

Greenlee County
Town of Duncan and Clifton

ALL HAZARD MITIGATION PLAN



Final: August 2021

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SECTION 1: JURISDICTIONAL ADOPTION AND FEMA APPROVAL

Requirement §201.6(c)(5): *[The local hazard mitigation plan shall include...] Documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council). For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.*

Requirement §201.6(d)(3): *A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within five (5) years in order to continue to be eligible for mitigation project grant funding.*

Requirement §201.7(a)(1): *Indian tribal governments applying to FEMA as a grantee must have an approved Tribal Mitigation Plan meeting the requirements of this section as a condition of receiving non-emergency Stafford Act assistance and FEMA mitigation grants.*

Requirement §201.7(a)(4): *Multi-jurisdictional plans (e.g. county-wide or watershed plans) may be accepted, as appropriate, as long as the Indian tribal government has participated in the process and has officially adopted the plan. Indian tribal governments must address all the elements identified in this section to ensure eligibility as a grantee or as a sub-grantee.*

1.1 DMA 2000 Requirements

1.1.1 General Requirements

This 2021 update of the Greenlee County Multi-Jurisdictional Hazard Mitigation Plan (Plan) has been prepared in compliance with Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 (Stafford Act), 42 U.S.C. 5165, as amended by Section 104 of the Disaster Mitigation Act of 2000 (DMA 2000) Public Law 106-390 enacted October 30, 2000. The regulations governing the mitigation planning requirements for local mitigation plans are published under the Code of Federal Regulations (CFR) Title 44, Section 201.6 (44 CFR §201.6). Minimum requirements for tribal mitigation plans are published under CFR Title 44, Section 201.7 (44 CFR §201.7). Additionally, a DMA 2000 compliant plan that addresses flooding will also meet the minimum planning requirements for the Flood Mitigation Assistance program as provided for under 44 CFR §78.

DMA 2000 provides requirements for States, Tribes, and local governments to undertake a risk-based approach to reducing risks to natural hazards through mitigation planning¹. The local mitigation plan is the representation of the jurisdiction's commitment to reduce risks from natural hazards, serving as a guide for decision makers as they commit resources to reducing the effects of natural hazards. Local plans will also serve as the basis for the State to provide technical assistance and to prioritize project funding.

Under 44 CFR §201.6 and §201.7, local and tribal governments must have a Federal Emergency Management Agency (FEMA)-approved local mitigation plan in order to apply for and/or receive project grants as a sub-grantee under the following Hazard Mitigation Assistance (HMA) programs:

- Hazard Mitigation Grant Program (HMGP)
- Building Resistant Infrastructure and Communities (BRIC)
- Flood Mitigation Assistance (FMA)
- Severe Repetitive Loss Program (SRL)

In addition, Indian Tribal governments applying to FEMA as a grantee must have an approved tribal mitigation plan meeting the requirements of 44 CFR §201.7 as a condition of receiving non-emergency Stafford Act assistance through Public Assistance Categories C through G and the above mentioned HMA program funds.

¹ FEMA, 2008, *Local Multi-Hazard Mitigation Planning Guidance*

1.1.2 Update Requirements

DMA 2000 requires that existing plans be updated every five years, with each plan cycle requiring a complete review, revision, and re-approval of the plan at both the state and FEMA level. Greenlee County and the incorporated communities of Clifton and Duncan are all currently covered under a FEMA approved multi-jurisdictional hazard mitigation plan. This Plan is the result of an update process performed by the participating jurisdictions to update the current 2016 version of the Greenlee County Multi-Jurisdictional Hazard Mitigation Plan (2016 Plan).

1.2 Official Record of Adoption

Promulgation of the Plan is accomplished through formal adoption of official resolutions by the governing body for each participating jurisdiction in accordance with the authority and powers granted to those jurisdictions by the State of Arizona and/or the federal government. Participating jurisdictions in the Plan include Greenlee County, the Town of Clifton and the Town of Duncan. Each jurisdiction will keep a copy of their official resolution of adoption located in Appendix A of their copy of the Plan.

1.3 FEMA Approval Letter

The Plan was submitted to the Arizona Department of Emergency and Military Affairs – Division of Emergency Management (DEMA), the authorized state agency, and FEMA, for review and approval. FEMA’s approval letter is provided on the following page.

[Insert FEMA Approval Letter Here]

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SECTION 2: INTRODUCTION

2.1 Plan History

In 2005 and 2006, Greenlee County and the incorporated communities of Clifton and Duncan participated in a mitigation planning process that resulted in the development of separate stand-alone plans for each participating jurisdiction. The following is a list of the plans that were produced for the Greenlee County jurisdictions:

- *Greenlee County Multi-Hazard Mitigation Plan*
- *Town of Clifton Multi-Hazard Mitigation Plan*
- *Town of Duncan Multi-Hazard Mitigation Plan*

Collectively and individually, these plans will be referred to herein as the 2006 Plan(s). The 2006 Plans received official FEMA approval ranging from June 15, 2006 to September 12, 2006. In September of 2010, the Greenlee County Department of Emergency Management (GCDEM) initiated and performed an update planning process with Clifton and Duncan resulting in the *2011 Greenlee County Multi-Jurisdictional Hazard Mitigation Plan*, herein referred to as the 2011 Plan, being submitted to FEMA and receiving official approval on October 11, 2011. The 2011 Plan expired on October 11, 2016.

The Greenlee County Department of Emergency Management successfully obtained a pre-disaster mitigation planning grant from FEMA for FY2015 to fund the required 5-year update. The planning process was officially kicked off in January 2016 with the selection of a consultant to assist with the update process. The first planning team meeting was convened on March 16, 2016. The planning process concluded with the final meeting on May 9 and 10, 2016, resulting in the *2016 Greenlee County Multi-Jurisdictional Hazard Mitigation Plan*, herein referred to as the 2016 Plan, which was submitted to FEMA and received official approval on December 14, 2016. The 2016 Plan is nearing the end of the 5-year planning cycle and will expire on December 12, 2021.

2.2 Plan Purpose and Authority

The purpose of the Plan is to identify natural hazards that impact the various jurisdictions located within Greenlee County, assess the vulnerability and risk posed by those hazards to community-wide human and structural assets, develop strategies for mitigation of those identified hazards, present future maintenance procedures for the plan, and document the planning process. The Plan is prepared in compliance with DMA 2000 requirements and represents a multi-jurisdictional update of the 2016 Plan.

Greenlee County and both Towns are political subdivisions of the State of Arizona and are organized under Title 9 (cities/towns) and Title 11 of the Arizona Revised Statutes (ARS). As such, each of these entities are empowered to formally plan and adopt the Plan on behalf of their respective jurisdictions.

Funding for the development of the Plan was provided by Greenlee County, the Town of Duncan and the Town of Clifton. JE Fuller/ Hydrology and Geomorphology, Inc. (JE Fuller) was retained by GCDEM to provide consulting services in guiding the plan update process and Plan development.

2.3 General Plan Description

The Plan is generally arranged and formatted to be consistent with the 2018 State of Arizona Multi-Hazard Mitigation Plan (State Plan) and is comprised of the following major sections:

Planning Process – this section summarizes the planning process used to update the Plan, describes the assembly of the planning team and meetings conducted, and summarizes the public involvement efforts.

Community Description – this section provides an overall description of the participating jurisdictions and the County as a whole.

Risk Assessment – this section summarizes the identification and profiling of natural hazards that impact the County and the vulnerability assessment for each hazard that considers exposure/loss estimations and development trend analyses.

Mitigation Strategy – this section presents a capability assessment for each participating jurisdiction and summarizes the Plan mitigation goals, objectives, actions/projects, and strategy for implementation of those actions/projects.

Plan Maintenance Strategy – this section outlines the proposed strategy for evaluating and monitoring the Plan, updating the Plan in the next 5 years, incorporating plan elements into existing planning mechanisms, and continued public involvement.

Plan Tools – this section includes a list of Plan acronyms and a glossary of definitions.

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SECTION 3: PLANNING PROCESS

§201.6 (b): *Planning process. An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:*

- (1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;*
- (2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and*
- (3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.*

§201.6(c)(1): *[The plan shall include...] (1) Documentation of the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.*

This section includes the delineation of various DMA 2000 regulatory requirements, as well as the identification of key stakeholders and planning team members within Greenlee County. In addition, the necessary public involvement meetings and actions that were applied to this process are also detailed.

3.1 Update Process Description

GCDEM selected JE Fuller to work with the participating jurisdictions and guide the Plan update process. An initial project kick-off meeting between JE Fuller and GCDEM was convened in early March 2021 to line up the first meeting date and discuss the agenda for the coming planning efforts, discuss the plan format and potential changes to the Plan outline and content to address recent FEMA guidelines, request initial data, and other administrative tasks. Two planning team meetings and two rounds of workshop meetings with each jurisdiction were subsequently conducted over the period of March to May 2021, along with all the work required to collect, process, document updated data, and make changes to the Plan. Details regarding updated key contact information and promulgation authorities, the planning team selection, participation, and activities, and public involvement are discussed in the following sections.

3.2 Previous Planning Process Assessment

The first task of preparation for the Plan update, was to evaluate the process used to develop the 2016 Plan. This was initially discussed by GCDEM and JE Fuller in the March 2021 kick-off meeting with the goal of establishing the framework for the planning effort ahead. Building on the 2011 Plan, the 2016 Plan process employed a multi-jurisdictional approach with representation from each participating jurisdiction in larger multi-jurisdictional planning team meetings wherein concepts would be presented and discussed, and work assignments would be made for completion by each jurisdiction. Supplemental follow-up sessions with one or more jurisdictions by both GCDEM and JE Fuller were also employed on an as-needed basis to assist jurisdictions with completing assignments on schedule. GCDEM and JE Fuller agreed to continue with substantially the same approach due to the success of the 2016 Planning effort in getting to an approved plan both in time and budget.

The Plan update process was presented and discussed at the first Multi-Jurisdictional Planning Team (MJPT) meeting for comment and concurrence of the Plan jurisdictions. It was agreed that the MJPT would meet twice to cover topics that pertain to all jurisdictions jointly, and then the consultant would meet individually with each participating jurisdiction to update jurisdiction specific planning items. Due to the COVID-19 Pandemic and the public health directives from various agencies, it was also agreed in advance that all planning and workshop meetings would be held online as video teleconferences.

3.3 Planning Team

3.3.1 General

Two levels of planning teams were organized for this Plan update. The first was a Multi-Jurisdictional Planning Team (MJPT) that was comprised of one or more representatives from each participating jurisdiction. The second level planning team was the Local Planning Team (LPT), which was generally composed of various representatives for departments or agencies specific to a jurisdiction.

The role of the MJPT and LPT was to work with the planning consultant to perform the coordination, research, and planning element activities required to update the 2016 Plan. Attendance by each participating jurisdiction was required for the MJPT meeting. Subsequent LPT workshop meetings were convened by jurisdiction to perform the jurisdiction specific updates.

3.3.2 Primary Point of Contact

Table 3-1 summarizes the primary points of contact (PPOC) identified for each participating local jurisdiction.

3.3.3 Planning Team Assembly

At the beginning of the update planning process, GCDEM organized and identified members for the MJPT by initiating contact with the Clifton and Duncan PPOCs identified in the 2016 Plan or their current equivalent. In early March 2021, JE Fuller sent out a project kickoff email to provide initial information and begin the process of scheduling the first MJPT meeting. A second MJPT meeting was held in May 2021. Two more planning workshop meetings were conducted with each jurisdiction to review and update the majority of planning elements. The participating members of the MJPT and LPTs are summarized in Table 3-2. Returning planning team members from the 2016 Plan are highlighted.

3.3.4 Planning Team Activities

The MJPT initially met on March 16, 2021 to kick-off the plan update process and held a second meeting on May 12, 2021. Two more LPT workshop meetings were conducted with each jurisdiction. Table 3-3 summarizes the MJPT and LPT workshop dates, times, locations, and a brief list of the agenda items discussed.

