan
Education	Join the “Firewise Communities/USA” recognition program sponsored by the National Wildlife Coordinating Group
	Offer GIS hazard mapping online for residents and design professionals.
	Sponsor awareness workshops for local officials, developers, civic groups, and neighborhood/homeowners’ associations.
	Organize a local fire department tour to show local elected officials and planners the most vulnerable areas of the community’s wildland-urban interface and increase their understanding of risks.
	Work with insurance companies, utility providers, and others to include wildfire safety information in materials provided to area residents.
	Develop partnerships with neighborhood groups, homeowners’ associations, and others to conduct outreach activities.
	Create a defensible space or buffer zone cleared of combustible materials around property.
	Remove dead or dry leaves, needles, twigs, and combustibles from roofs, decks, eaves, porches, and yards.

Section 6 – Mitigation Strategy

6.1 Introduction

As part of this planning effort, Rio Arriba County worked to minimize the risk of future impacts from identified hazards to all citizens of the region. In an attempt to shape future regulations, ordinances and policy decisions the MPC reviewed, revised, and developed a comprehensive hazard mitigation strategy. This comprehensive strategy includes:

- Goals to guide the selection of activities to mitigate and reduce potential loss.
- A discussion of funding capabilities for hazard mitigation projects.
- Identification, evaluation, and prioritization of mitigation actions along with potential funding sources.



Rio Arriba County's mitigation strategy promotes long-term hazard resilience that will have a positive impact on quality-of-life issues. By minimizing both the exposure to, and potential impacts from, identified hazards jurisdictions can expect to minimize injuries and loss of life, reduce property damage, and minimize the day-to-day social and economic disruptions that follow hazard events.

According to an analysis by the National Institute of Building Sciences, natural hazard mitigation saves \$6 on average for every \$1 spent on federal mitigation grants. Additional findings indicate that:

6.2 Goals and Objectives

Rio Arriba County, participating jurisdictions, and all stakeholders reviewed the previous LHMP's goals and objectives to determine if they remained viable and valid. In general terms, the relationship between goals and objectives is as follows:

- **Hierarchy:** Goals provide the overarching direction and desired outcomes, while objectives break down those goals into specific, actionable steps.
- **Alignment:** Objectives should align with and support the achievement of goals. Each objective should be directly related to one or more goals.
- **Measurement:** Goals set the vision, and objectives provide the means to measure progress toward that vision. Objectives are often used to track and evaluate the success of achieving broader goals.

During this process, and after a thorough review and discussion with all stakeholders, it was determined that the priorities of the Rio Arriba County in relation to hazard mitigation planning have not changed during the five years of the previous planning cycle. Additionally, and based on discussion with all stakeholders, it was determined that the goals and objectives identified in the previous LHMP remained viable and valid. However, a need was determined to include a goal addressing the relationship between climate change and hazard mitigation. As such, Goal 5 was added to address the impacts of climate change on the landscape of mitigation planning. The following represent the identified goals for the 2024 LHMP:

- **Goal 1:** Reduce the risk to the people and property from the identified hazards in this plan.
- **Goal 2:** Work to protect all vulnerable populations, structures, and critical facilities from the impacts of the identified hazards.
- **Goal 3:** Improve public outreach initiatives to include education, awareness, and partnerships with all entities in order to enhance the understanding identified hazards and hazard mitigation opportunities.
- **Goal 4:** Enhance communication and coordination among all agencies and between agencies and the public.

Participants in the LHMP will continuously evaluate these identified goals and objectives against current capabilities and conditions. As part of this process, and where possible, data and feedback from plan stakeholders will be collected

and analyzed to help identify gaps, roadblocks, and achievements. Using this information, strategies will be developed to bridge identified gaps, remove identified roadblocks, and celebrate identified successes in achieving the goals of this LHMP. Additionally, when necessary, goals and objectives will be modified, updated, or expanded based on the review process. In addition, SCOES will work with all local, county, regional, and state agencies and policy makers to help integrate the goals delineated in the LHMP and goals and plans for combating climate change.

6.3 Review and Creation of Hazard Mitigation Actions

Hazard mitigation actions are proactive measures taken to reduce or eliminate the long-term risk and impact of natural and human-made hazards. These actions are designed to minimize the damage caused by disasters and contribute to the overall resilience of communities and infrastructure.

For this plan update members of the MPC were provided with a complete list of previously identified mitigation actions and asked to review them to determine their status. Previously identified mitigation status was reported using the following definitions:

- **Completed:** The action has been fully completed.
- **Not Completed:** The action was not started or has been started and is not completed.
- **Revised:** Action has been revised to reflect current planning environment or identified changes.
- **Cancelled:** The action has been removed from consideration due to either a lack of resources or changing mitigation priorities.
- **Ongoing:** The action is completed and has become an ongoing activity or capability.

Additionally, MPC members and stakeholders were provided with opportunities to identify and incorporate newly identified actions based on the changing hazard environment or previously unidentified needs. When considering new mitigation actions, participating jurisdictions were guided to the January 2013 FEMA publication *Mitigation Ideas, A Resource for Reducing Risk to Natural Hazards*. This document offers a comprehensive collection of strategies and best practices for reducing risks associated with natural hazards. It covers various types of natural hazards, and provides practical ideas for communities, local governments, and individuals to implement.

In preparing a mitigation strategy all reasonable and obtainable mitigation actions were considered to help achieve the general goals. Priorities were developed based on past damage, existing exposure to risk, and weaknesses identified by the State and local capability assessments. In identifying mitigation actions, the following activities were considered:

- The use of applicable building construction standards.
- Hazard avoidance through appropriate land-use practices.
- Relocation, retrofitting, or removal of structures at risk.
- Removal or elimination of the hazard.
- Reduction or limitation of the amount or size of the hazard.
- Segregation of the hazard from that which is to be protected.
- Modification of the basic characteristics of the hazard.
- Control of the rate of release of the hazard.
- Provision of protective systems or equipment for both cyber and physical risks.
- Establishment of hazard warning and communication procedures.
- Redundancy or duplication of essential personnel, critical systems, equipment, and information materials.

In general, all identified mitigation actions were classified under one of the following broad categories:

- **Local plans and regulations:** Actions that create or update plans to reflect situational changes and/or actions that aid in the creation, revision, or adoption of regulations related to hazard mitigation and management.
- **Infrastructure:** Actions that the modification of existing buildings or structures or involve the construction of structures to reduce the impact of hazard.
- **Natural system protection:** Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems.

- **Public education and awareness:** Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them.

Current climate adaptation strategies highlights using natural system solutions, when possible, to promote community resilience. Natural system solutions utilize natural features or processes to build more resilient communities, which in turn can contribute to climate change mitigation, climate adaptation, hazard mitigation, and environmental justice. These natural system solutions, often referred to as “green infrastructure” provide many additional community benefits including improving community health and wellness, protecting the environment, creating wildfire habitats, reducing greenhouse gas emissions, and providing recreational opportunities. As an additional benefit, the FEMA Building Resilient Infrastructure and Communities grant program provides additional scoring criteria to promote and encourage the utilization of natural system solutions.

6.4 Prioritization of Mitigation Actions

The MPC and subject matter experts worked together to prioritize both previously identified and newly identified hazard mitigation actions. The methodology used to determine mitigation action priorities was based upon the following:

- Review of the updated risk assessments.
- Review of revised goals and objectives.
- Review of capabilities.

A multi-pronged and flexible analysis method was used for determining and prioritizing mitigation actions. An initial review of previously identified but not completed actions was conducted to ensure that, based on current condition and capabilities, the actions were still viable. Actions that were considered viable were retained in this plan update, with minor revisions completed as necessary.

For identified actions that were retained, and for newly identified actions, the FEMA recommended Social, Technical, Administrative, Political, Legal, Economic, and Environmental (STAPLEE) criteria were used to assist with prioritization. The following table details the STAPLEE criteria:

Table 123: STAPLEE Review Criteria

Criteria	Discussion	Example Considerations
Social	There should be community acceptance and support for the mitigation action?	Does the action have community acceptance? Will the proposed action adversely affect one segment of the population?
Technical	The proposed mitigation action should be technically feasible and should provide a long-term reduction in losses.	How effective is the action in avoiding or reducing future losses? Does it solve a problem or only a symptom? Does the action create additional problems?
Administrative	Personnel and administrative capabilities should be available to administer all phases of the project.	Are the staffing and administrative capabilities to implement the action in place? Is there someone to coordinate and lead the effort?
Political	Political support for the mitigation action needs to be present.	Is the action politically acceptable? Have political leaders been involved in the planning process? Is there a political champion to help see the project to completion?
Legal	The legal authority to implement the actions need to be in place or possible with the passing of laws or regulations.	Does the legal authority to implement the proposed action exist? Are there potential legal repercussions?
Economic	The current budget (and/or general obligation bonds or other instruments) need to be in place to fully fund the mitigation action.	Do the potential benefits of this action exceed the potential costs? Has funding been secured for the proposed action? What are the potential funding sources (public, non-profit, and private)?

Table 123: STAPLEE Review Criteria

Criteria	Discussion	Example Considerations
		How will this action affect the fiscal capability of the community(s)? Does the action contribute to other community goals, such as capital improvements or economic development?
Environmental	Actions should interface with the need for sustainable and environmentally healthy communities. Also, statutory considerations, such as the National Environmental Policy Act need to be considered for federal funds.	How will the action affect the environment? Will the action need environmental regulatory approvals? Will it meet federal, state, and local state regulatory requirements? Are endangered or threatened species likely to be affected?