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Table 3-1: List of jurisdictional primary points of contact

| Jurisdiction | Name | Department / Position | Address | Phone | Email |
|-----------------|------------------|--|--|--------------|-------------------------------|
| Greenlee County | Steve Rutherford | Health Department Director / Emergency Manager | Greenlee County Government, 253 Fifth St, P.O. Box 908, Clifton, AZ 85533 | 928-865-2601 | srutherford@greenlee.az.gov |
| Clifton | Rudy Perez | Town Manager | Administration Department 510 N. Coronado Blvd. Clifton, AZ 85533 | 928-865-4146 | perez@townofclifton.com |
| Duncan | John Basteen Jr. | Town Manager | 506 Old West Hwy Duncan, AZ 85534 | 928-359-2791 | john.basteen@townofduncan.org |

Table 3-2: Summary of multi-jurisdictional planning team participants

| Name | Jurisdiction / Organization | Department / Position | Planning Team Role |
|------------------------|-----------------------------|---|---|
| Omar Negrete | Town of Clifton | Police / Police Chief | • Clifton LPT Member |
| John Basteen | Town of Duncan | Administration / Town Manager | • Duncan PPOC and MJPT / LPT Member |
| James Maher | Town of Duncan | Field Supervisor | • Duncan LPT Member |
| Rudy Perez | Town of Clifton | Administration / Town Manager | • Clifton PPOC and MJPT / LPT Member |
| Peter Ortega | Town of Clifton | Fire / Fire Chief | • Clifton LPT Member |
| Mary Evans | JE Fuller | Consultant | • Planning Consultant |
| George Victor Stacy | Town of Clifton | Public Works / Director | • Clifton LPT Member |
| Steve Rutherford | Greenlee County | Health Department Director/ Emergency Manager | • Greenlee County PPOC and MJPT / LPT Member • Primary POC for Plan |
| Esperanza Castaneda | Town of Clifton | Administration / Finance Director | • Clifton LPT Member |

| Table 3-3: Summary of planning meetings convened as part of the plan update process | |
|---|--|
| Meeting Type, Date, and Location | Meeting Agenda |
| <p>MJPT Meeting No. 1</p> <p>March 16, 2021</p> <p>Video Teleconference</p> <p>12:00 to 3:00pm</p> | <ul style="list-style-type: none"> • Initial Introductions • Discussion of Scope And Schedule • DMA2K Overview And Update Requirements <ul style="list-style-type: none"> ○ General DMA2K Overview ○ Update Requirements (New Crosswalk) ○ Proposed Outline for New Plan • Planning Process & Team Roles <ul style="list-style-type: none"> ○ Discussion Of Last Planning Process ○ Planning Team Roles And Responsibilities • Public Involvement <ul style="list-style-type: none"> ○ Discuss Past Strategy ○ Formulate New Strategy ○ Additional Agency/organization Invitations • Risk Assessment <ul style="list-style-type: none"> ○ Hazard List Review • Mitigation Strategy <ul style="list-style-type: none"> ○ Goals and Objectives • Plan Maintenance Strategy <ul style="list-style-type: none"> ○ Review/Discuss maintenance and monitoring over the last plan cycle ○ Develop New Monitoring Schedule ○ Plan Update Schedule ○ Continued Public Involvement Strategy • Promulgation Process Review • Next Steps |
| <p>LPT Workshop No. 1</p> <p>Greenlee County</p> <p>April 7, 2021</p> <p>9:00 to 11:00am</p> <p>Video Teleconference</p> <p>Town of Duncan</p> <p>April 15, 2021</p> <p>2:30 to 4:30pm</p> <p>Video Teleconference</p> <p>Town of Clifton</p> <p>April 29, 2021</p> <p>3:00 to 5:00pm</p> <p>Video Teleconference</p> | <ul style="list-style-type: none"> • General – Community Descriptions • Risk Assessment <ul style="list-style-type: none"> ○ Asset Inventory Review/Update ○ Repetitive Loss Properties ○ Discuss and Profile Development Trends <ul style="list-style-type: none"> ▪ Past Plan Cycle ▪ Future Development • Mitigation Strategy <ul style="list-style-type: none"> ○ Capability Assessment ○ Legal and Regulatory (Codes / Ordinances) ○ Administrative and Technical Staff Resources ○ Fiscal Capabilities • Plans / Manuals / Guidelines / Studies Integration and Incorporation <ul style="list-style-type: none"> ○ Past Plan Cycle ○ Future Strategy • NFIP Statistics and Compliance |

| Table 3-3: Summary of planning meetings convened as part of the plan update process | |
|---|---|
| Meeting Type, Date, and Location | Meeting Agenda |
| MJPT Meeting No. 2 May 12, 2021 Video Teleconference 8:00 to 10:00am | <ul style="list-style-type: none"> • Risk Assessment <ul style="list-style-type: none"> ○ VA Result Review • Mitigation Strategy <ul style="list-style-type: none"> ○ Existing Mitigation Action/Project Assessment ○ Action/Project Identification <ul style="list-style-type: none"> ▪ Repetitive Loss Structures Recommendations ○ Implementation Strategy ○ New Mitigation Actions/Projects • Promulgation Process/Timeline • Next Steps |
| LPT Workshop No. 2 Greenlee County May 18, 2021 8:00 to 10:00am Video Teleconference Town of Duncan May 19, 2021 9:00 to 11:00am Video Teleconference Town of Clifton May 20, 2021 9:00 to 11:00am Video Teleconference | <ul style="list-style-type: none"> • Risk Assessment <ul style="list-style-type: none"> ○ Review hazard profile mapping and data for each hazard ○ CPRI Analysis ○ VA Result Review • Mitigation Strategy <ul style="list-style-type: none"> ○ Existing Mitigation Action/Project Assessment ○ Action/Project Identification <ul style="list-style-type: none"> ▪ Repetitive Loss Structures Recommendations ○ Implementation Strategy ○ New Mitigation Actions/Projects |

3.3.5 Agency/Organization Participation

The planning process used to develop the 2016 Plan included participation from several agencies and organizations which operate within or have jurisdiction over small and large areas of Greenlee County. For this update, a list of known and/or potential stakeholders not already involved in the MJPT was brainstormed and compiled at the MJPT Meeting No. 1. The MJPT started with a list of Local Emergency Planning Committee (LEPC) members since most of those individuals would represent the type of organizations and agencies that would have an interest in Greenlee County hazard mitigation. Invitations were sent to the identified list via emails with an attached document that explained the DMA 2000 planning process and the request for involvement. In addition to the personal invitations, a broader invitation to all citizens within and near Greenlee County was indirectly extended via website and social media postings, which are discussed more thoroughly in Section 3.5.2. This approach was considered the best way to reach interested non-profits and businesses within the County and provide them an opportunity for participation in the planning process. Table 3-4 represents the list of all entities that were directly invited to participate in the planning process. There were no responses from the organizational invitations. Likewise, no responses were received from the public invitations.

Table 3-4: List of agencies and organizations invited to participate in the planning process

| Agency / Organization | Contact Name and Position |
|-------------------------------------|--|
| Clifton Police Department | Omar Negrete, Chief of Police |
| Greenlee County | Derek Rapiere, County Administrator |
| Greenlee County | Austin Adams, Deputy County Administrator |
| Greenlee County Sheriff's Office | Tim Sumner, Sheriff |
| Greenlee County Sheriff's Office | Mark Crandell, Chief Deputy |
| Greenlee County Sheriff's Office | Jeromy Vaughn, LT. |
| Town of Duncan | John Basteen, Duncan Town Manager |
| Town of Clifton | Rudy Perez, Town Manager |
| Greenlee County | Steve Rutherford, Emergency Management |
| Greenlee County | Reed Larson, County Engineer |
| Greenlee County | Jeremy Ford, County Attorney |
| Greenlee County | Tony Hines, Road Department Maintenance |
| Greenlee County | David Manuz, Road Department |
| Gila Health Resources | Hayden Boyd, Gila Health Resources |
| Morenci Fire/ FMI | Paul Easley, Emergency Coordinator |
| Duncan Valley Electric CO-OP | Steve Lunt, CEO |
| Clifton Fire Department | Peter Ortega, Chief |
| Graham County | Brian Douglas, Emergency Manager |
| Copper Era | Kim Smith, Editor |
| Apache County | Brian Hounshell, EM Director |
| Greenlee County | Matt Bolinger, Deputy Director Health |
| Department of Transportation | Tyrel Cranford, ADOT Greenlee County |
| Arizona Department of Public Safety | Stewart Shupe, Greenlee/Graham DPS |
| Duncan School District | Eldon Merrell, Duncan Schools Sup. |
| Morenci School District | David Woodall, Morenci School Sup. |
| Hidalgo County New Mexico | Scott Richins, Emergency Management Director |
| El Paso Natural Gas, Thatcher AZ | El Paso Natural Gas |
| Catron County New Mexico | Dusty Choate, Emergency Manager |
| Morenci Water and Electric | Ruel Rogers, Superintendent |
| Southwest Gas | Greg Jones, SWG Eastern Division |
| Clifton Public Works Dept. | Victor Stacy, Acting Public Works Director |

An integral part of the planning process also included coordination with agencies and organizations outside of the participating jurisdiction's governance to obtain information and data for inclusion into the Plan, or to provide more public exposure to the planning process. Much of the information and data that is used in the risk assessment is developed by agencies or organizations other than the participating jurisdictions. In some cases, the jurisdictions may be members of a larger organization that has jointly conducted a study or planning effort like the development of a community wildfire protection plan, participation in an area association of governments, or participation in a FEMA RiskMAP Discovery study. Examples of those data sets include the FEMA floodplain mapping, community wildfire protection plans, severe weather statistics, hazard incident reports, and regional comprehensive plans. The resources obtained, reviewed and compiled into the risk assessment are summarized in Section 3.6 and at the end of each subsection of Section 5.3 of this Plan. Jurisdictions needing these data sets obtained them by requesting them directly from the host agency or organization, downloading information posted to website locations, or engaging consultants.

3.4 Public Involvement

3.4.1 Previous Plan Assessment

The public involvement strategy for the 2016 Plan development a public notice published in the Copper Era and an announcement of the mitigation planning process was made at a LEPC meeting. Participating jurisdictions also posted public notices to their respective websites that included a link to the full time website maintained on the Greenlee County servers. A copy of the 2011 Plan was made available on the County website along with contact information for the MJPT PPOCs. No responses from the general public were received from the first round of notices.

A second wave of post-draft public notices was posted to jurisdiction websites and a copy of the draft Plan was posted to the County website for review and comment. Interested citizens were also encouraged to participate in the local community adoption process which, depending upon the jurisdiction, included a formal public hearing and in some cases, a prior informal presentation.

3.4.2 Plan Update

The opportunity for public involvement and input to the plan update process was accommodated using the same general strategy as the 2016 Plan.

Participating jurisdictions also posted public notices to their respective websites that included a link to the full time website maintained on the Greenlee County servers. A copy of the 2016 Plan was made available on the County website along with contact information for the MJPT PPOCs. Additionally, the Town of Clifton posted a notice of the Plan Update process to their Facebook account. No responses from the general public were received from the first round of notices.

A second wave of post-draft public notices was posted to jurisdiction websites and a copy of the draft Plan was posted to the County website for review and comment. Interested citizens were also encouraged to participate in the local community adoption process which, depending upon the jurisdiction, included a formal public hearing and in some cases, a prior informal presentation.

3.5 Reference Documents and Technical Resources

Over the course of the update planning process, numerous other plans, studies, reports, and technical information were obtained and reviewed for incorporation or reference purposes. The majority of sources referenced and researched pertain to the risk assessment and the capabilities assessment. To a lesser extent, the community descriptions and mitigation strategy also included some document or technical information research. Table 3-5 provides a reference listing of the primary documents and technical resources reviewed and used in the Plan. Detailed bibliographic references for the risk assessment are provided at the end of each hazard risk profile in Section 5.3. Other bibliographic references are provided as footnotes throughout the Plan.

3.6 Plan Integration Into Other Planning Mechanisms

Incorporation and/or integration of the Plan into other planning mechanisms, either by content or reference, enhances a community's ability to perform hazard mitigation by expanding the scope of the Plan's influence. It also helps a community to capitalize on all available mechanisms at their disposal to accomplish hazard mitigation and reduce risk.

3.6.1 Past Plan Incorporation/Integration Assessment

A poll of the participating jurisdictions revealed that success of incorporating the 2016 Plan elements into other planning programs has varied over the past planning cycle. Ways in which the 2016 Plan has been successfully incorporated or referenced into other planning mechanisms by each jurisdiction are summarized in Tables 3-6 through 3-8.

| Table 3-5: List of resource documents and references reviewed and incorporated in the Plan update process | | |
|--|------------------------------------|---|
| Referenced Document or Technical Source | Resource Type | Description of Reference and Its Use |
| Arizona Department of Administration – Employment and Population Statistics | Website Data | Reference for demographic and economic data for the county and community. |
| Arizona Department of Emergency Management | Data and Planning Resource | Resource for state and federal disaster declaration information for Arizona. Also a resource for hazard mitigation planning guidance and documents. |
| Arizona Department of Water Resources | Technical Resource | Resource for data on drought conditions and statewide drought management (AzGDTF), and dam safety data. Used in risk assessment. |
| Arizona Geological Survey | Technical Resource | Resource for earthquake, fissure, landslide/mudslide, subsidence, and other geological hazards. |
| Arizona Model Local Hazard Mitigation Plan | Hazard Mitigation Plan | Guidance document for preparing and formatting hazard mitigation plans for Arizona. |
| Arizona State Land Department | Data Source | Source for statewide GIS coverages (ALRIS) and statewide wildfire hazard profile information (Division of Forestry). Used in the risk assessment. |
| Bureau Net (2021) | Website Database | Source for NFIP statistics for Arizona. |
| Greenlee County Comprehensive Plan (2003) | Comprehensive Plan | Source for history, demographic and development trend data for the unincorporated county. Still latest version. |
| Greenlee County Multi-Jurisdictional Hazard Mitigation Plan (2016) | Hazard Mitigation Plan | Current FEMA approved hazard mitigation plan that formed the starting point for the update process. |
| Greenlee County Community Wildfire Protection Plan (LSD, 2005) | Community Wildfire Protection Plan | Source of wildfire hazard profile data for hazard mapping and risk assessment. No updates are available |
| Environmental Working Group’s Farm Subsidy Database (2021) | Website Database | Source of disaster related agricultural subsidies. Used in the risk assessment. |
| Federal Emergency Management Agency | Technical and Planning Resource | Resource for HMP guidance (How-To series), floodplain and flooding related NFIP data (mapping, repetitive loss, NFIP statistics), and historic hazard incidents. Used in the risk assessment and mitigation strategy. |
| HAZUS-MH | Technical Resource | Based data sets within the program were used in the vulnerability analysis. |
| InciWeb – Incident Information System (2020) | Wildfire Data | Source wildfire incident information for historical hazard and profile information. |
| National Climatic Data Center | Technical Resource | Online resource for weather related data and historic hazard event data. Used in the risk assessment. |
| National Integrated Drought Information System (2021) | Technical Resource | Source for drought related projections and conditions. Used in the risk assessment. |
| National Weather Service | Technical Resource | Source for hazard information, data sets, and historic event records. Used in the risk assessment. |

Table 3-5: List of resource documents and references reviewed and incorporated in the Plan update process

| Referenced Document or Technical Source | Resource Type | Description of Reference and Its Use |
|---|---------------------------------|--|
| National Wildfire Coordination Group (2021) | Technical Resource | Source for historic wildfire hazard information. Used in the risk assessment. |
| Office of the State Climatologist for Arizona | Website Reference | Reference for weather characteristics for the county. Used for community description. |
| Standard on Disaster/Emergency Management and Business Continuity Programs (2000) | Standards Document | Used to establish the classification and definitions for the asset inventory. Used in the risk assessment. |
| State of Arizona MHMP (2018) | Hazard Mitigation Plan | The state plan was used a source of hazard information and the state identified hazards were used as a starting point in the development of the risk assessment. |
| USACE Flood Damage Report (1978) | Technical Data | Source of historic flood damages for 1978 flood. Used in the risk assessment. |
| USACE Flood Damage Report (1994) | Technical Data | Source of historic flood damages for 1993 flood. Used in the risk assessment. |
| U.S. Census Bureau | Technical Data and Website Data | Source of demographic and building permit data. |
| U.S. Forest Service | Technical Data | Source for local wildfire data. Used in the risk assessment. |
| U.S. Geological Survey | Technical Data | Source for geological hazard data and incident data. Used in the risk assessment. |
| Jurisdictional General Plans | Planning and Hazard Data | General Plans prepared by each of the jurisdictions summarizes the long-term growth strategies and can provided data regarding development trends. |
| Western Regional Climate Center | Website Data | Online resource for climate data used in climate discussion. |
| Zillow Real Estate Values | Website Reference | Obtained home value indexes for incorporated and unincorporated areas of Greenlee County to use for residential values in vulnerability assessment. |

Table 3-6: Plan integration history and future strategy for Clifton

| | |
|---|--|
| Plan Integration Over the Past Plan Cycle: | |
| The 2016 MJHMP was referenced and/or incorporated into updates to the following plans maintained by the Town: | |
| <ul style="list-style-type: none"> • Town Of Clifton General Plan • Town of Clifton Emergency Operation Plan • Levee repair & rehab. | |
| Plan Integration Strategy for Next Five Years: | |
| Planning Mechanism | Description of Planning Mechanism Opportunity |
| Town of Clifton Emergency Operations Plan | Future updates to the EOP will include a review of the MJHMP risk assessment as appropriate. |

| Table 3-6: Plan integration history and future strategy for Clifton | |
|--|--|
| Levee Plan | Any significant repair and rehabilitation will be coordinated with MJHMP and incorporated into the next MJHMP update as appropriate. |
| CIP | The Town is considering developing a formal capital improvements plan. If developed, the Town will reference and include the mitigation A/Ps as appropriate. |

| Table 3-7: Plan integration history and future strategy for Duncan | |
|--|---|
| Plan Integration Over the Past Plan Cycle: | |
| <ul style="list-style-type: none"> The MJHMP has and will continue to be referenced as a part of the current General Plan update process to ensure that the mitigation goals and activities are congruent with General Plan. CIP | |
| Plan Integration Strategy for Next Five Years: | |
| Planning Mechanism | Description of Planning Mechanism Opportunity |
| Town of Duncan General Plan | The MJHMP will be reviewed and incorporated/referenced in the final update of the Town’s General Plan, which is anticipated to be completed late in 2021. |
| Town of Duncan Emergency Operations Plan and Procedures | The Town will use the MJHMP to assist with any future updates of the EOP, including the risk profiles and vulnerability assessments. |
| Town of Duncan 5-Year Capital Improvements Program | The Town will review the MJHMP mitigation actions/projects to determine if any are eligible for inclusion in the 5-year CIP |
| Ordinance Updates | The MJHMP will be referenced and incorporated, where applicable, into an effort to update Town Ordinances in late 2021. |

| Table 3-8: Plan integration history and future strategy for Greenlee County | |
|---|--|
| Plan Integration Over the Past Plan Cycle: | |
| <ul style="list-style-type: none"> The County used the MJHMP to assist with updates of the EOP, including the risk profiles and vulnerability assessments. As the lead agency for the LEPC, the County integrates the MJHMP with the LEPC Plan and vice-versa by keeping PPOCs current and correlating potential hazards. The County continues to keep the MJHMP mitigation actions/projects and CIP projects current with each other. | |
| Plan Integration Strategy for Next Five Years: | |
| Planning Mechanism | Description of Planning Mechanism Opportunity |
| Greenlee County Comprehensive Plan | During updates, the MJHMP will be referenced and elements incorporated to provide a connection between the two planning documents. |
| Greenlee County Emergency Operations Plan | The County will use the MJHMP to assist with any future updates of the EOP, including the risk profiles and vulnerability assessments. |
| Greenlee County LEPC Plan | As the lead agency for the LEPC, the County will integrate the MJHMP with the LEPC Plan and vice-versa by keeping PPOCs current and correlating potential hazards. |
| Greenlee County CIP | The County will continue to keep the MJHMP mitigation actions/projects and CIP projects current with each other. |

| Table 3-8: Plan integration history and future strategy for Greenlee County | |
|--|---|
| Floodplain Management Ordinance, Zoning Ordinance, Subdivision Ordinance, Hazard Abatement Ordinance | During updates, the MJHMP will be referenced and elements incorporated to provide a connection to related ordinances. |

3.6.2 Five Year Plan Integration/Incorporation Strategy

With the efficacy of integrating the 2016 Plan during the last cycle in view, the MJPT identified typical ways to use and incorporate the Plan over the next five-year planning cycle, as follows:

- Use of, or reference to, Plan elements in updates/revisions to codes, ordinances, general and/or comprehensive planning documents, and other long-term strategic plans.
- Integration of defined mitigation A/Ps into capital improvement plans and programming.
- Reference to Plan risk assessments during updates or revisions to land use planning and zoning maps.
- Resource for developing and/or updating emergency operations plans, community wildfire protection plans, emergency response plans, etc.
- Reference during grant application processes.
- Use of the Plan as a resource during LEPC meetings.

Specific opportunities for integrating and/or referencing the Plan into other planning mechanisms over the next five years are summarized by jurisdiction in Tables 3-6 to 3-8. In all cases, the jurisdiction’s PPOC will take responsibility to ensure that the Plan, risk assessment, goals and mitigation strategies are integrated and/or incorporated into the listed planning mechanism by participating in those efforts as they occur.

3.6.3 Plan Incorporation Process

Each jurisdiction has particular processes that are followed for officially incorporating and adopting planning documents and tools. Many of the processes and procedures are similar for jurisdictions with comparable government structures.

In general, planning documents prepared by the various departments or divisions of a particular jurisdiction are developed using an appropriate planning process that is overseen and carried out by staff, and often with the aid of consultants. Each planning process is unique to the plan being developed, but all usually involve the formation of a planning or steering committee, and have some level of interagency/stakeholder coordination within the plan’s effective area. Public involvement may also be incorporated when appropriate and depending on the type of plan. New or updated plans are usually developed to a draft stage wherein they are presented to the respective governing body for initial review and comment. Upon resolution and address of all comments, which may take several iterations, the plans are then presented to the governing body for final approval and official adoption.

Integration or reference to the Plan into these various processes will be accomplished by the active participation of the MJPT PPOC representative(s) from each jurisdiction, in the other planning teams or committees to ensure that the Plan risk assessment, goals, and mitigation A/Ps are integrated and/or incorporated into the planning mechanism as appropriate.

Table 3-9 provides a summary of standard operating procedures that each of the participating jurisdictions follow when considering and incorporating official planning mechanisms, and how they apply to integration of the Plan.

| Table 3-9: Jurisdictional standard operating procedures for integration of planning mechanisms | |
|---|--|
| Jurisdiction | Description of Plan Integration Standard Operating Procedures |
| Clifton | <p>The development or update of planning related documents and mechanisms in the Town will generally be accomplished using the following steps:</p> <ul style="list-style-type: none"> • At Council direction, conduct initial planning using internal resources to discern feasibility. • Staff would then work with a consultant to develop the plan to draft stage. • The draft plan would be presented to council in work session(s) and public outreach would be performed as needed. • The plan would be finalized and formally adopted by the Council during an open public meeting. |
| Duncan | <p>The Town Manager, Council, and Town Attorney will convene a work session to discuss plans and procedures on the proposed planning document. Direction will be given to the Town Manager by the Council in developing the planning document. The draft document is then presented and reviewed by the Council, corrections are made, and then the planning document is officially adopted by the Council. When developing the planning document, the Town Manager will review and reference the MJHMP as appropriate. Updates of planning documents will generally follow the same process.</p> |
| Greenlee County | <p>In general, the development of planning documents and tools within the County follow a basic process outlined by the bullets below:</p> <ul style="list-style-type: none"> • Initiation of plan development can be from staff or as a directive from BOS • Plan is written by staff and/or consultants • Plan goes through a legal review • Plan goes out for public comment • Work-study session(s) are convened with BOS • Edited plan is presented to BOS for adoption <p>Whenever possible and appropriate, the PPOC for the County will endeavor to make sure the Greenlee County Multi-Jurisdictional Hazard Mitigation Plan is reviewed and as appropriate, incorporated into future planning documents and mechanisms by active participation in the development or update of those plans and mechanisms.</p> |

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SECTION 4: COMMUNITY DESCRIPTIONS

4.1 General

The purpose of this section is to provide updated basic background information on Greenlee County as a whole and includes information on geography, climate, population and economy. Abbreviated details and descriptions are also provided for each participating jurisdiction.

4.2 County Overview

4.2.1 History

The first mineral discoveries in the Clifton-Morenci District were made around 1856 when a group of California volunteers pursuing renegade Apache Indians came through the area and wrote about the colorful mineral outcrops. In 1872 a group of soldiers from New Mexico were seeking renegade Indians, among the group were Joe Yankie, Robert and James Metcalf. They later returned to the area searching for placer gold. Although very little gold was found, they located the Longfellow, Arizona Central and Metcalf claims which later become the mines around the town of Metcalf and Morenci.



Source: Phelps Dodge/Greenlee County Historical Society

Two mining companies were organized in the Clifton-Morenci District in the early 1870's; the Longfellow Copper Company (which later became the Arizona Copper Company) and the Detroit Copper Company (later became Phelps Dodge, Morenci Branch). The first ore mined from the Longfellow mine assayed as high as 80% copper, and averaged 20% copper over the first 10 years of mining. The first copper furnace was built in Chase Creek, about 800 feet below the Longfellow Mine so the ore had to be lowered by cable in ore cars. Horse and mule-drawn wagons transported ore before the coming of the railroad in 1879. They hauled in all supplies and carried out the limited amount of copper from the crude smelters. The wagons then hauled the copper to the railroads that carried them to markets as far away

as San Francisco and Kansas City or Kit Carson, Colorado, which was the nearest railroad.