Based on the prioritization review, the MPC assigned each action the following prioritized ranking:

- **High Priority:** Actions that provide substantial progress towards improving resiliency and are determined as potentially urgent in nature by the MPC. This would include actions that strongly support the reduction of high hazard risks and meet mitigation goals. Additionally, actions in this ranking may have imminent funding availability or strong community support.
- **Medium Priority:** Actions that provide reasonable progress towards improving resiliency and are determined as moderately urgent in nature by the MPC. This would include actions that would lessen impact hazard events, but not eliminate the impact completely.
- **Low Priority:** Actions that provide incremental progress towards improving resiliency and are determined as slightly urgent in nature by the MPC. This would include actions that are generally the responsibility of the local community, actions outside the normal authority of the State, or actions whose cost/benefit analysis returns a low yield.

6.5 Mitigation Action Funding Sources

It is generally recognized that mitigation actions help realize long term savings by preventing future losses due to hazard events. However, many mitigation actions are beyond the budgetary capabilities of a single jurisdiction. This section provides a general description of some of the avenues available to defray the cost of implementing mitigation actions.

FEMA provides financial assistance to state, local, tribal, and territorial governments, as well as certain private non-profit organizations, to implement projects that help reduce the risk and impact of future disasters. These grant programs are designed to support initiatives aimed at mitigating hazards and improving resilience. The main grant program offered by FEMA for hazard mitigation is the Hazard Mitigation Assistance (HMA) program. The HMA program includes four subprograms, the Hazard Mitigation Grant Program (HMGP), the HMGP Post-Fire, Building Resilient Infrastructure and Communities (BRIC), and the Flood Mitigation Assistance (FMA) grant program. Applicants to these grant programs are required to submit project proposals that demonstrate the effectiveness of their proposed mitigation projects. The eligibility criteria, application process, and specific requirements for each program are outlined by FEMA in their guidelines and announcements, which are typically published on FEMA's website.

The following provides a general overview of major grant funding streams:





- **HMGP and HMGP Fire:** The HMGP grants assist in implementing long-term hazard mitigation measures following Presidential disaster declarations, including fire declarations. Funding is available to implement projects in accordance with State, Tribal, and local priorities.
- **BRIC:** BRIC supports states, local communities, tribes and territories as they undertake hazard mitigation projects, reducing the risks they face from disasters and natural hazards. The BRIC program guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency. Working

in coordination with BRIC, the National Mitigation Investment Strategy is intended to provide a national, whole-community approach to investments in mitigation activities and risk management.

- **FMA Grant Program:** FMA is a competitive grant program that provides funding to states, local communities, federally recognized tribes and territories. Funds can be used for projects that reduce or eliminate the risk of repetitive flood damage to buildings insured by the NFIP. FEMA chooses recipients based on the applicant's ranking of the project and the eligibility and cost-effectiveness of the project. FEMA requires state, local, tribal and territorial governments to develop and adopt hazard mitigation plans as a condition for receiving certain types of non-emergency disaster assistance, including funding for hazard mitigation assistance projects.

The following chart summarizes HMA grants programs:

Chart 28: HMA Grant Program Summary

HMA Program Comparison	 HMGP	 HMGP Post Fire	 BRIC	 FMA
Program Type	Post-disaster	Post-disaster	Pre-disaster	Pre-disaster
Funding Availability	Presidentially declared disaster	FMAG-declared disaster	6% set aside from federal post-disaster grant funding	Annual appropriations
Competitive?	No	No	Yes	Yes
Eligible Applicants	States, federally recognized tribes, territories and the District of Columbia (DC)	States, federally recognized tribes, territories and DC	States, federally recognized tribes, territories and DC	States, federally recognized tribes, territories and DC
Eligible Subapplicants	State agencies, local governments, tribes and private nonprofit organizations	State agencies, local governments, tribes and private nonprofit organizations	State agencies, local governments and tribes	State agencies, local governments and tribes
Hazard Mitigation Plan Requirement	Yes	Yes	Yes	Yes
NFIP Participation	Communities with projects in Special Flood Hazard Areas (SFHAs)	Communities with projects in SFHAs	Communities with projects in SFHAs	Subapplicants and properties

Additionally, the following provide available grant funding avenues for hazard mitigation projects:

- **Rehabilitation Of High Hazard Potential Dam (HHPD) Grant Program:** HHPD awards provide technical, planning, design and construction assistance in the form of grants for rehabilitation of eligible high hazard potential dams. A state or territory with an enacted dam safety program, the State Administrative Agency, or an equivalent state agency, is eligible for the grant.
- **Emergency Management Performance Grant:** Program provides state, local, tribal and territorial emergency management agencies with the resources required for implementation of the National Preparedness System and works toward the National Preparedness Goal of a secure and resilient nation. Allowable costs support efforts to build and sustain core capabilities across the prevention, protection, mitigation, response and recovery mission areas.

- **State Homeland Security Program:** Program includes a suite of risk-based grants to assist state, local, tribal and territorial efforts in preventing, protecting against, mitigating, responding to and recovering from acts of terrorism and other threats. This grant provides grantees with the resources required for implementation of the National Preparedness System and working toward the National Preparedness Goal of a secure and resilient nation.
- **Nonprofit Security Grant Program:** Program is one of three grant programs that support DHS/FEMA's focus on enhancing the ability of state, local, tribal, and territorial governments, as well as nonprofits, to prevent, protect against, prepare for, and respond to terrorist or other extremist attacks. These grant programs are part of a comprehensive set of measures authorized by Congress and implemented by DHS to help strengthen the nation's communities against potential terrorist or other extremist attacks. Among the five basic homeland security missions noted in the DHS Strategic Plan for Fiscal Years 2020-2024
- **Public Assistance Program:** The mission of FEMA's Public Assistance program is to provide assistance to State, Tribal and local governments, and certain types of Private Nonprofit organizations so that communities can quickly respond to and recover from major disasters or emergencies declared by the President. Through the Public Assistance program, FEMA provides supplemental Federal disaster grant assistance for debris removal, emergency protective measures, and the repair, replacement, or restoration of disaster-damaged, publicly owned facilities and the facilities of certain private non-profit organizations. The Public Assistance Program also encourages protection of these damaged facilities from future events by providing assistance for hazard mitigation measures during the recovery process. The Federal share of assistance is not less than 75% of the eligible cost for emergency measures and permanent restoration. The grantee determines how the non-Federal share (up to 25%) is split with the eligible applicants.
- **Individual Assistance Program:** After a disaster, the federal government determines if any county in the state meets the criteria for individual disaster assistance. The decision is based on damage related to the severity and magnitude of the event. When a county receives an Individual Assistance declaration from the President of the United States, anyone who lives in that county can apply for assistance.
- **Small Business Administration Disaster Loans:** The Small Business Administration provides low-interest disaster loans to homeowners, renters, businesses of all sizes, and most private nonprofit organizations. Small Business Administration disaster loans can be used to repair or replace the following items damaged or destroyed in a declared disaster: real estate, personal property, machinery and equipment, and inventory and business assets.
- **The Housing and Urban Development Agency:** Provides flexible grants to help cities, counties, and States recover from Presidentially declared disasters, especially in low-income areas, subject to availability of supplemental appropriations.
- **Community Development Block Grant Program:** This is a flexible program that provides communities with resources to address a wide range of unique community development needs. The program provides annual grants on a formula basis to general units of local government and States.
- **Individual and Households, Other Needs Assistance Program:** This program provides financial assistance to individuals or households who sustain damage or develop serious needs because of a natural or man-made disaster. The funding share is 75% federal funds and 25% state funds. The program provides grants for necessary expenses and serious needs that cannot be provided for by insurance, another federal program, or other source of assistance. The current maximum allowable amount for any one disaster to individuals or families is \$25,000. The program gives funds for disaster-related necessary expenses and serious needs, including personal property, transportation, medical and dental, funeral, essential tools, flood insurance, and moving and storage.
- **WUI Grants:** The 10-Year Comprehensive Strategy focuses on assisting people and communities in the WUI to moderate the threat of catastrophic fire through the four broad goals of improving prevention and suppression, reducing hazardous fuels, restoring fire-adapted ecosystems, and promoting community assistance. The WUI Grant may be used to apply for financial assistance towards hazardous fuels and educational projects within the four goals of: improved prevention, reduction of hazardous fuels, restoration of fire-adapted ecosystems and promotion of community assistance.