Although the ore contained very high copper grades, the early mining in the district had three major problems. The early smelters lasted only a few weeks (sometimes only days) before they had to be rebuilt. The transportation costs of the ore from the mine to the smelters, to the railhead for delivery and then to the market were expensive and often unreliable. The constant threat of Indian raids often caused temporary production losses.

Early mining by the Detroit Copper Company ceased after a short time because of the dangers of Indian raids and the remoteness of the mines. It was reactivated a few years later with the arrival of William Church. In 1880, Church decided to build a smelter to handle the ore from his mines. He didn't have the required capital, so he went to New York to seek a loan. On a historic day in 1881, Church entered the office of Phelps Dodge and Company in New York City and asked for a loan. Phelps Dodge at this time was not in the mining business, but rather involved in exporting commodities such as cotton, and importing metals, primarily tin, copper, brass, and zinc. Phelps Dodge did not immediately extend the loan, but asked Dr. James Douglas, a renowned metallurgist to examine Church's claims. Douglas reported favorably and recommended that Phelps Dodge invest in mining properties in Bisbee, Arizona that same year. Because of Douglas favorable report, Phelps Dodge and Company advanced \$50,000 to Church and became part owners of the Detroit Mining Company. The year 1881 thus became the year Phelps Dodge entered Morenci and began mining copper.

In 1882, the Detroit Copper Company smelter was shut down because an Apache Indian raid killed several workers, stole the supplies and left the smelter riddled with bullet holes. Because of the difficulties with the Indians, the high cost of ore transportation to the smelter in Clifton, the smelter was relocated in 1883 closer to the mining in Copper Mountain. As part of the move the name "Morenci" was given to this new area, replacing the old name of "Joy's Camp".

The Detroit Copper Company smelter in 1896. This site is now under a mine dump on the south side of the Morenci pit.



Source: Phelps Dodge/Greenlee County Historical Society

In 1892, the Detroit Copper Company was forced to shut down because the price of copper dropped to six cents per pound. An attempt to start back by building a concentrator to handle lower grade sulfide copper ore was unsuccessful. In 1897, Church sold the remainder of the Detroit Copper Company to Phelps Dodge and Company for \$1,600,000. Underground mining was renewed, a new concentrator was built and the Company again prospered.

The three major operators in the early 1900's were the Detroit, the Arizona, and the Shannon Copper Companies. In the towns of Metcalf were the Arizona and Shannon Copper Company mines; Morenci had the Arizona Copper Company mines and concentrator, and the Detroit Copper Company mines, concentrator and smelter. Clifton with the Arizona Copper Company and the Shannon Copper Company concentrators and smelters were all thriving.

Clifton has been under the jurisdiction of several counties. In 1872 they were recorded in Prescott, the county seat of Yavapai County. Later the territory was placed under the jurisdiction of Apache County. In 1881 Graham County was created from parts of Apache and Pima counties. Clifton was in the part of Apache County that was ceded to Graham County. The people were glad because now their county seat was only 45 miles away at Solomonville. Being a wild mining town, Clifton was not interested in government or they would have fought for the county seat, because Clifton had far more population than Solomonville. By the turn of the century the people of Clifton began to fight for the establishment of a new county. Clifton and Morenci had a combined population of 10,000 while Safford and Solomonville had about half that number. The people of Clifton-Morenci felt that it was the old story of taxation without representation since most of the county officers were chosen by the political machine at Safford. The Clifton and Morenci mines were paying most of the county's taxes.

In the early 1900's the fight for county division was renewed. The managers of the three mining companies had taken up the fight. The Arizona Copper Company wished to name the county after Mr. Colquhoun, who was the head of the company. The leaders in Morenci wanted the name to be Douglas in honor of Dr. James Douglas, superintendent of the Detroit Copper Company of Morenci. This proposal caused the Clifton leaders to give up their proposed name of Colquhoun and substitute Lincoln instead. They sent John R. Hampton a young, able lawyer who worked for the Shannon Copper Company, to the state legislature. He organized the fight at the territorial capital, which led to the establishment of Greenlee County. The mining companies decided to send a large delegation of local men to Phoenix to lobby for division. In Safford and Solomonville a fight was led by Charles Solomon, a banker, against the county division. When the bill was introduced before the legislature, many farmers and townspeople from Graham County made the trip to Phoenix to lobby against it. The bill was introduced on February 25, 1909 as council bill 94. It passed by a majority of 10 to 1. The bill went to the house where it was passed with an amendment to change the name from Lincoln to Greenlee. This was done to delay the final passage of the bill, the amendment lost by a vote of 5 to 4. Mr. Mills, General Manager of the Detroit Copper Company made a trade with the Safford opponents where the final division would be delayed for two years. This agreement and the assumption of all Graham county debts, which were \$146,000, by the new county appeased the Safford delegation. Nearly all opposition ceased and the bill passed the next day by a vote of seven to two in the Council. The bill to create a new county was approved March 10, 1909 by Governor Joseph H. Kibbey. It was one of the smaller counties, being only 120 miles

long and 20 miles wide containing 1,037,713 acres. With only four populated towns the new county had a population of about 12,000 to 13,000 people.

Both Clifton and Duncan fought to become the county seat. The citizens of Duncan argued that since Duncan was the county's outlet to the rest of the world, and more accessible to the rest of the world, it should become the County's seat. Clifton argued that it was nearer the geographical center of the county and nearer to the population centers of Morenci and Metcalf. Clifton won the fight and the seat was located there.

In 1921, Phelps Dodge became sole owner of the entire mining District through its purchase of the Arizona Copper Company which had been the largest copper operation in the Clifton-Morenci District since 1882. Most of the ore mined by the underground methods after 1921 was sulfide copper ore from the Humboldt Mine and assayed 2% to 4% copper. By 1928 and 56 years of operation, the Morenci district had produced almost two billion pounds of copper.

Between 1928 and 1930, Phelps Dodge drilled many test holes in the "Clay" deposits. Although huge tonnages of ore were indicated, the grade of the ore was too low to be mined profitably by underground methods. In 1932, all underground mining ended in Morenci because the depression had dropped copper prices to less than six cents per pound.

In 1937 mining was again started in Morenci, not by underground methods, but rather by open pit methods. Stripping of waste from the top of the ore body lasted until 1942 when the first ore was delivered to the new Morenci concentrator and a new era of mining in the Morenci district began.

Besides the Copper Mines of the Clifton-Morenci-Metcalf area, there are mines in the Duncan District of the Gila Valley. Precious metals have been produced at Ash Peak and from the mines in the mountains east of Duncan. Duncan is considered a farming and ranching area. Ranching on Blue River, Eagle Creek, and the "Frisco" River has added to the County economy since the 1870's. One of the three largest cattle companies to operate in Arizona was the Double Circle with ranch headquarters on Eagle Creek.

4.2.2 *Geography*

Greenlee County is located in eastern Arizona on the state line with New Mexico. According to the Greenlee County Comprehensive Plan ², the County was created by an Act of the 25th Territorial Assembly in 1909, by a division of Graham County. The County is currently comprised of 1,838 square miles, with the Town of Clifton serving as the County seat since inception. The location of Greenlee County, relative to other counties within the State of Arizona is depicted in Figure 4-1.

The County limits generally extend from longitude 109.05 to 109.50 degrees west and latitude 32.42 to 33.80 degrees north. Major roadway transportation routes through the County include U.S. Highways 70 and 191, and State Routes 75 and 78. Railways through the County include the Southern Pacific Railway and the Phelps Dodge Industrial Railroad, which services the Morenci Copper Mine. Figure 4-2 shows all the major roadway and railway transportation routes and the airports within Greenlee County.

The Gila River, San Francisco River, Blue River, Black River and Eagle Creek are the primary perennial watercourses located within the County. The Black River also forms a portion of the northwest boundary of the County. The remaining watercourses are primarily ephemeral washes.

The geographical characteristics of Greenlee County have been mapped into three terrestrial ecoregions³, which are depicted in Figure 4-3 and described below:

- **Arizona/New Mexico Mountains** – this ecoregion contains a mountainous landscape, with moderate to steep slopes. Elevations in this zone range from approximately 4,000 to

² Greenlee County, 2003, *2003 Greenlee County Comprehensive Plan*, adopted March 4, 2003

³ World Wildlife Fund, 2010, GIS database.

13,000 feet, resulting in comparatively cool summers and cold winters. Vegetation in these areas are largely high altitude grasses, shrubs, brush, and conifer forests.

- **Chihuahuan Desert** – this ecoregion is typical of the high altitude deserts and foothills and is found in much of the southeastern portion of Arizona. Elevations in this zone vary between 3,000 to 4,500 feet. The average temperatures for the Chihuahuan Desert tend to be cooler than the Sonoran Desert (see below) due to the elevation differences. However, like its lower elevation cousin, the summers are hot and dry with mild to cool winters.
- **Madrean Archipelago** – this ecoregion is predominant to mountainous regions in southeast Arizona with elevations generally above 5,000 feet. The average temperatures tend to be cool during the summer and cold in winter.

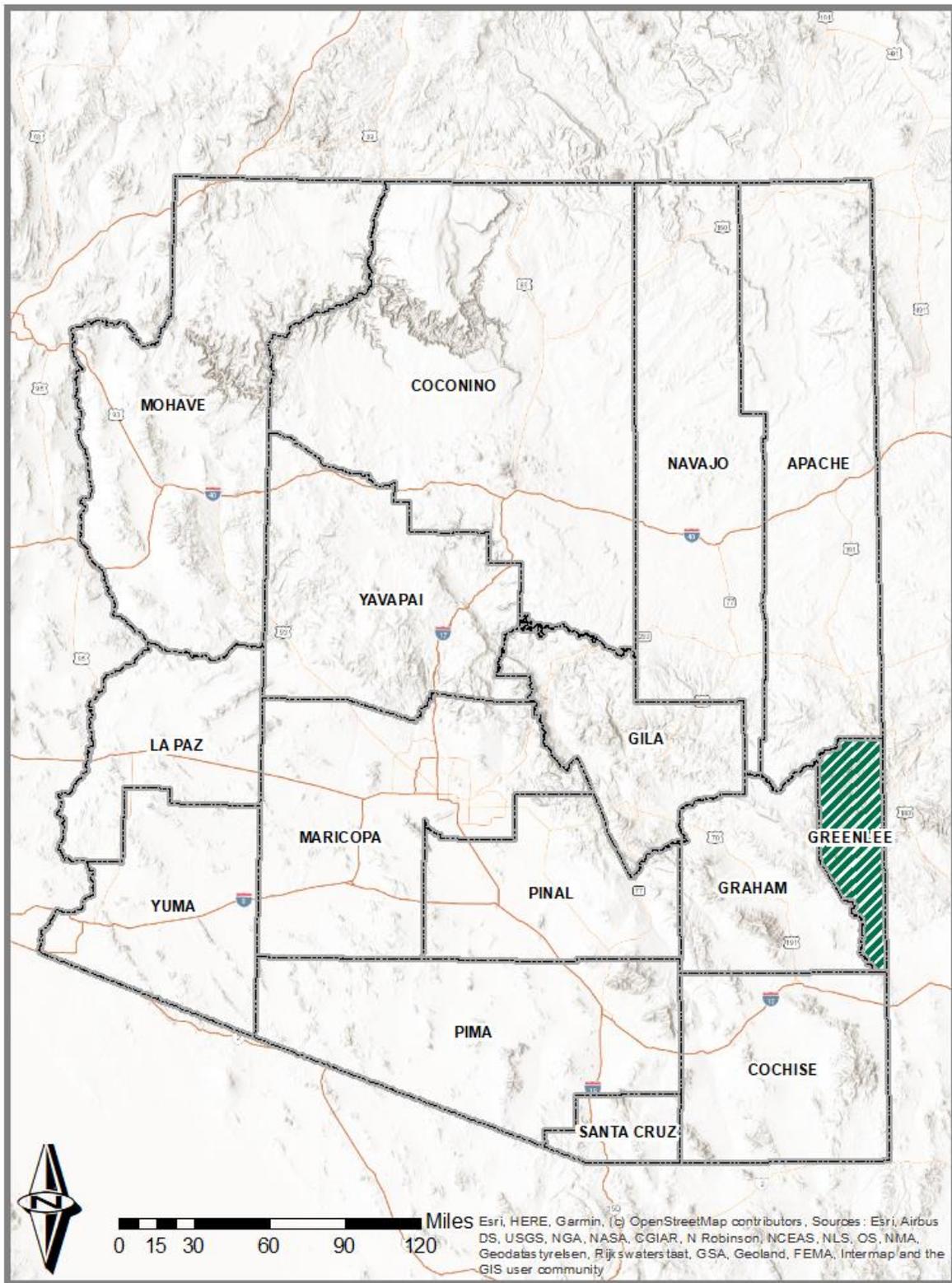


Figure 4-1
Vicinity Map

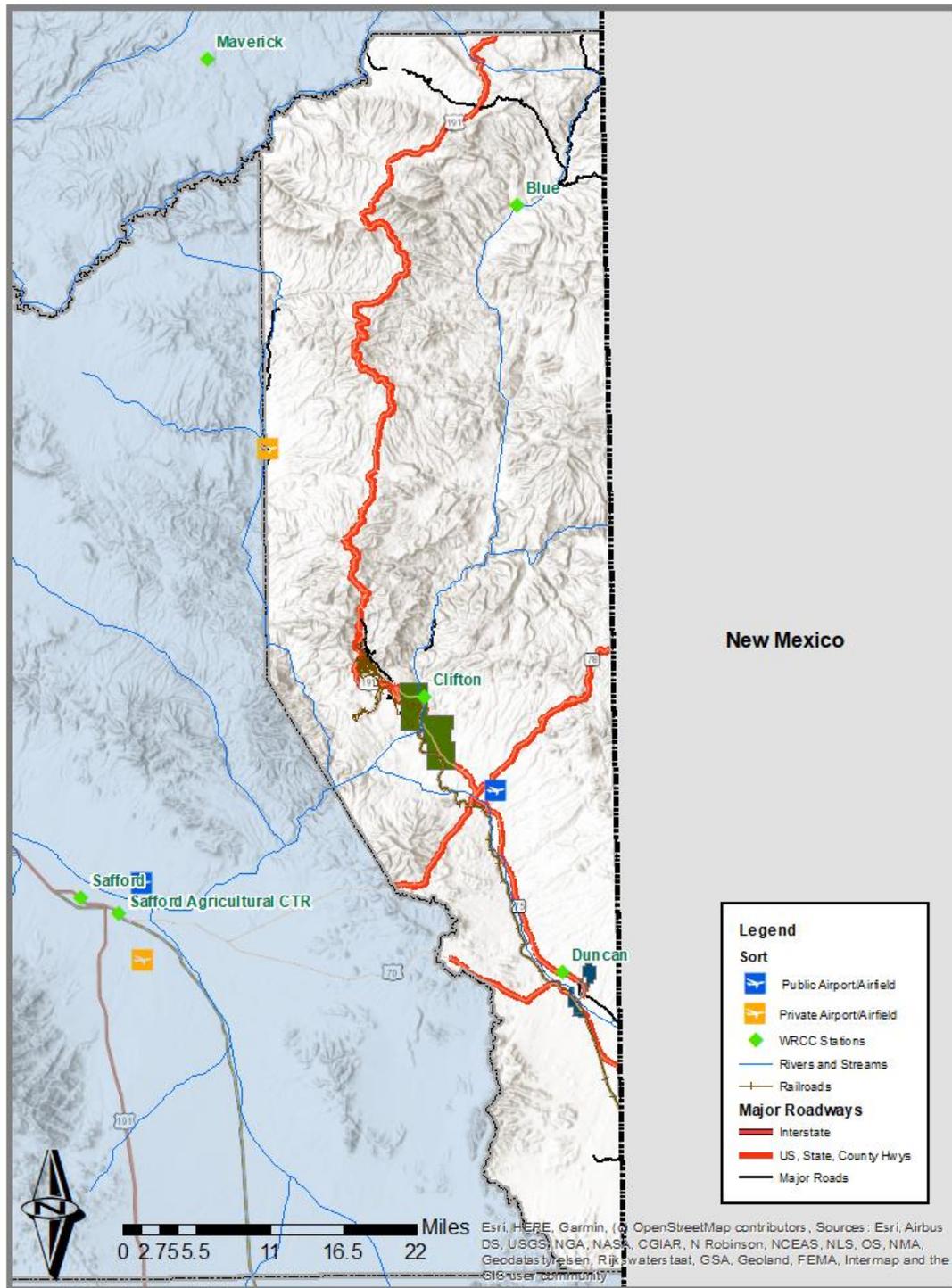


Figure 4-2
Transportation Routes Map

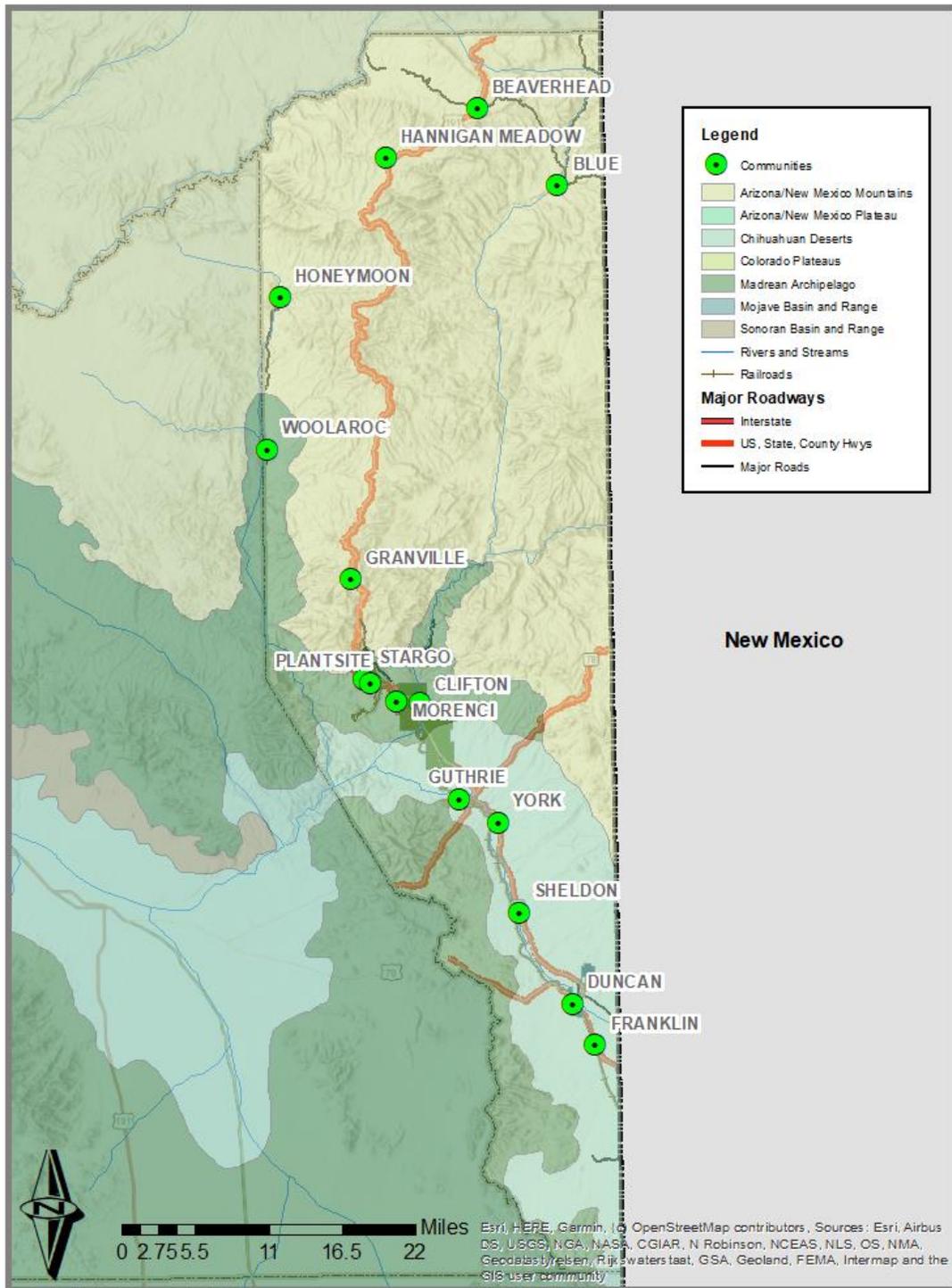


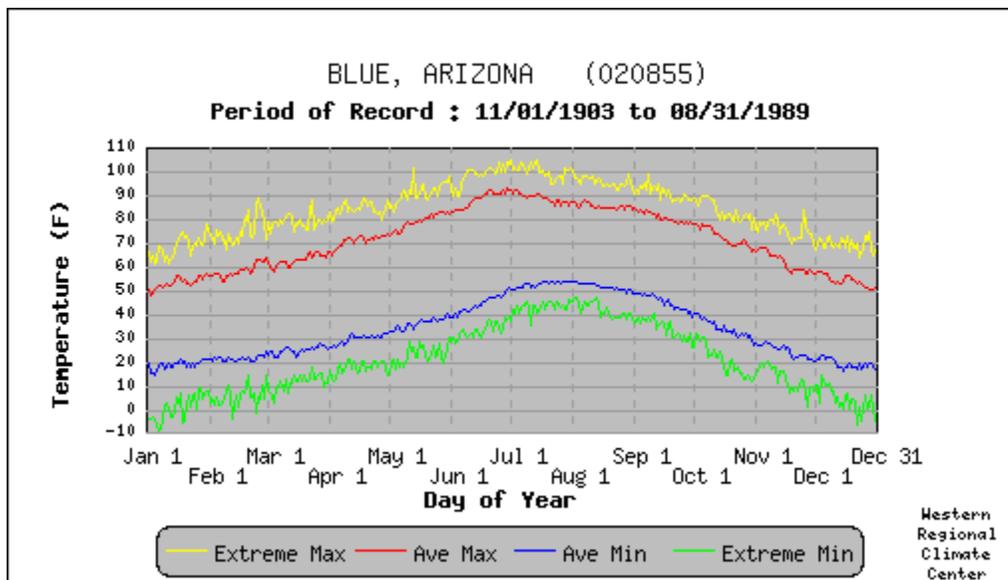
Figure 4-3
 Terrestrial Ecoregions Map

4.2.3 *Climate*

For the majority of Greenlee County, the climate when compared to other regions in the State of Arizona, is relatively moderate. Climatic statistics for weather stations within Greenlee County are produced by the Western Region Climate Center⁴ and span records dating back to the early 1900's. Locations of reporting stations within or near Greenlee County are shown on Figure 4-2.

Average temperatures within Greenlee County range from below freezing during the winter months to over 100 degrees Fahrenheit during the hot summer months. The severity of temperatures in either extreme is highly dependent upon the location, and more importantly the altitude, within the County. Below are figures taken from three climate stations found in geographically different areas of Greenlee County. Figures 4-4, 4-5, and 4-6 present graphical depictions of temperature variability and extremes throughout the year for the Blue, Clifton, and Duncan Stations respectively. The Blue Station would be representative of typical Arizona Mountain Forest ecoregions. The Clifton Station would represent the transitional zone from Arizona Mountain Forest to Chihuahuan Desert. The Duncan Station represents values typical of the Chihuahuan Desert ecoregion. In general, there is an approximate ten degree reduction in temperature between the lower Chihuahuan Desert and upper Arizona Mountain Forest elevation stations.

Precipitation throughout Greenlee County is governed to a great extent by elevation and season of the year. From November through March, storm systems from the Pacific Ocean cross the state as broad winter storms producing mild precipitation events and snowstorms at the higher elevations. Summer rainfall begins early in July and usually lasts until mid-September. Moisture-bearing winds move into Arizona at the surface from the southwest (Gulf of California) and aloft from the southeast (Gulf of Mexico). The shift in wind direction, termed the North American Monsoon, produces summer rains in the form of thunderstorms that result largely from excessive heating of the land surface and the subsequent lifting of moisture-laden air, especially along the primary mountain ranges.