The Bureau of Indian Affairs (BIA) offers various grant programs aimed at supporting hazard mitigation efforts within tribal communities, including the Ohkay Owingeh. These programs are designed to reduce the risk of natural hazards,

enhance community resilience, and protect life, property, and cultural resources on tribal lands. Key BIA mitigation grant programs include:

- **Tribal Resilience Program Grants:** These grants support tribes in planning and implementing actions to address climate change impacts, including hazard mitigation related to extreme weather events, droughts, wildfires, and other climate-related hazards. Grants can be used for activities such as vulnerability assessments, resilience planning, capacity building, and community education. Federally recognized tribes and tribal organizations are eligible to apply for these grants.
- **BIA Emergency Management Program Grants:** This program provides financial assistance to tribes to develop and implement emergency management programs, including hazard mitigation planning and preparedness activities. Grants can be used to develop tribal hazard mitigation plans, purchase emergency management equipment, and conduct training and exercises. Federally recognized tribes can apply.
- **Indian Community Development Block Grant Imminent Threat Grants:** These grants are designed to address imminent threats to public health and safety on tribal lands, including those posed by natural hazards. Funds can be used for projects such as flood control, fire protection, and infrastructure improvements that mitigate the impact of natural disasters. Federally recognized tribes are eligible to apply.
- **BIA Housing Improvement Program:** While primarily focused on improving housing conditions for low-income tribal members, HIP funds can also be used for housing-related hazard mitigation activities, such as floodproofing and retrofitting homes for resilience. Grants can be used to repair or replace substandard housing and improve the safety and resilience of tribal homes. Federally recognized tribes and individual tribal members are eligible to apply.
- **BIA Forestry and Wildland Fire Management Program:** This program focuses on the management of forest resources and the prevention and mitigation of wildfires on tribal lands. Grants and technical assistance are provided for wildfire prevention, fuel reduction projects, and post-fire rehabilitation efforts. Federally recognized tribes and tribal organizations with forested lands.
- **BIA Aid to Tribal Governments:** This program provides funds to Indian Tribal governments to support general Tribal government operations, to maintain up-to-date Tribal enrollment, to conduct Tribal elections, and to develop appropriate Tribal policies, legislation, and regulations. Funds may be used in a variety of ways to strengthen the capabilities of Indian tribes in self-government, community planning, and maintenance of membership records.
- **BIA Replacement and Repair of Indian Schools:** Providing safe, functional, code-compliant, economical, and energy efficient education facilities for American Indian students attending Bureau of Indian Affairs owned or funded primary and secondary schools or residing in Bureau owned or funded dormitories. Additional objectives for ARRA funded projects include having a demonstrated or potential ability to deliver programmatic results, optimizing economic activity and the number of jobs created or saved, achieving long-term public benefits from improved school infrastructure, fostering energy independence or improving educational quality.

These grants help tribes proactively address the risks associated with natural hazards, reducing vulnerability and increasing community resilience. By providing funding directly to tribes, these programs support tribal sovereignty, allowing tribes to design and implement mitigation strategies that are tailored to their specific needs and priorities. Additionally, many of these programs also emphasize the protection of culturally significant sites and resources from the impacts of natural hazards.

Small and impoverished communities that receive grants may receive a federal cost share of up to 90% of the total amount approved under the grant award. As defined in 44 CFR 201.2, a small and impoverished community is:

- A community of 3,000 or fewer individuals that is identified by the State as a rural community
- Is not a remote area within the corporate boundaries of a larger city
- Is economically disadvantaged, by having an average per capita annual income of residents not exceeding 80% of national, per capita income

- The local unemployment rate exceeds by one percentage point or more, the most recently reported, average yearly national unemployment rate
- Any other factors identified in the State Plan in which the community is located

6.6 Previously Identified Jurisdictional Mitigation Actions

Previously identified hazard mitigation actions were reviewed by the relevant jurisdiction to determine the status of each action. The status of these previously identified hazard mitigation actions indicates if the action has been completed, is carried over to this version of the plan, has been revised, or is no longer being considered. Additionally, each action was assigned a new number to conform with the numbering system in this LHMP.

Actions in the previous LHMP were not differentiated by jurisdiction, and only assigned to Rio Arriba County. The following table details the status of the actions, for the county. All other jurisdictions elected to create standalone actions for purposes of this plan.

Table 124: Rio Arriba County Previous Plan Hazard Mitigation Actions

New Action Number	Previous Action Number	Description	Status
11	1	Air Conditioning and Ventilation Modernization	Carried over, modified
-	2	Alert, Broadcast, and Warning System	Deleted, not mitigation
18	3	Bionet Installation Program	Carried over, modified
1	4	Critical Facility Backup Generator Installation	Carried over, modified
26	5	Debris & Natural Fuels Reduction Program	Carried over, modified
27	6	Defensible Spaces/Buffer Zones Program	Carried over, modified
19	7	Embankment Soil Barrier Installation	Carried over, modified
22	8	FEMA Code 361 Safe Room Projects	Carried over, modified
25	9	Insulation & Energy Efficiency Upgrade Program	Carried over, modified
7	10	Dam Failure Public Awareness and Education Program	Carried over, modified
16	11	Rainwater Retention/Detention Project	Carried over, modified
-	12	Remote Water Monitoring Stations	Deleted, not technically feasible
19	13	Slope Reinforcement and Modification Program	Carried over, modified
24	14	Snow Fence Installation Program	Carried over, modified
-	15	Expansive Soil Sampling and Analysis	Deleted, hazard no longer considered
14	16	Storm Water Drainage System Upgrade	Carried over, modified
2	17	Transportation Status and Routing Notification Systems	Carried over, modified
5	18	Tree Wire Installation	Carried over, modified
-	19	Underground Electrical Transmission Installation	Deleted, cost prohibitive
25	20	Water Line Insulation Program	Carried over, modified
21	21	Wildfire Structural Retrofit Program	Carried over, modified
9	22	Xeriscaping program	Carried over, modified

Completed actions may be found in the following section. Carried over, revised, and deleted actions may be found in 6.8.

6.7 Completed Mitigation Actions

Rio Arriba County, the Ohkay Owingeh, and all participating jurisdictions remain committed to investigating and obtaining all available grant funding for the completion of hazard mitigation projects. Since the completion of the previous LHMP in 2013 none of the identified mitigation actions have been completed:

Neither Rio Arriba County, the Ohkay Owingeh, or any participating jurisdictions have received any FEMA Hazard Mitigation Grant funding (HMGP, BRIC, PDM, FMAG) as of this plan.

6.8 Jurisdictional Mitigation Actions

To support the mitigation goals identified in this LHMP, Rio Arriba County, the Ohkay Owingeh, and all participating jurisdictions identified a comprehensive range mitigation projects and activities. The selected set carefully takes an all-hazards approach to mitigation while simultaneously addressing each of the plan's profiled hazards. The list of

mitigation actions is based upon the potential to reduce risk to life and property with an emphasis on ease of implementation, community and agency support, consistency with local jurisdictions' plans and capabilities, available funding, and jurisdictional vulnerability.

It is important to note that since the previous LHMP, requirements for plan approval have changed. In the previous plan, all jurisdictions identified only a few actions, with many of the actions identified at the county level to cover local participants. As such, the actions in this plan have been re-written and reclassified on a wholesale basis to ensure each participating jurisdiction has identified at least one action per identified hazard. In doing so, presenting a comparison to previously identified actions is impractical. However, any actions previously identified that have been completed are noted to illustrate successes.

The strategy for development and revision of hazard mitigation actions in this LHMP allows a more tailored approach to mitigation planning, ensuring that communities address the hazards most relevant to their circumstances while also acknowledging that not all hazards may be equally significant across different areas. It promotes a more efficient use of resources by focusing efforts on mitigating the most pressing risks faced by each community.

For each identified action, the following applies:

- New actions that have been added to this plan update are identified as such
- Some actions have been reassigned or reclassified. In these cases, not all information is provided under the original listing, rather the newly assigned responsible entity has been given the opportunity to detail the requested information
- All mitigation action information was provided by jurisdictional officials through outreach from the MPC

The following table provides a mitigation action cross check for each participating jurisdiction.

Table 125: Participating Jurisdiction Mitigation Action Cross Check

Hazard	Rio Arriba County	Chama	Espanola	Ohkay Owingeh
All Hazards	1, 2, 3, 4, 5	-	-	-
Dam Failure	6, 7	1, 2	1, 2	1, 2
Drought	8, 9, 10	3, 4	3, 4	3, 4, 5
Extreme Temperatures	11, 12	5, 6	5, 6	6, 7
Flood	13-17	7, 8	7, 8	8, 9
Landslide	18, 19	9, 10	9, 10	10, 11
Severe Weather	20, 21, 22, 23	11, 12	11, 12	12, 13, 14
Severe Winter Weather	24, 25	13	13	15, 16
Wildfire	26, 27, 28	14, 15	14, 15	12, 14, 17, 18, 19

The following tables identify mitigation action items for each participating jurisdiction, along with the following information:

- Hazard addressed
- Responsible party
- Overall priority
- Goal(s) addressed
- Estimated cost
- Potential funding source
- Proposed completion timeframe
- Current status

It is important to note that when assigning a responsible party for these actions the participating jurisdictions have limited staff and departments. As such, the overall assignment has been given to the highest-ranking employee or overarching department.

Table 126: Rio Arriba County Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Rio Arriba County 1	Install generators in all county facilities to ensure the continuous function of government activities.	All hazards	Emergency Manager, Rio Arriba County Facilities Director	High	1, 2	\$10,000 to \$50,000 per location	HMGP, BRIC, General Funds	Ten years	Carried over due to lack of funding
Rio Arriba County 2	Purchase electronic mobile traffic notification signs.	All Hazards	Emergency Manager, Rio Arriba County Public Works Director	Medium	1, 2	\$35,000 - \$50,000	HMGP, General Funds	Five years	Carried over due to lack of funding
Rio Arriba County 3	Conduct education programs on all hazards for citizens and businesses of Rio Arriba County.	All hazards	Emergency Manager	Medium	3	\$500 per event	HMGP, BRIC, General Funds	Three years	New
Rio Arriba County 4	Develop restrictions on planting large or rapidly growing trees near power lines and major arterials.	All hazards	Emergency Manager, County Manager	Low	1, 2, 4	Staff time	General Funds	Five years	New
Rio Arriba County 5	Conduct a regular tree trimming and tree wire installation program.	All hazards	Emergency Manager	High	1, 2	\$25,000 per occurrence	General Funds	Continuous	Carried over due to lack of funding
Rio Arriba County 6	Conduct a GIS driven analysis of all assets in identified high hazard dam inundation areas for the determination of long-term projects to reduce or eliminate the vulnerability of these identified assets.	Dam Failure	Emergency Manager, IT Director, NFIP Coordinator	Medium	1, 2	Staff time	General Funds	Five years	New
Rio Arriba County 7	Post permanent signage showing evacuation and higher ground routes in identified inundation areas.	Dam Failure	Emergency Manager, GIS Director, NFIP Coordinator	Medium	1, 2	Staff time and \$10,000	General Funds	Five years	New
Rio Arriba County 8	Develop. and adopt a water conservation	Drought	Emergency Manager,	Low	1, 2, 3, 4	Staff time	General Funds	Five years	New

Table 126: Rio Arriba County Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
	ordinance that stipulates landscaping requirements, hours for irrigation, retrofitting with low-flow outlets, and penalties for wasting water.		County Manager						
Rio Arriba County 9	Replace existing plantings with low water native plants at all jurisdictional owned facilities	Drought	Rio Arriba County Facilities Director	Medium	1, 2	\$5,000 - \$20,000 per facility	HMGP, BRIC, General Funds	Ten years	Carried over due to lack of funding
Rio Arriba County 10	Conduct regular water use seminars to provide information on low flow utilities, low water native plants, and conservation methods.	Drought	Emergency Manager	Medium	3, 4	\$1,000 per class	General Funds	Yearly	New
Rio Arriba County 11	Modernization HVAC systems in jurisdictional facilities.	Extreme Heat	Rio Arriba County Facilities Director	Low	1, 2	\$25,000 per facility	HMGP, BRIC, General Funds	Five years	Carried over due to lack of funding
Rio Arriba County 12	Identify and prepare county buildings for usage as heat shelters.	Extreme Heat	Facilities Director	Low	1, 2	\$2,000 per facility	BRIC, General Funds	Five years	New
Rio Arriba County 13	Continue to participate in, and enforce provisions of, NFIP.	Flood	NFIP Administrator	High	1, 2	Staff time	General Fund	On-going	On-going
Rio Arriba County 14	Upgrade all stormwater systems to be able to handle high flood flows	Flood	Emergency Manager, NFIP Administrator	High	1, 2	Per project cost	FMA, HMGP, BRIC, General Funds	Ten years	Carried over due to lack of funding
Rio Arriba County 15	Designate all floodways as open space	Flood	Emergency Manager, NFIP Administrator	High	1, 3	Staff Time	General Funds	Five years	New

Table 126: Rio Arriba County Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Rio Arriba County 16	Construct rainwater retention/detention ponds at strategic locations.	Flood	NFIP Administrator, Public Works Director	Medium	1, 2	Facility size dependent	HMGP, BRIC, General Funds	Ten years	Carried over due to lack of funding
Rio Arriba County 17	Procure permanent signage to warn of flood hazard areas.	Flood	NFIP Administrator, Emergency Manager	Medium	1, 2	Location dependent	HMGP, General Funds	Five years	New
Rio Arriba County 18	Stabilize cliffs with terracing or plantings of grasses or bionets to hold soil together.	Landslide	Rio Arriba County Public Works Director	Low	1, 3	Location dependent	HMGP, BRIC, General Funds	5-10 years	Carried over due to lack of funding
Rio Arriba County 19	Map landslide prone slopes, and then conduct a slope reinforcement and modification program.	Landslide	Rio Arriba County Public Works Director	Low	1, 2	Location dependent	HMGP, BRIC, General Funds	5-10 years	Carried over due to lack of funding
Rio Arriba County 20	Install signage on highways in known high wind areas alerting high profile vehicles of hazard.	Severe Storms	Rio Arriba County Public Works Director	Medium	1, 2	\$20,000	HMGP, BRIC, General Funds	Five years	New
Rio Arriba County 21	Install high wind, hail, and fire-resistant roofing on all jurisdictional facilities.	Severe Weather	Rio Arriba County Facilities Director	Medium	1, 2	Project dependent	General Fund, HMGP, BRIC	Five years	New
Rio Arriba County 22	Construct FEMA approved saferooms in county facilities.	Severe Storms	Rio Arriba County Public Works Director	Medium	1, 2	Facility size dependent	HMGP, BRIC, General Funds	5-10 years	Carried over due to lack of funding
Rio Arriba County 23	Install and maintain surge protection on critical electronic equipment.	Severe Weather	City Manager	Low	1, 3	\$10,000 per location	General Fund, HMGP, BRIC	Five years	New
Rio Arriba County 24	Install living snow fences along major roads.	Severe Winter Weather	Rio Arriba County Public Works Director	Low	1, 3	Per location cost	General Fund, HMGP, BRIC	Ten years	Carried over due to lack of funding

Table 126: Rio Arriba County Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Rio Arriba County 25	Further insulate all water lines in jurisdictional facilities.	Severe Winnter Weather	Rio Arriba County Facilities Director	Medium	1, 2	Location dependent	General Fund, HMGP, BRIC	Five years	Carried over due to lack of funding
Rio Arriba County 26	Conduct a fuel thinning program on all county owned and managed land, to include private lands overseen by Rio Arriba County Fire Districts, to reduce potential wildfire hazard.	Wildfire	Rio Arriba County Emergency Manager, Fire Chiefs	Medium	1, 2	\$500 per acre	HMGP, BRIC, General Funds	Continuous	On-going
Rio Arriba County 27	Create defensible space buffers at all critical facilities	Wildfire	Fire Chiefs, Emergency Manager	High	1, 2	Facility size dependent	HMGP, BRIC, General Funds	As required	Carried over due to lack of funding
Rio Arriba County 28	Increase public training on wildland-urban interface fire prevention.	Wildfire	Fire Chiefs, Emergency Manager	High	2	Staff time	General fund	Three to five years	New

Table 127: Chama Hazard Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Chama-1	Install evacuation route and high ground signage in any high hazard dam potential inundation areas.	Dam Failure	City Manager	Medium	1, 2	\$5,000 per location	FEMA mitigation grant, General fund	Five years	New
Chama-2	Map all infrastructure and facilities within dam inundation areas.	Dam Failure	City Manager	Medium	1, 2, 3	\$10,000 per location	FEMA mitigation grant, General fund	Five years	New
Chama-3	Conduct a native, low water planting program for all jurisdictional owned facilities.	Drought	City Manager	Low	1, 3, 6	\$5,000 - \$50,000 per location	FEMA mitigation grant, General fund	Five years	New
Chama-4	Conduct agricultural education program on water reduction methods.	Drought	City Manager	High	1, 2, 3, 6	Staff Time	General fund	Five years	New
Chama-5	Modernization of HVAC systems in jurisdictional facilities.	Extreme Temperatures	City Manager	Low	1, 3, 6	\$25,000 per facility	FEMA mitigation grant, General fund	Ten years	New
Chama-6	Identify and prepare jurisdictional buildings for usage as temperature shelters.	Extreme Temperatures	City Manager	Low	1, 3, 6	\$2,000 per facility	General fund	Two years	New
Chama-7	Continue to participate in the National Flood Insurance Program.	Flood	City Manager	High	3	Staff Time	General fund	Continuous	On-going
Chama-8	Construct rainwater retention/detention ponds at strategic locations.	Flood	City Manager	Medium	1, 3, 6	Project dependent	General Fund, FMA, HMGP, BRIC	Ten years	New
Chama-9	Stabilize cliffs with terracing or plantings of grasses or other plants to hold soil together.	Landslide	City Manager	Low	1, 3	Staff time	General Fund	5-10 years	New
Chama-10	Map , and then notify property owners located	Landslide	City Manager	Low	1, 2, 3	Staff time	General Fund	Three years	New

Table 127: Chama Hazard Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
	in high-risk landslide areas.								
Chama-11	Install high wind, hail, and fire-resistant roofing on all jurisdictional facilities.	Severe Weather	City Manager	Medium	1, 3, 6	Project dependent	General Fund, HMGP, BRIC	Five years	New
Chama-12	Install and maintain surge protection on critical electronic equipment.	Severe Weather	City Manager	Low	1, 3	\$10,000 per location	General Fund, HMGP, BRIC	Five years	New
Chama-13	Install living snow fences along major roads.	Severe Winter Weather	City Manager	Low	1, 3	Per location cost	General Fund, HMGP, BRIC	Ten years	New
Chama-14	Create defensible space buffers at all critical facilities	Wildfire	City Manager	High	1, 2	Facility size dependent	HMGP, BRIC, Jurisdiction budget	As required	New
Chama-15	Increase public and fire department training on wildland-urban interface fire prevention.	Wildfire	City Manager	High	3	\$30 per student per training session	Forest Service and federal grants	Three to five years	New