**Figure 4-4
Daily Temperatures and Extremes for Blue Station, Arizona**

⁴ Most of the data provided and summarized in this plan are taken from the WRCC website beginning at the following URL: <http://www.wrcc.dri.edu/CLIMATEDATA.html>

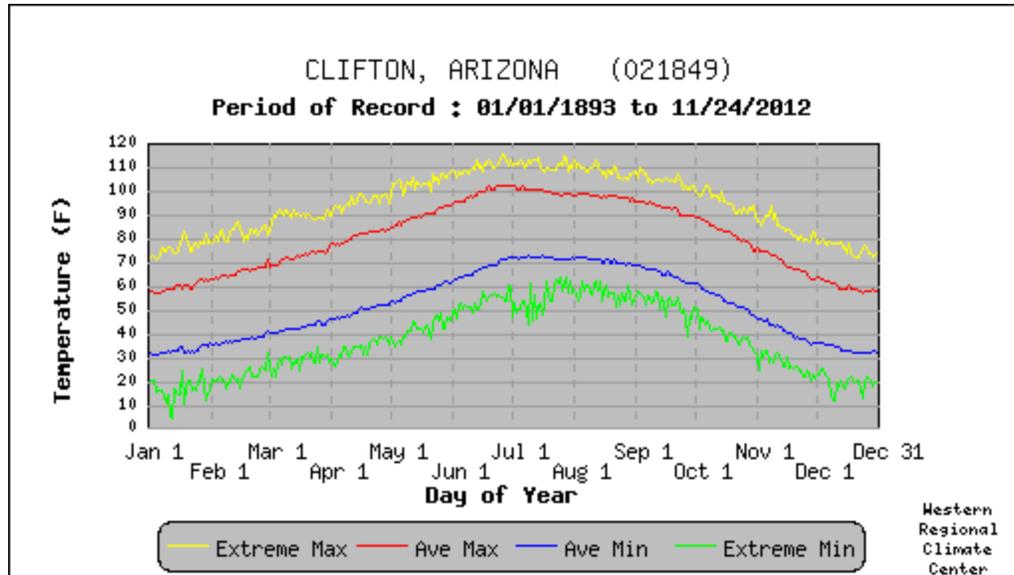


Figure 4-5
Daily Temperatures and Extremes for Clifton Station, Arizona

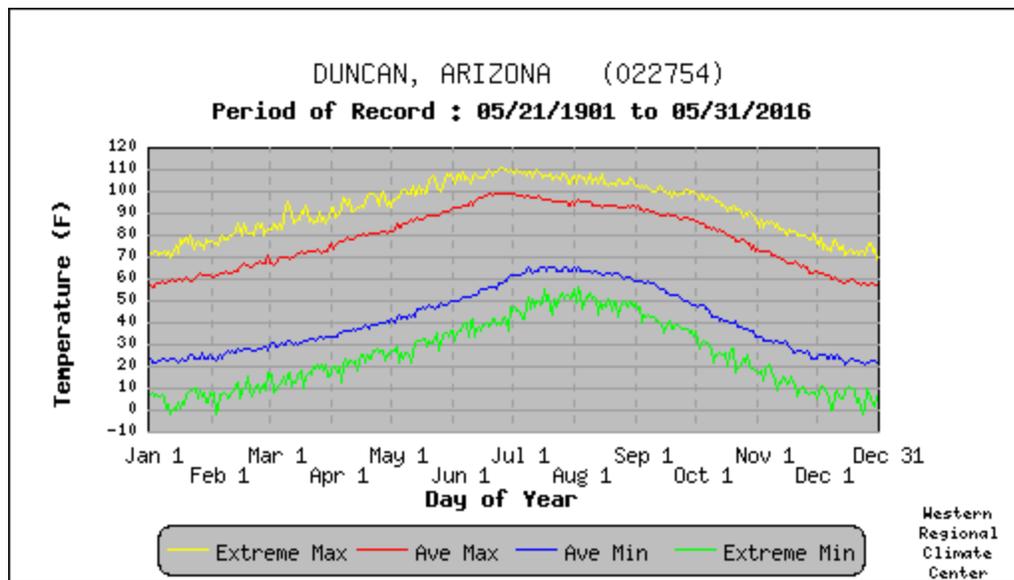


Figure 4-6
Daily Temperatures and Extremes for Duncan Station, Arizona

The monsoon activity accounts for roughly half the annual precipitation in central Arizona, and two-thirds to three-fourths of the annual precipitation in southern Arizona. The short-lived, intense thunderstorms often result in flash flooding in steep terrain, as well as urban flooding through low-lying roads and normally dry washes⁵.

⁵ Office of the State Climatologist for Arizona, 2021. Partially taken from the following weblink:
<https://azclimate.asu.edu/monsoon/>

Figures 4-7, 4-8, and 4-9 show tabular temperature and precipitation statistics for the Blue, Clifton, and Duncan Stations. Statistics for other stations shown on Figure 4-3 may be viewed by accessing the WRCC website.

| BLUE, ARIZONA (020855) | | | | | | | | | | | | | |
|--|------|------|------|------|------|------|------|------|------|------|------|------|--------|
| Period of Record Monthly Climate Summary | | | | | | | | | | | | | |
| Period of Record : 11/01/1903 to 08/31/1989 | | | | | | | | | | | | | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
| Average Max. Temperature (F) | 53.5 | 58.1 | 62.6 | 70.6 | 78.9 | 88.3 | 88.9 | 85.7 | 80.8 | 72.4 | 61.8 | 54.3 | 71.3 |
| Average Min. Temperature (F) | 18.6 | 21.1 | 24.5 | 29.4 | 36.0 | 44.3 | 52.5 | 51.4 | 45.2 | 34.3 | 24.6 | 19.1 | 33.4 |
| Average Total Precipitation (in.) | 1.35 | 1.30 | 1.27 | 0.70 | 0.50 | 0.68 | 3.90 | 3.69 | 2.27 | 2.13 | 1.14 | 1.79 | 20.73 |
| Average Total SnowFall (in.) | 5.3 | 5.9 | 2.8 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 1.7 | 7.6 | 24.6 |
| Average Snow Depth (in.) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Percent of possible observations for period of record. | | | | | | | | | | | | | |
| Max. Temp.: 37% Min. Temp.: 36.8% Precipitation: 63.6% Snowfall: 63.6% Snow Depth: 59.8% | | | | | | | | | | | | | |
| Check Station Metadata or Metadata graphics for more detail about data completeness. | | | | | | | | | | | | | |
| Western Regional Climate Center, wrcc@dri.edu | | | | | | | | | | | | | |

**Figure 4-7
Monthly Climate Summary for Blue Station, Arizona**

| CLIFTON, ARIZONA (021849) | | | | | | | | | | | | | |
|--|------|------|------|------|------|------|-------|------|------|------|------|------|--------|
| Period of Record Monthly Climate Summary | | | | | | | | | | | | | |
| Period of Record : 01/01/1893 to 11/24/2012 | | | | | | | | | | | | | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
| Average Max. Temperature (F) | 59.7 | 65.8 | 72.5 | 80.9 | 89.7 | 99.2 | 100.1 | 97.7 | 93.2 | 82.9 | 69.3 | 59.7 | 80.9 |
| Average Min. Temperature (F) | 32.8 | 37.2 | 42.6 | 49.3 | 57.6 | 67.1 | 71.5 | 70.6 | 65.1 | 54.0 | 40.8 | 33.4 | 51.8 |
| Average Total Precipitation (in.) | 1.02 | 1.01 | 0.82 | 0.39 | 0.35 | 0.42 | 2.22 | 2.43 | 1.64 | 1.10 | 0.79 | 1.19 | 13.36 |
| Average Total SnowFall (in.) | 0.3 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.5 | 1.1 |
| Average Snow Depth (in.) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Percent of possible observations for period of record. | | | | | | | | | | | | | |
| Max. Temp.: 81.9% Min. Temp.: 81.1% Precipitation: 96.4% Snowfall: 96.2% Snow Depth: 96.1% | | | | | | | | | | | | | |
| Check Station Metadata or Metadata graphics for more detail about data completeness. | | | | | | | | | | | | | |
| Western Regional Climate Center, wrcc@dri.edu | | | | | | | | | | | | | |

**Figure 4-8
Monthly Climate Summary for Clifton Station, Arizona**

| DUNCAN, ARIZONA (022754) | | | | | | | | | | | | | |
|--|------|------|------|------|------|------|------|------|------|------|------|------|--------|
| Period of Record Monthly Climate Summary | | | | | | | | | | | | | |
| Period of Record : 05/21/1901 to 05/31/2016 | | | | | | | | | | | | | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
| Average Max. Temperature (F) | 59.5 | 64.3 | 70.6 | 79.0 | 87.2 | 96.1 | 96.4 | 93.8 | 89.6 | 80.3 | 68.1 | 59.3 | 78.7 |
| Average Min. Temperature (F) | 23.5 | 26.5 | 31.4 | 37.2 | 45.1 | 54.3 | 63.7 | 62.4 | 54.2 | 41.2 | 29.2 | 23.2 | 41.0 |
| Average Total Precipitation (in.) | 0.83 | 0.77 | 0.56 | 0.23 | 0.25 | 0.32 | 1.88 | 2.04 | 1.13 | 0.95 | 0.60 | 1.00 | 10.57 |
| Average Total SnowFall (in.) | 0.4 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.7 |
| Average Snow Depth (in.) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Percent of possible observations for period of record. | | | | | | | | | | | | | |
| Max. Temp.: 57.7% Min. Temp.: 57.8% Precipitation: 65.2% Snowfall: 64.3% Snow Depth: 63.9% | | | | | | | | | | | | | |
| Check Station Metadata or Metadata graphics for more detail about data completeness. | | | | | | | | | | | | | |
| Western Regional Climate Center, wrcc@dri.edu | | | | | | | | | | | | | |

**Figure 4-9
Monthly Climate Summary for Duncan Station, Arizona**

4.2.4 Population

Greenlee County is home to approximately 9,500 residents, with approximately half of the population living in the two communities of Clifton and Duncan which are geographically located in the southern half of the County. The largest community is the Town of Clifton. Other smaller, unincorporated places are located throughout the county, with most situated along major highways and primarily comprised of only a few structures or landmark. Table 4-1 summarizes jurisdictional population statistics for Greenlee County incorporated communities and the County as a whole.

| Table 4-1: Summary of jurisdictional population estimates for Greenlee County | | | | | |
|--|-------------|-------------|-------------|-------------|-------------|
| Jurisdiction | 2000 | 2010 | 2015 | 2020 | 2030 |
| Greenlee County (total) | 8,547 | 8,437 | 9,529 | 10,657 | 11,368 |
| Towns | | | | | |
| Clifton | 2538 | 3,311 | 4,510 | 4,627 | 4,929 |
| Duncan | 812 | 696 | 802 | 771 | 824 |
| Unincorporated | n/a | 4,430 | 5,243 | 5,260 | 5,616 |
| <i>Note:</i> | | | | | |
| <ul style="list-style-type: none"> n.a. – not available at this time. Will be published in September 2016 Figures for 2019 – 2055 Sub-County Population Projections, as accessed at: https://www.azcommerce.com/oeo/population/population-projections | | | | | |

4.2.5 Economy

Greenlee County, Arizona's 14th county, was created from the eastern part of Graham County by an act of the 25th territorial assembly on March 10, 1909. There was great resistance to the formation of this new county because Graham County would lose considerable copper mining revenue. However, the citizens in the Morenci mining district of eastern Graham County wanted a more localized governing area. As a compromise, Greenlee County assumed \$146,000 of Graham County's debt and Greenlee County was made smaller than originally proposed. The County was named after Mason Greenlee, an early day mining man. In 1921, Phelps Dodge became sole owner of the entire mining district through its purchase of the Arizona Copper Company which had been the largest copper operation in the Clifton-Morenci District since 1882. Most of the ore mined by the underground methods after 1921 was sulfide copper ore from the Humboldt Mine and assayed 2% to 4% copper. By 1928 and after 56 years of operation, the Morenci district had produced almost two billion pounds of copper. Between 1928 and 1930, Phelps Dodge drilled many test holes in the "clay" deposits. Although huge tonnages of ore were

indicated, the grade of the ore was too low to be mined profitably by underground methods. In 1932, all underground mining ended in Morenci because the depression had dropped copper prices to less than six cents per pound. In 1937, mining was again started in Morenci, but not by underground methods. This era of mining saw the introduction of open pit methods. Stripping of waste from the top of the ore body lasted until 1942 when the first ore was delivered to the new Morenci concentrator and a new era of mining in the Morenci district began ⁶.

Duncan was originally established as a shipping point for cattle. Around Duncan, substantial agriculture has developed in the rich soils of the well-watered Gila River Valley. Farming and ranching continue to be the primary industries for the small community.

As indicated by Table 4-1, growth in Greenlee County has been very slow and is closely tied to the copper mining industry. During the period of 1990 to 2000, census data housing unit counts indicate an average annual growth rate of less than 0.8 percent. During 2000-2010, the County essentially experienced a net of zero growth.

Greenlee County covers 1,837 square miles. The vast majority of land is government-owned. The U.S. Forest Service controls 63.5 percent; the U.S. Bureau of Land Management, 13.6 percent; and individual or corporate ownership, only 8.1 percent. Figure 4-10 provides a visual depiction of the land ownership and town or community locations within the County.