Table 128: Espanola Hazard Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Espanola-1	Install evacuation route and high ground signage in any high hazard dam potential inundation areas.	Dam Failure	City Manager	Medium	1, 2	\$5,000 per location	FEMA mitigation grant, General fund	Five years	New
Espanola-2	Map all infrastructure and facilities within dam inundation areas.	Dam Failure	City Manager	Medium	1, 2, 3	\$10,000 per location	FEMA mitigation grant, General fund	Five years	New
Espanola-3	Conduct a native, low water planting program for all jurisdictional owned facilities.	Drought	City Manager	Low	1, 3, 6	\$5,000 - \$50,000 per location	FEMA mitigation grant, General fund	Five years	New
Espanola-4	Conduct agricultural education program on water reduction methods.	Drought	City Manager	High	1, 2, 3, 6	Staff Time	General fund	Five years	New
Espanola-5	Modernization of HVAC systems in jurisdictional facilities.	Extreme Temperatures	City Manager	Low	1, 3, 6	\$25,000 per facility	FEMA mitigation grant, General fund	Ten years	New
Espanola-6	Identify and prepare jurisdictional buildings for usage as temperature shelters.	Extreme Temperatures	City Manager	Low	1, 3, 6	\$2,000 per facility	General fund	Two years	New
Espanola-7	Continue to participate in the National Flood Insurance Program.	Flood	City Manager	High	3	Staff Time	General fund	Continuous	On-going
Espanola-8	Construct rainwater retention/detention ponds at strategic locations.	Flood	City Manager	Medium	1, 3, 6	Project dependent	General Fund, FMA, HMGP, BRIC	Ten years	New
Espanola-9	Stabilize cliffs with terracing or plantings of grasses or other plants to hold soil together.	Landslide	City Manager	Low	1, 3	Staff time	General Fund	5-10 years	New
Espanola-10	Map , and then notify property owners located	Landslide	City Manager	Low	1, 2, 3	Staff time	General Fund	Three years	New

Table 128: Espanola Hazard Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
	in high-risk landslide areas.								
Espanola-11	Install high wind, hail, and fire-resistant roofing on all jurisdictional facilities.	Severe Weather	City Manager	Medium	1, 3, 6	Project dependent	General Fund, HMGP, BRIC	Five years	New
Espanola-12	Install and maintain surge protection on critical electronic equipment.	Severe Weather	City Manager	Low	1, 3	\$10,000 per location	General Fund, HMGP, BRIC	Five years	New
Espanola-13	Install living snow fences along major roads.	Severe Winnter Weather	City Manager	Low	1, 3	Per location cost	General Fund, HMGP, BRIC	Ten years	New
Espanola-14	Create defensible space buffers at all critical facilities	Wildfire	City Manager	High	1, 2	Facility size dependent	HMGP, BRIC, Jurisdiction budget	As required	New
Espanola-15	Increase public and fire department training on wildland-urban interface fire prevention.	Wildfire	City Manager	High	3	\$30 per student per training session	Forest Service and federal grants	Three to five years	New

Table 129: Ohkay Owingeh Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Ohkay Owingeh 1	Install evacuation route and high ground signage in any high hazard dam potential inundation areas.	Dam Failure	Ohkay Owingeh Tribal Council	Medium	1, 2	\$5,000 per location	FEMA mitigation grant, Tribal General Fund	Five years	New
Ohkay Owingeh 2	Map all infrastructure and facilities within dam inundation areas.	Dam Failure	Ohkay Owingeh Tribal Council	Medium	1, 2, 3	\$10,000 per location	FEMA mitigation grant, Tribal General Fund	Five years	New
Ohkay Owingeh 3	Install low flow utilities in all tribal facilities.	Drought	Ohkay Owingeh Tribal Council	High	1, 2	\$50,000 per facility	BIA, HMGP, BRIC, Tribal General Fund	Five years	New
Ohkay Owingeh 4	Conduct a native plant landscaping program for all tribal owned facilities	Drought	Ohkay Owingeh Tribal Council	High	1, 2	\$5,000 - \$20,000 per location	BIA, HMGP, BRIC, Tribal General Fund	Five years	New
Ohkay Owingeh 5	Conduct a personal water use education program.	Drought	Ohkay Owingeh Tribal Council	High	1, 3	\$5,000	Tribal General Fund	Five years	New
Ohkay Owingeh 6	Modernization of HVAC systems in tribal facilities.	Extreme Temperatures	City Manager	Low	1, 3, 6	\$25,000 per facility	BIA, HMGP, BRIC, Tribal General Fund	Ten years	New
Ohkay Owingeh 7	Educate tribal members of potential health impacts of extreme temperatures.	Extreme Temperatures	City Manager	Low	1, 3, 6	\$2,000 per facility	BIA, HMGP, BRIC, Tribal General Fund	Two years	New
Ohkay Owingeh 8	Clean and repair drainage ditches and culverts to maintain capacity.	Flood	Ohkay Owingeh Tribal Council	High	1, 2	\$300,000	BIA, HMGP, BRIC, Tribal General Fund	Five years	New
Ohkay Owingeh 9	Construct rainwater retention/detention ponds at strategic locations.	Flood	Ohkay Owingeh Tribal Council	Medium	1, 2	Location and size dependent	BIA, HMGP, BRIC, Tribal General Fund	Ten years	New
Ohkay Owingeh 10	Install bionets in landslide prone locations.	Landslide	Ohkay Owingeh Tribal Council	Low	1, 2	Location and size dependent	BIA, HMGP, BRIC, Tribal General Fund	Ten years	New
Ohkay Owingeh 11	Conduct a slope reinforcement and modification program in slide prone areas	Landslide	Ohkay Owingeh Tribal Council	Low	1, 2	Location and size dependent	BIA, HMGP, BRIC, Tribal General Fund	Ten years	New
Ohkay Owingeh 12	Purchase and install critical facility backup generators.	Severe Weather, Wildfire	Ohkay Owingeh Tribal Council	High	1, 2	\$40,000 per facility	BIA, HMGP, BRIC, Tribal General Fund	Five years	New

Table 129: Ohkay Owingeh Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Ohkay Owingeh 13	Install surge protectors in all tribal facilities.	Severe Weather	Ohkay Owingeh Tribal Council	Low	1, 2	\$10,000 per location	BIA, HMGP, BRIC, Tribal General Fund	Five years	New
Ohkay Owingeh 14	Install hail and fire-resistant roofing on all tribal facilities.	Severe Weather, Wildfire	Ohkay Owingeh Tribal Council	Low	1, 2	\$50,000 per location	BIA, HMGP, BRIC, Tribal General Fund	Five years	New
Ohkay Owingeh 15	Conduct a winterization educational class for the public.	Severe Winter Weather	Ohkay Owingeh Tribal Council	Medium	1, 3		Tribal General Fund	Five years	New
Ohkay Owingeh 16	Conduct an insulation and energy upgrade program for all tribal owned and managed buildings.	Severe Winter Weather	Ohkay Owingeh Tribal Council	Medium	1, 2	\$75,000 - \$125,000	BIA, HMGP, BRIC, Tribal General Fund	Five years	New
Ohkay Owingeh 17	Create defensible spaces and buffer zones void of vegetative fuel at all tribal facilities.	Wildfire	Ohkay Owingeh Tribal Council	High	1, 2	Facility size dependent	BIA, HMGP, BRIC, Tribal General Fund	As required	New
Ohkay Owingeh 18	Implement hazardous fuels reduction program.	Wildfire	Ohkay Owingeh Tribal Council	High	1, 2	\$100,000	BIA, HMGP, BRIC, Tribal General Fund	Five years	New
Ohkay Owingeh 19	Conduct wildfire education program and outreach programs for public.	Wildfire	Ohkay Owingeh Tribal Council	High	1, 3	Staff Time	Tribal General Fund	Five years	New

Table 130: Rio Arriba School District Hazard Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Rio Arriba School District-1	Conduct a native, low water planting program for all jurisdictional owned facilities.	Drought	School Superintendent	Low	1, 3, 6	\$5,000 - \$50,000 per location	FEMA mitigation grant, District General Budget	Five years	New
Rio Arriba School District-2	Conduct agricultural education program on water reduction methods.	Drought	School Superintendent	High	1, 2, 3, 6	Staff Time	District General Budget	Five years	New
Rio Arriba School District-3	Modernization of HVAC systems in district facilities.	Extreme Temperatures	School Superintendent	Low	1, 3, 6	\$25,000 per facility	FEMA mitigation grant, District General Budget	Ten years	New
Rio Arriba School District-4	Identify and prepare district buildings for usage as shelters during times of extreme temperatures.	Extreme Temperatures	School Superintendent	Low	1, 3, 6	\$2,000 per facility	District General Budget	Two years	New
Rio Arriba School District-5	Educate students on dangers of entering flooded areas..	Flood	School Superintendent	High	3	Staff Time	District General Budget	One year	New
Rio Arriba School District-6	Construct rain gardens next to paved parking areas.	Flood	School Superintendent	Medium	1, 3, 6	Project dependent	District General Budget, FMA, HMGP, BRIC	Ten years	New
Rio Arriba School District-7	Map any district facilities in high-risk landslide areas.	Landslide	School Superintendent	Low	1, 3	Staff time	District General Budget	5-10 years	New
Rio Arriba School District-8	Install high wind, hail, and fire-resistant roofing on all district facilities.	Severe Weather	School Superintendent	Medium	1, 3, 6	Project dependent	District General Budget, HMGP, BRIC	Five years	New

Table 130: Rio Arriba School District Hazard Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Rio Arriba School District-9	Install and maintain surge protection on critical electronic equipment.	Severe Weather	School Superintendent	Low	1, 3	\$10,000 per location	District General Budget, HMGP, BRIC	Five years	New
Rio Arriba School District-10	Educate students on impacts of severe winter weather, including education on proper driving techniques.	Severe Winter Weather	School Superintendent	Low	1, 3	Staff Time	District General Budget, HMGP, BRIC	Ten years	New
Rio Arriba School District-11	Create defensible space buffers at all district facilities.	Wildfire	School Superintendent	High	1, 2	Facility size dependent	Jurisdiction budget	As required	New

Prior to the implementation of any action further feasibility analysis will be performed. Additionally, a Benefit-Cost Analysis that determines the future risk reduction benefits of a hazard mitigation project and compares those benefits to its costs will be conducted as required. Applicants and sub-applicants will use FEMA approved methodologies and tools, such as the Benefit-Cost Analysis Toolkit, to demonstrate the cost-effectiveness of their projects. The result of the analysis is a Benefit-Cost Ratio, and a project is considered cost-effective when the Benefit-Cost Ratio is 1.0 or greater. Depending on the project, either a full Benefit-Cost Analysis will be completed by entering documented values into the FEMA Benefit-Cost Analysis Toolkit, which calculates a benefit-cost ratio or, if the project meets specified criteria, a streamlined Benefit-Cost Analysis may be completed (FEMA's cost-effectiveness requirement is never waived).

Rio Arriba County, the Ohkay Owingeh, and all participating jurisdictions acknowledge that the adoption and approval of this plan does not obligate the completion of each identified action. Rather, the MPC understands that progress should be shown in mitigation efforts which may include the completion of mitigation actions or other actions or progress in achieving the goals of the LHMP.

6.9 Mitigation Action Implementation and Monitoring

Rio Arriba County, the Ohkay Owingeh Tribe, and each participating jurisdiction is responsible for implementing and managing identified mitigation actions. To foster accountability and increase the likelihood that actions will be implemented, every proposed action is assigned to a specific department or position as a champion. In general:

- The identified champion will be responsible for tracking and reporting on action status.
- The identified champion should provide input on whether the action as implemented is successful in reducing vulnerability, if applicable.
- If the action is unsuccessful in reducing vulnerability, the identified champion will be tasked with identifying deficiencies and additional required actions.

Additionally, each action has been assigned a proposed completion timeframe to determine if the action is being implemented according to plan.

RACOEM is responsible for monitoring the progress of mitigation activities and projects throughout the county in conjunction with the participating stakeholder communities. To facilitate the tracking of any awarded hazard mitigation grants, the RACOEM will compile a list of projects funded throughout the calendar year, if any, and add it to an electronic database. Additionally, RACOEM will monitor information on any other mitigation projects that were not funded through hazard mitigation grants. RACOEM will utilize the NMDHSEM tracking system, an automated system that provides a streamlined and efficient way to apply for and manage grant funding.

Providing grant oversight, NMDHSEM will continuously monitor the grant process to ensure compliance with federal and state regulations and requirements. Monitoring focuses on providing technical assistance and guidance to validate or improve administrative and fiscal efficiencies in managing award funds. As part of the monitoring process, NMDHSEM will provide as needed compliance assessment to review all related transactions and processes to verify that Grant Subaward funds were expended in compliance with federal and state regulations and the terms and conditions of the Subaward.

During the monitoring process, NMDHSEM may determine that the process is not in compliance with federal and state regulation and requirements. The following are common areas of non-compliance:

- Internal Controls
 - Lack of segregation of duties for smaller nonprofit organizations
 - Inadequate policies for victim petty cash/financial assistance
 - Single audit findings, audit reports submitted late, lack of required audits
 - Inadequate monitoring of second tier subrecipients
- Financial Management
 - Improper/inadequate tracking and recording of Subaward costs

- Costs not allocated properly and/or Inadequate cost allocation plan
- Overcharging of office facility rent or indirect costs
- Inadequate/unsupported/unallowable required match
- Match not recorded or not identified in accounting records as match
- Match not claimed on reimbursement request as occurred
- Reimbursement requests not submitted timely
- Personnel
 - Functional timesheets not used for Subaward Personnel costs
 - Fringe benefit costs claimed in incorrect cost category
 - Unsupported/unallowable Personnel costs
 - Unsupported volunteer in-kind match claimed on reimbursement request
- Operating
 - Unsupported/unallowable operating cost items
 - Lack of proof of payment of cost item(s)
 - Cost claimed on reimbursement request prior to expending money
- Equipment
 - Equipment inventory records missing required information
 - Disposal data and information missing from records
 - Physical equipment inventory/record reconciliation not performed
 - Missing or unidentifiable equipment (onsite equipment inspections)
- Procurements/Contracts
 - Lack of written procurement procedures
 - Lack of written code of conduct covering conflicts of interest in procurements
 - Improper procurement
 - Non-competitive procurement not justified/approved
 - Procurement documentation not maintained
 - Suspension/debarment not checked prior to awarding contract
 - Competition requirements not met (quotes, bids, proposals)
 - No cost/price analysis
 - Lack of negotiating profit/discount when required
 - Contracts/purchase orders do not contain all required provisions

Should any areas be determined as non-complaint, a Corrective Action Plan may be required to address any identified issues, with the plan needing to be completed and implemented in a specific time frame.

Upon completion of a project, a member of the awarded jurisdiction, a member of the Rio Arriba County MPC, and a NMDHSEM representative will conduct a closeout site visit to:

- Review all files and documents
- Review all procurement files and contracts to third parties
- Take photos of the completed project

Project closeout packages will generally be submitted 90 days after a project has been completed, and will include the following:

- Summary of documentation
- Pictures of completed project
- Materials, labor, and equipment forms, if required
- Close-out certification

Section 7 – Plan Maintenance

7.1 Introduction

The LHMP is a living document that will be updated and submitted to FEMA for approval every five years as required by 44 CRF 201.4. During the five-year cycle, the plan will undergo continuous monitoring and evaluation to ensure that the policies, procedures, priorities, and state environment established in the plan reflect current conditions. Rio Arriba County and all participating jurisdictions will utilize the MPC to provide plan updates, revisions, and data collection for future LHMP planning purposes.

7.2 Plan Maintenance Responsibilities

RACOEM and the Ohkay Owingeh serve as the lead coordinating agencies for plan maintenance. Additional assistance in the plan maintenance process is provided by members of the MPC, subject matter experts, and representatives of local jurisdictions.

RACOEM and the Ohkay Owingeh will facilitate the review and revision of the LHMP every five years, with each participating jurisdiction managing the revision of their specific jurisdictional annex. The review and revision will be an ongoing process. This process will incorporate all of the revisions made during the life of the plan, especially newly obtained data on hazard occurrence or identified vulnerability.

7.3 Plan Review Meetings

The MPC will meet annually for the first two years after plan approval. MPC members will determine the meeting dates and locations and will ensure that the meetings are open to all interested parties. The Rio Arriba County Emergency Manager and Ohkay Owingeh Fire Chief will be the main point of contact for these meetings and will maintain attendance and meeting minutes.

The purpose of these meetings is to discuss capability changes, the status of proposed projects, and any new studies or mapping that may inform the LHMP. Should a specific plan element or section require revision or amendment due to a state or federal legislation or policy change, the MPC will work with NMDHSEM to complete a plan addendum and submit it to FEMA as quickly as is practicable.

During these meetings, and in order to monitor LHMP progress, the following information will be tracked:

- How the actions from the mitigation strategy are being pursued and completed
 - Are actions being prioritized
- How the plan goals and objectives are being carried out
- How mitigation funding mechanisms are being utilized
- How is technical assistance being received

Additionally, the MPC will monitor the following elements to ensure the LHMP is current and correct:

- Reviewing the hazards and determining if any of them have changed
- Determining if there are new hazards that pose a risk to the state
- Ensuring goals and objectives are still relevant
- Determining if any actions have been completed or are deemed irrelevant
- Determining if new actions should be added
- Determining if capabilities have changed

After each meeting, the MPC will compile a meeting report for usage in future plan revisions.

In addition to these meetings, MPC members will monitor and evaluate the progress of mitigation projects via quarterly reports, site visits, correspondence, and reimbursements. Completed projects will be evaluated for loss avoidance and alignment with local development plans.

NMDHSEM may request a non-scheduled report on the monitoring, evaluation, or updating of any portion of the LHMP due to irregular progress on mitigation actions and or projects, in the aftermath of a hazard event, or for any reason deemed appropriate.

7.4 Plan Monitoring and Situational Change

Plan monitoring can be defined as the ongoing process by which stakeholders obtain regular feedback on the progress being made towards achieving their goals and objectives. In the more limited approach, monitoring may focus on tracking projects and the use of the agency's resources. In the broader approach, monitoring also involves tracking strategies and actions being taken by partners and non-partners, and figuring out what new strategies and actions need to be taken to ensure progress towards the most important results.