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⁶ Excerpts taken from the Greenlee County website at the following URLs:
<https://greenlee.az.gov/history/duncan>,
<https://greenlee.az.gov/history/morenci-mining-district>, and
<https://greenlee.az.gov/history>

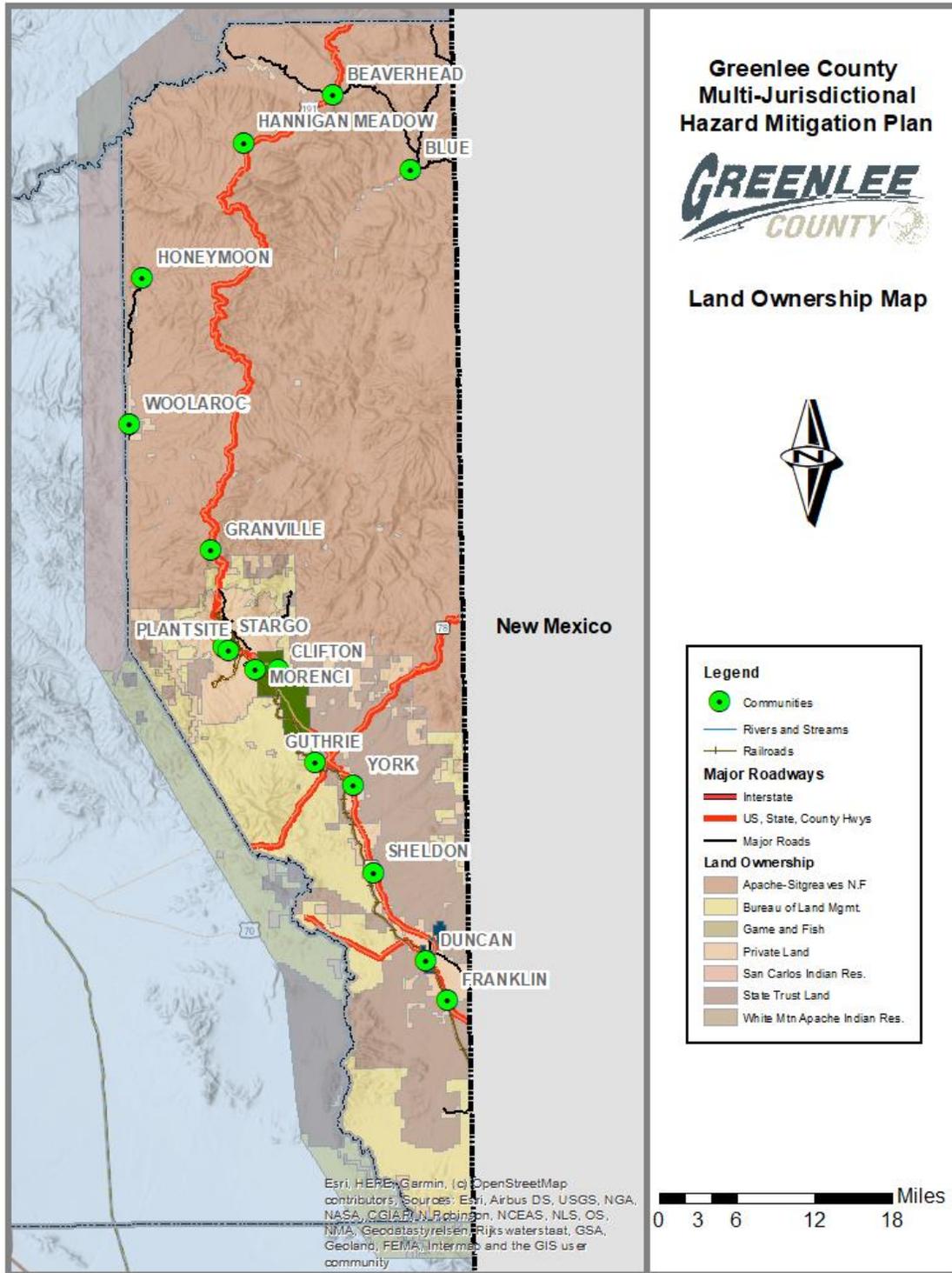


Figure 4-10: Land Ownership and Community Location Map for Greenlee County

4.3 Incorporated Jurisdictional Overviews

The following are brief overviews for each of the participating jurisdictions in the Plan.

4.3.1 Clifton

The Town of Clifton is located in the central portion of Greenlee County in southeastern Arizona. Clifton is one of two incorporated communities in Greenlee County and serves as the County seat. The Town is enclosed by steep canyon walls with the San Francisco River and Chase Creek running through the middle. The Town is sometimes referred to as the “Gateway to the Coronado Trail,” which follows U.S. Highway 191 from Clifton north to the town of Springerville, Arizona and is noted as one of the most scenic drives in Arizona. The present incorporated Town limits occupy 14.86 square miles, with approximately half encompassing the main portion of Town and the other half extending south of the main Town. The location of Clifton, relative to Greenlee County is depicted in Figure 4-11.

The centroid of the Town is generally located at longitude 109.29 degrees west and latitude 33.02 degrees north and the average elevation is 3,464 feet. The major roadway through the Town is U.S. Highway 191, otherwise known as the Coronado Trail. State Routes 75 and 78 junction with U.S. Highway 191 south of the Town boundaries. The Southern Pacific Railway passes through Clifton and is primarily used to service the Freeport McMoRan, Incorporated’s Morenci Operations. Greenlee County operates an airport south of Town off of State Route 78. Figure 4-2 shows all the major roadway and railway transportation routes within the vicinity of Clifton.

The San Francisco River is the primary perennial watercourse located within the Town. Other major watercourses include Chase Creek, Wards Canyon Wash, and Owl Canyon Wash. The remaining watercourses are primarily small ephemeral washes.

As shown on Figure 4-3, the Town of Clifton is located at the transitional zone from Chihuahuan Desert to Arizona Mountain Forests. The corridor along the San Francisco River upstream and downstream of Clifton provides an example of a desert riparian community where scattered cottonwood, willow, sycamore, box elder, ash, and walnut trees grow along the riverbank.

Clifton is one of two (2) incorporated communities within Greenlee County. There are an additional thirteen (13) unincorporated communities scattered across the County, with Morenci and Guthrie being the closest to Clifton. Approximately half of the land is privately owned with the other half divided between Bureau of Land Management holdings and State Land. Figure 4-11 provides a visual depiction of the land ownership within the Town.

The total 2020 population for Clifton was estimated to be 4,627. Table 4-1 summarizes population estimates for Clifton and other Greenlee County communities in 10-year cycles beginning in 2010 and projecting through 2030.

Manufacturing/Mining: According to the Arizona Office of Economic Opportunity, the average labor force in 2021 was 1,850 with an unemployment rate of 1.6 percent. The major industries significant to the economy of Clifton include: Copper Mining and Processing, Retail Trade and Services, and Tourism.

According to the Greenlee County website, Henry Clifton, Recorder of the Hassayampa Mining District, and for whom the city of Clifton is thought to be named, learned of placer mining in the area and journeyed overland in 1864. There, among the cliffs and canyons where Chase Creek joins the San Francisco, he found signs of copper, but gold and silver were still the metals sought, and the copper went undeveloped. In 1870, the growing demand for copper brought a renewal of exploration. Soon the town of Metcalf arose upon Chase Creek, five miles to the north. A smelter large enough to accommodate the surrounding mining needs was built at Clifton, where waterpower was available. Once established as a smelter site and as a trans-shipment point for copper, Clifton's future was assured.

Very early in 1879, Clifton claimed the distinction of possessing the first steam-powered railroad in Arizona-making runs between the Longfellow Mine and the Clifton smelter. In the early eighties, the railhead of the Arizona and New Mexico Railroad was extended from Lordsburg with

Clifton becoming the terminus. Along with the boost to civic pride and economic well-being, this development ended the difficult and dangerous haulage by mule and wagon, which were often attacked by Apache ambush.

Indian attacks, floods, mine fires, and a coarse standard for the mining camps of that day were easily taken in stride by the people of Clifton. At one point during its years of lusty, roaring growth, it was known as being the second toughest town in the west. The community standing first in this honor was not specified. In time, the high-grade copper ore was depleted and the direct-smelting process for low-grade ore became uneconomical. During the Depression years the flotation process, now in use by Freeport McMoRan, Incorporated, was developed to exploit the very-low grade ores of the Morenci Pit, which then was in the planning stage. A vast complex of tailings ponds and basins was erected along the hilltops of Morenci, and the role of Clifton in the copper mining industry changed.

Tourism: No longer directly involved in the physical mining processes, the Town, with characteristic enterprise, has evolved into a trading center for the ranching and farming regions lying southward, and as a tourism stop along the famous Coronado Trail.

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4.3.2 *Duncan*

The Town of Duncan is located in southeastern Arizona and is within six miles of the Arizona/New Mexico state border. Duncan is situated along the Gila River in the southern portion of the county. The Town lies in the central portion of a long, narrow valley extending from east of Virden, New Mexico to the Gila River confluence with the San Francisco River. The present incorporated Town limits occupy 2.38 square miles, with approximately half situated north of the Gila River (locally referred to as Hunter Flat) and the other half on the south (Main Town). The location of Duncan, relative to Greenlee County is depicted in Figure 4-1.

The centroid of the Town is generally located at longitude 109.10 degrees west and latitude 32.74 degrees north and the average elevation is 3,535 feet. Major roadway transportation routes through the Town include U.S. Highway 70 and State Route 75. The Southern Pacific Railway passes through Duncan and is primarily used to service the Freeport McMoRan Corporation's Morenci Mining District. In the past, Duncan has operated its own airport (O'Connor Airfield), which is located approximately 1.5 miles southwest of Town. Increased insurance costs forced the closure of the airport for a period of time; however, the Town began operation again in late 2016. Figure 4-12 shows all the major roadway and railway transportation routes within the vicinity of Duncan.

The Gila River is the primary, and only perennial, watercourse located within the Town. The remaining watercourses are primarily ephemeral washes, with Blackfield Canyon Wash and Packer Wash being the largest.

As shown on Figure 4-3, the Town of Duncan lies entirely within the Chihuahuan Desert. The corridor along the Gila River provides an excellent example of a healthy desert riparian community where scattered cottonwood, willow, sycamore, and mesquite trees grow in dense thickets of water motie and arrow weed.

Duncan is one of two (2) incorporated communities within Greenlee County. There are an additional thirteen (13) unincorporated communities scattered across the County, with Franklin and Sheldon being the closest to Duncan. The majority of land within Duncan is privately held with the rest being State Land. Figure 4-12 provides a visual depiction of the land ownership within the Town.

The total 2020 population for Duncan was 771. Table 4-1 summarizes population estimates for Duncan and other Greenlee County communities in 10-year cycles beginning in 2000 and projecting through 2030.

Agriculture: Irrigation and farming were well established when the Duncan Post Office was created in 1883. Approximately, 10,000 acres is under irrigation which produces around 5,000 bales of cotton annually. Some of the other crops include: alfalfa, grains, potatoes, melons and chilies. The Duncan Valley became the heart of the cattle and farming area and exported meat and milk products, vegetables and wheat throughout the copper mining area of southeastern Arizona.

Mining/Manufacturing: According to the Arizona Office of Economic Opportunity⁷, the average labor force in 2021 was 311 with an unemployment rate of 1.0 percent. The major industries significant to the economy of Duncan include: Crop and Ranching Agriculture, Copper Mining, Retail Trade and Services, and Public Administration.

According to the 2004 update to the Town of Duncan General Plan⁸, which is currently undergoing an update, the first permanent communities in the Duncan area were established after the Civil War. The settlement of the Western U.S. and the opening of the copper mines in Clifton/Morenci pulled many people into the southeastern Arizona area.

A narrow-gauge railroad, the Arizona and New Mexico, was completed from Lordsburg in 1883 as well. The rail line was changed to standard gauge in the early 1900's and still serves the copper mine

⁷ Arizona Office of Economic Opportunity, URL at: <https://www.azcommerce.com/oeo/labor-market/>

⁸ Town of Duncan, 2004, *Town of Duncan Comprehensive Plan – 2004 Update*.

in Clifton/Morenci. Stage routes and freight hauling roads gradually developed into the current highway system of well-maintained two-lane roads between Duncan, Virden, Clifton/Morenci, and Safford.

Tourism:

The Town was most likely named after Sheriff James Duncan Smith, a director of the Arizona Copper Company, headquartered in Scotland. Duncan was officially incorporated on July 5, 1938. The first major expansion of the Town boundaries was the annexation of the Hunter Estates area, north of the Gila River, in 1974. The Babbitt Heights area was subdivided in 1980 and the Duncan Heights were annexed in 1983. The LDS Church area was also annexed in 1983. In 2010 the town started its own farmers market located at Centennial Park. Along with the historical buildings already in Duncan, ADOT relocated some historical markers to Duncan in 2011. The Sandra Day O’Conner walkway is a new addition to Duncan and was completed in May 2011.