The MPC will track and record all substantial situational changes and will address, as appropriate, the following questions:

- Is the mitigation project under, over, or on budget?
- Is the mitigation project behind, ahead of, or on schedule?
- Are there any changes in jurisdictional capabilities which impact the plan?
- Are there any changes in jurisdictional hazard risk?
- Has the mitigation action been initiated, or its initiation planned?
- Is the current process of prioritizing mitigation actions and projects appropriate and accurate?
- Has the current method of incorporating mitigation actions and projects yielded a comprehensive action and project strategy to address seen and unforeseen hazards?
- If applicable, has participation in a mitigation action's collaboration been regular?
- Was a negative result caused directly or indirectly by insufficient levels of public outreach?
- If any, what plan updates occurred, why they occurred, and what is their impact?

7.5 Post-Disaster Review

After each Presidential disaster declaration, and in coordination with FEMA and the NMDHSEM, the MPC will convene to document impacts on Rio Arriba County and to determine if any mitigation actions should be considered to reduce future risk. This will allow for the development of hazard mitigation recommendations to FEMA during the disaster operation as well as to update the mitigation strategy as needed. The post-disaster review may coincide with established meetings or may be convened as separate events.

7.6 Plan Evaluation

A plan evaluation is a rigorous and independent assessment of either completed or ongoing activities to determine the extent to which they are achieving stated goals and contributing to decision making.

A plan evaluation report, conducted by the MPC, will be completed when the situation dictates. The following situations are typical examples of when an evaluation will be necessary.

- Post hazard event
- Post training exercise
- Post tabletop or drill exercise
- Significant change or completion of a mitigation project
- Significant change or completion of a mitigation action

An evaluation report will ask the following questions in response to the previously listed events.

- Do the mitigation objectives and goals continue to address the current hazards?
- Are there new or previously unforeseen hazards?
- Does a change in hazard vulnerability demand a change of or addition of mitigation actions or projects?
- Does a change in the mitigation strategy demand a change of or addition of mitigation actions or projects?

- Are current resources appropriate for implementing a mitigation project?
- Was the outcome of a mitigation action/project expected?
- Are there implementation problems?
- Was the public engaged to the point where they were satisfied with current engagement strategies?
- Did the public participate in a number that produced a positive yield on the plan, action, or project?
- Are there coordination problems?

7.7 Plan Updates

Typically, the updating of a LHMP is initiated upon the completion of a plan evaluation when the evaluation determines an update is appropriate. A plan update also occurs every five years per FEMA guidelines or at any time it is deemed necessary by MPC.

According to FEMA DMA 2000 guidelines for mitigation planning, Rio Arriba County and the Ohkay Owingeh will begin the update process three years from this plan's adoption. An increase in meeting tempo to twice a year will allow MPC to gather relevant information needed for the next plan update. The following meeting schedule indicates the tasks to be performed during this plan update period:

- **2027 Spring Meeting:** The MPC will begin updating the risk assessment portion of the plan. Hazards will be analyzed to determine if they are still relevant, if location should be updated, and if new hazards should be added. Previous occurrences will be reviewed to help determine the probability of future events.
- **2027 Fall Meeting:** The MPC will begin updating the vulnerability assessment. The MPC will update the vulnerability assessment portion of the plan. Data will need to be gathered for assets, critical facilities, building stock values, jurisdictional damages, etc.
- **2028 Spring Meeting:** The MPC will review information received and determine if the goals and objectives are still relevant and if new ones should be added. Actions will be reviewed to determine if they should remain in the plan, have been completed, or are no longer relevant. The MPC will review the potential funding sources for each action.
- **2028 Fall Meeting:** As appropriate, a new MPC for Rio Arriba County will be formed to take over the planning process. The new MPC will evaluate the policies, programs, capabilities, and funding sources from the previous plan to determine if they are still accurate and if any new items should be added.
- **2029 Spring Meeting:** The new MPC will review the draft copy of the mitigation plan and make comments and updates if necessary. Formal submittal to FEMA for re-approval will follow.

In general, the following steps will be taken to complete the next LHMP revision:

Table 131: LHMP Update Task List

Task	Action
1	Evaluate and update the planning process.
2	Review the stakeholder contact list and identify new stakeholders.
3	Initiate plan outreach and discussion, including a stakeholder meeting.
4	Consider the addition, removal, or modification of hazards identified in the plan.
5	Update and revise membership of the MPC.
6	Evaluate risk assessment methodologies and data sources.
7	Evaluate and update critical facility inventory information.
8	Evaluate and update the hazard profiles.
9	Evaluate and update the risk assessment summary.
10	Evaluate and update the mitigation strategy, including proposed mitigation actions.
11	Evaluate and update the mitigation implementation system.
12	Integrate new and updated local plans.
13	Evaluate and update other plans sections.
14	Identify and add any additional sections or information needed.

Table 131: LHMP Update Task List

Task	Action
15	Review updated plan in its entirety.
16	Conduct updated plan outreach, including public information, comment period, and meetings.
17	Integrate additional comments received.
18	Finalize plan document.
19	Complete crosswalk and submit final plan to FEMA for review and approval.
20	Make additional modifications as required.
21	Obtain jurisdictional adoption resolutions.

7.8 Continued Public Involvement

Rio Arriba County, the Ohkay Owingeh, and all participating jurisdictions are dedicated to involving the public in the continual shaping of the LHMP and in the development of its mitigation projects and activities.

The Rio Arriba County MPC will continue to keep the public informed about hazard mitigation projects and activities through jurisdictional websites, and as appropriate, public announcements. The public will also be invited to participate in all meetings to review and discuss the mitigation-related events. Additionally, participating jurisdictions will present to public officials in a public forum concerning the progress of mitigation actions identified in this plan as progress is made.

Copies of the Rio Arriba County LHMP will be made available to the public. Methods of public availability may include electronically posted on a website or a hard copy kept at a jurisdictional office.

7.9 Plan Amendment

Amending the approved and adopted Rio Arriba County LHMP does not necessarily result in the need to reevaluate the entire plan against all requirements. As the Rio Arriba MPC will consistently review this LHMP, FEMA Region VI expects modifications to the risk assessment or adding/removing mitigation actions, especially in preparation for submitting applications to FEMA for assistance and ensuring the project conforms with the mitigation plan. Rio Arriba County and all participating jurisdictions are encouraged to keep the State of New Mexico and FEMA Region VI informed, but these amendments do not need to be reviewed by either. If these changes identify new mitigation actions that might be eligible for FEMA assistance programs, then Rio Arriba County and/or the participating jurisdiction will advise FEMA Region VI and the State of New Mexico. FEMA will acknowledge and note the receipt of the added action(s), where appropriate, but will not need to formally review or approve the action(s).

7.10 Amendment to Include New Jurisdiction

Jurisdictions may be added to this existing and approved LHMP only if the following conditions below met:

- The jurisdiction asking to be included is within the boundaries of Rio Arriba County.
- Rio Arriba County agrees with adding the requesting jurisdiction(s) to the mitigation plan.
- An analysis of the natural hazards that have the potential to affect the additional jurisdiction must be completed and integrated into any current analysis within the LHMP.
- The new jurisdiction must meet all requirements of 44 CFR § 201.6, including:
 - Review the multi-jurisdictional hazard analysis and determine if any additional hazards that have not been addressed threaten the jurisdiction(s).
 - Document their agreement with the stated mitigation goals
 - Develop a list of proposed mitigation actions
 - Document the involvement of both the general public and the local government in the planning process
 - Submit the annex or appendix, along with the multi-jurisdictional mitigation plan and correspondence of concurrence from Rio Arriba County for formal review.
 - Adopt the LHMP.

7.11 Late LHMP Adoption

Any participating jurisdiction that did not adopt the plan within one year of the Approved Pending Adoption date must either:

- Validate that the information in the plan remains current with respect to both the risk assessment and mitigation strategy.

Or

- Make the necessary updates before submitting the adoption resolution to State of New Mexico and FEMA Region VI.

This late adoption does not affect the plan expiration date, with the adopted LHMP expiring five years from the date the first adoption was received.

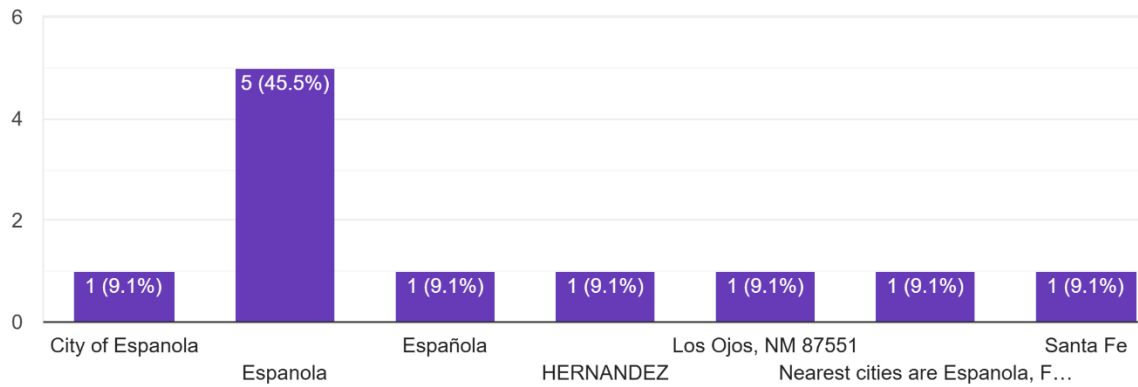
Appendix A – Rio Arriba County Adoption Documentation and FEMA Region VI Approval Documentation

Appendix B – Community Feedback

Kickoff Survey Responses

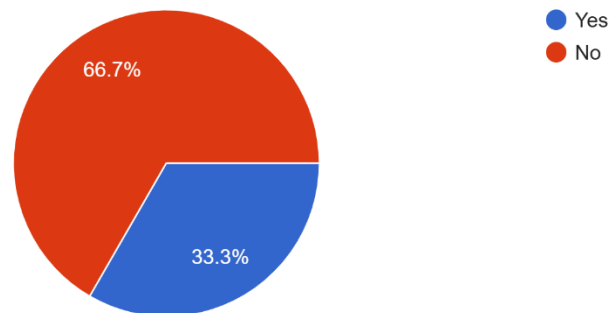
What city do you live in (or nearest city)?

11 responses



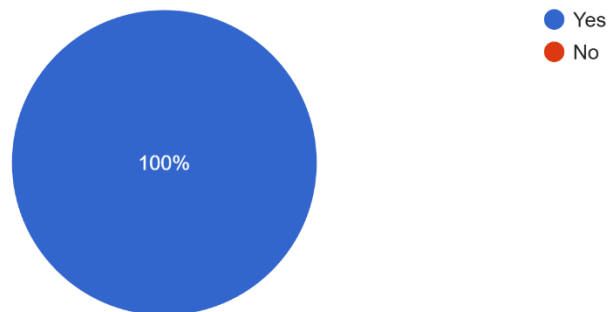
Have you read, reviewed, or used the previous Hazard Mitigation Plan

12 responses



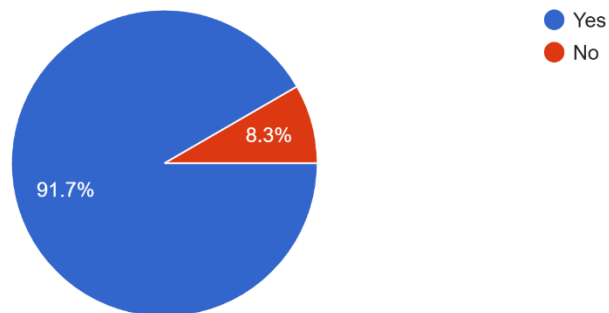
Should dam failure continue to be included in the Hazard Mitigation Plan:

12 responses



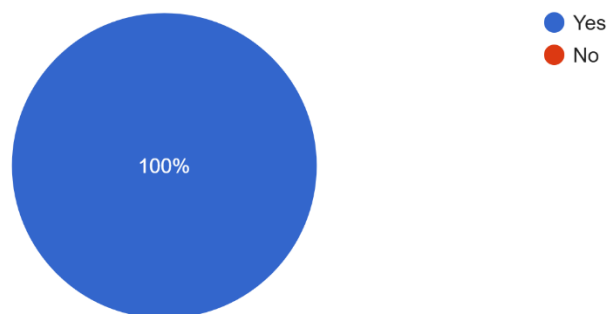
Should drought continue to be included in the Hazard Mitigation Plan:

12 responses



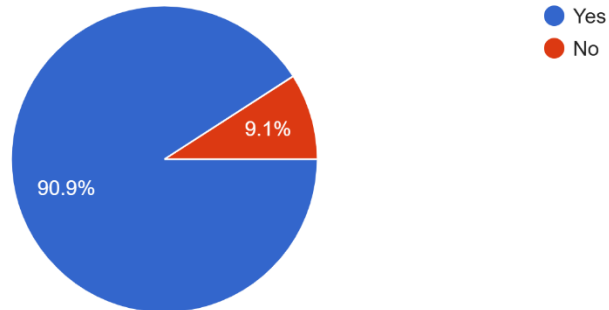
Should extreme heat continue to be included in the Hazard Mitigation Plan:

12 responses



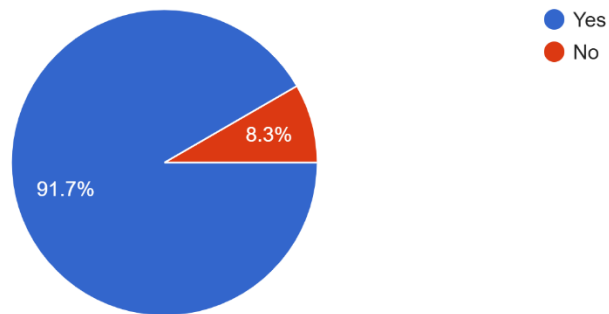
Should landslide continue to be included in the Hazard Mitigation Plan:

11 responses



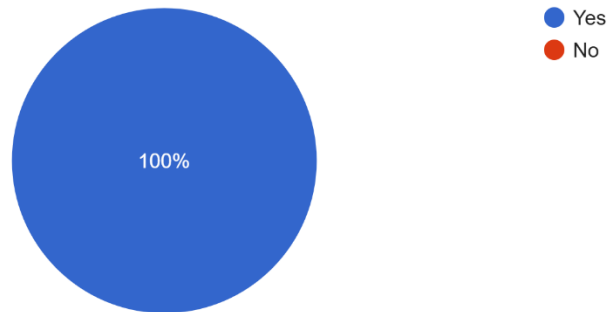
Should severe weather (high winds, lightning, thunderstorms) continue to be included in the Hazard Mitigation Plan:

12 responses



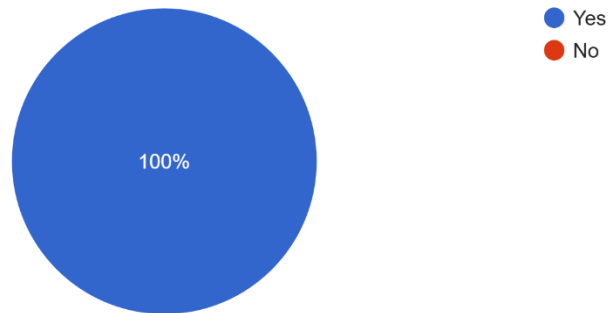
Should severe winter weather continue to be included in the Hazard Mitigation Plan:

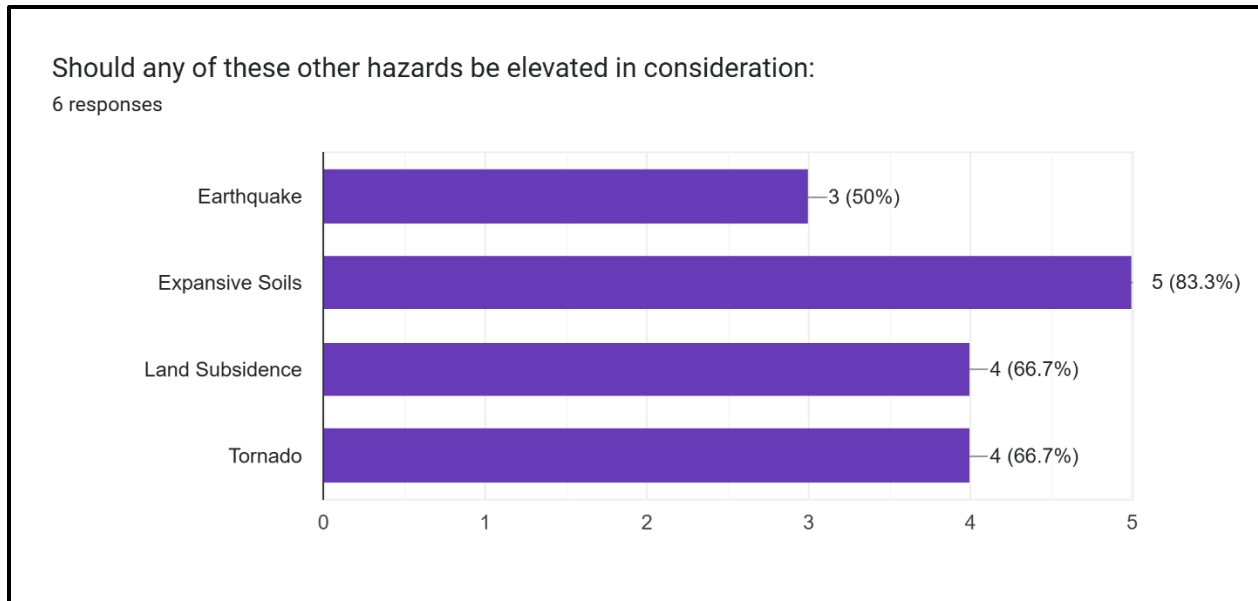
12 responses



Should wildfire continue to be included in the Hazard Mitigation Plan:

12 responses





Do you have any specific concerns about any of these hazards?

- No
- Climate change and the related impacts
- Unsure if tornadoes should be elevated as they are becoming more prevalent in areas not formally expected.
- Wildfire and Flooding seem to be the most prominent issues affecting Rio Arriba County
- 911 Services
- Lack of resources for wildfire evacuation, mitigation, burn co-ops
- NO
- Fire flooding

Is there anything else concerning hazard mitigation that you would like us to know?

- No
- Not at this time
- Wildfire is our greatest hazard and forest thinning and controlled burns are the best mitigation approaches. The Forest Service and BLM are essential partners in mitigation efforts.
- Wildfire is especially prevalent in the bosque area near the Rio Grande as clearing has been an issue due to multiple agencies/pueblos/property owners not clearing or maintaining clear areas to avoid said wildfires.
- NO