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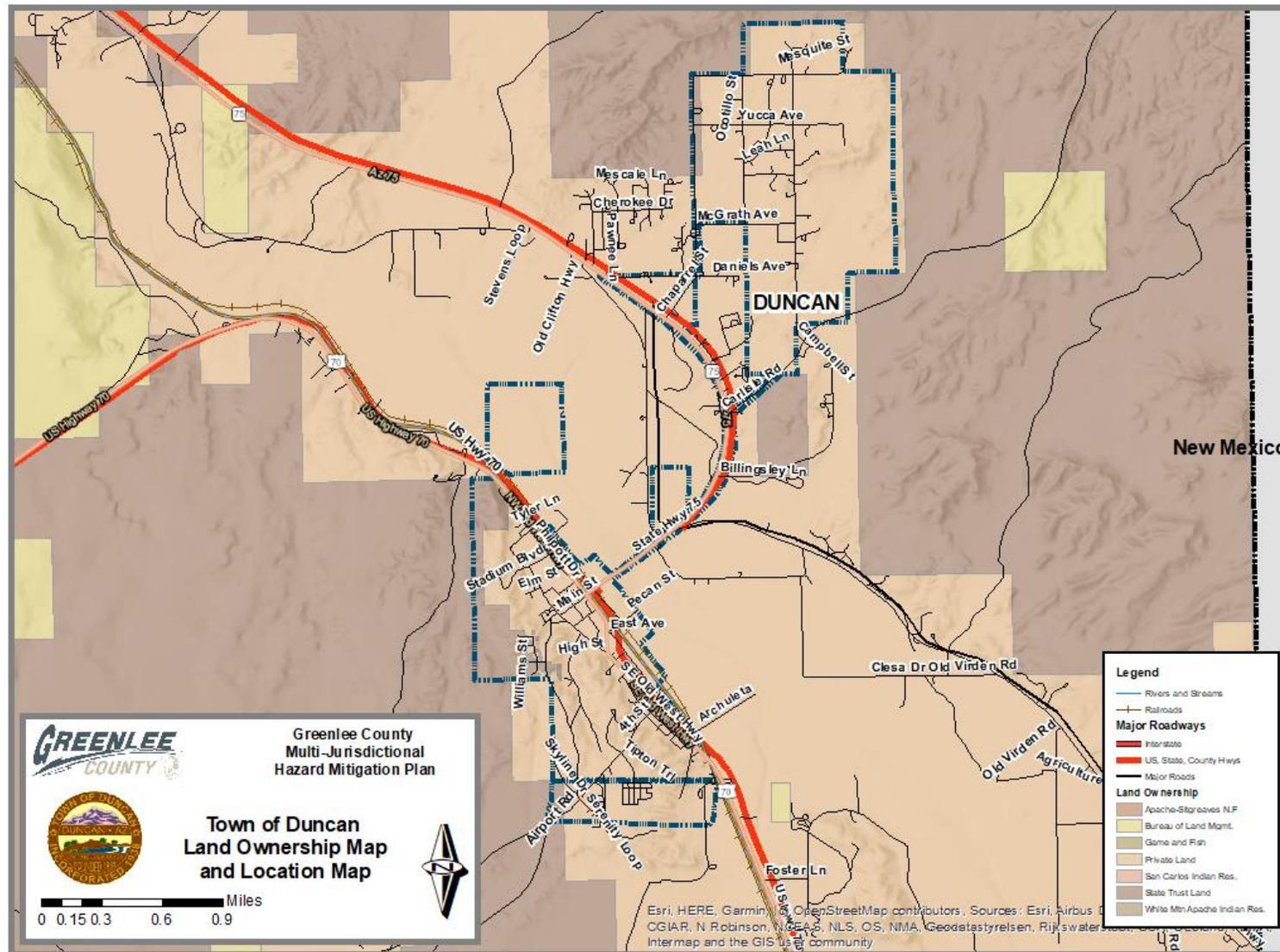


Figure 4-12: Town of Duncan Landownership and Location Map

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SECTION 5: RISK ASSESSMENT

§201.6(c)(2): [The plan shall include...] (2) A **risk assessment** that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards. The risk assessment shall include:

- (i) A description of the type, location, and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
- (ii) A description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. The plan should describe vulnerability in terms of:
 - (A) The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas;
 - (B) An estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate;
 - (C) Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.
- (iii) For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

One of the key elements to the hazard mitigation planning process is the risk assessment. In performing a risk assessment, a community determines “what” can occur, “when” (how often) it is likely to occur, and “how bad” the effects could be⁹. According to DMA 2000, the primary components of a risk assessment that answer these questions are generally categorized into the following measures:

- **Hazard Identification and Screening**
- **Hazard Profiling**
- **Assessing Vulnerability to Hazards**

The risk assessment for Greenlee County and participating jurisdictions was performed using a county-wide, multi-jurisdictional perspective, in cooperation with the Planning Team. This integrated approach was employed because many hazard events are likely to affect numerous jurisdictions within the County, and are not often relegated to a single jurisdictional boundary. The vulnerability analysis was performed in a way such that the results reflect vulnerability at an individual jurisdictional level, and at a countywide level.

5.1 Hazard Identification and Screening

Hazard identification is the process of answering the question; “*What hazards can and do occur in my community or jurisdiction?*” For this Plan, the list of hazards identified in the 2016 Plan were reviewed by the Planning Team with the goal of refining the list to reflect the hazards that pose the greatest risk to the jurisdictions represented by this Plan. The Planning Team also compared and contrasted the 2016 Plan list to the comprehensive hazard list summarized in the 2018 State Plan¹⁰ to ensure compatibility with the State Plan. Table 5-1 summarizes the 2016 Plan and 2018 State Plan hazard lists.

⁹ National Fire Protection Association, 2000, *Standard on Disaster/Emergency Management and Business Continuity Programs*, NFPA 1600.

¹⁰ ADEM, 2018, *State of Arizona Multi-Hazard Mitigation Plan*

| Table 5-1: Summary of initial hazard identification lists | |
|---|--|
| 2016 Greenlee County Plan Hazard List | 2018 State Plan Hazard List |
| <ul style="list-style-type: none"> • Drought • Flooding/Flash Flood • Levee Failure • Wildfires | <ul style="list-style-type: none"> • Dam Failure • Drought • Earthquake • Extreme Heat • Fissure • Flooding • HAZMAT • Infectious Disease • Landslides • Levee Failure • Severe Wind • Subsidence • Terrorism • Wildfires • Winter Storms |

The review included an initial screening process to evaluate each of the listed hazards based on the following considerations:

- Experiential knowledge on behalf of the Planning Team with regard to the relative risk associated with the hazard
- Documented historic context for damages and losses associated with past events (especially events that have occurred during the last plan cycle)
- The ability/desire of Planning Team to develop effective mitigation for the hazard under current DMA 2000 criteria
- Compatibility with the state hazard mitigation plan hazards
- Duplication of effects attributed to each hazard

One tool used in the initial screening process was the historic hazard database generated for the 2011 and 2016 Plans. With this update, the 2016 Plan database was reviewed and revised to separately summarize declared disaster events versus non-declared events. Declared event sources included Greenlee County Department of Emergency Management (GCDEM), Arizona Division of Emergency Management (ADEM), Federal Emergency Management Agency (FEMA), and United States Department of Agriculture (USDA). Non-declared sources included Arizona State Land Department (ASLD), National Weather Service (NWS), National Oceanic and Atmospheric Administration (NOAA), National Climatic Data Center (NCDC), United States Geological Survey (USGS), and United States Forest Service (USFS). Both data sets were updated with additional hazard events that have occurred over the last plan cycle. The declared events represent the period of February 1966 to 2021. The undeclared events were decided by the Planning Team to represent the past 35 years. Two tables are used in this update to summarize the historic hazard events. Tables 5-2 summarizes federal and state disaster declarations that included Greenlee County and Table 5-3 summarizes all non-declared hazard events specific to Greenlee County, that were considered to be a significant event to the jurisdiction(s) using the following selection criteria:

- 1 or more fatalities
- 1 or more injuries
- Any dollar amount in property or crop damages
- For wildfires, all the following must be met:
 - 100 acres or larger, and
 - Any reported amount for firefight costs, and
 - Any reported damages to structures
- A significant event to a community regardless of the above criteria

The following should be noted when reviewing Tables 5-2 and 5-3: 1) Hazard categories in all tables follow the updated hazard categories discussed in the following paragraphs; 2) If a hazard is not listed, that means there were no events reported for that hazard that fit the criteria above.

| Table 5-2: Human and Property Loss Estimates for State and Federally Declared Events That Included Greenlee County January 1966 to September 2021 | | | | |
|--|----------------------------|------------------------|-----------------|--------------------------|
| Hazard | No. of Declarations | Recorded Losses | | |
| | | Fatalities | Injuries | Damage Costs (\$) |
| Drought | 10 | 0 | 0 | \$303 million |
| Flooding / Flash Flooding | 16 | 48 | 1,187 | \$903 million |
| Wildfire | 16 | 0 | 0 | \$0 |
| Winter Storm | 1 | 0 | 0 | \$0 |
| Notes: - Damage Costs are reported as is and no attempt has been made to adjust costs to current dollar values. Sources: ADEM, FEMA, USDA, NCDC, AFMA | | | | |

| Table 5-3: Undeclared Historic Hazard Events for Greenlee County – December 1985 through November 2020 | | | | |
|--|-----------------------|------------------------|-----------------|--------------------------|
| Hazard | No. of Records | Recorded Losses | | |
| | | Fatalities | Injuries | Damage Costs (\$) |
| Flooding / Flash Flooding | 28 | 3 | 0 | \$363,000 |
| Severe Wind | 20 | 0 | 0 | \$139,500 |
| Wildfire | 20 | 0 | 16 | \$10.1 million |
| Notes: <ul style="list-style-type: none"> • Damage costs include property and crop/livestock losses and are reported as is with no attempt to adjust costs to current dollar values. Furthermore, wildfire damage cost do not include the cost of suppression which can be quite substantial. Sources: ADEM, NCDC, NWCG, NWS, USFS • No damages for drought reported. | | | | |

The culmination of the review and screening process by the Planning Team concluded that no changes will be made to the hazard list for this updated mitigation plan. Accordingly, the Planning Team has selected the following list of hazards for profiling and updating based on the above explanations and screening process. Revised and updated definitions for each hazard are provided in Section 5.3 and in Section 8.2:

- **Drought**
- **Flooding / Flash Flooding**
- **Levee Failure**
- **Wildfire**

5.2 Vulnerability Analysis Methodology

5.2.1 General

The following sections summarize the methodologies used to perform the vulnerability analysis portion of the risk assessment. For the purposes of this vulnerability analysis, hazard profile maps were developed for Levee Failure, Flooding/Flash Flooding, and Wildfire to map the geographic variability of the probability and magnitude risk of the hazards as estimated by the Planning Team. Hazard profile categories of HIGH, MEDIUM, and/or LOW were used and were subjectively assigned based on the factors discussed in the Probability and Magnitude sections below. Within the context of the county limits, the other hazards do not exhibit significant geographic variability and will not be categorized as such.

Unless otherwise specified in this Plan, the general cutoff date for new hazard profile data and jurisdictional corporate limits is the end of May 2021.

5.2.2 *Climate Change*

In recent years, FEMA and others have begun to take a harder look at the impacts of climate change on natural hazards and the mitigation planning process. In March 2016, FEMA released new state mitigation planning guidance that will require all state hazard mitigation plans to address climate change beginning with all updates submitted after March 2016¹¹. FEMA’s National Advisory Council noted that the effects of climate change could manifest as a “threat multiplier”. When considering probabilities of hazard events, it is typical to make the implicit assumption that the past is a prologue for the future; however, trending changes to climate related variables may require broader thinking and projections to develop mitigation actions and projects that account for those changes.

The scope and severity of cause and impacts relating to climate change are still difficult to predict and highly debated. There is, however, a growing body of science and research that indicates a few noticeable trends that should be considered when evaluating natural hazard vulnerability and risk. In 1989, the U.S. Global Change Research Program (USGCRP) was established by Presidential Initiative and later mandated by Congress in the Global Change Research Act of 1990 with the stated purpose of assisting “the Nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change.” In 2018, the USGCRP released the 4th National Climate Assessment (NCA), which is a comprehensive compilation of the latest body of work and science on the topic of climate change. The NCA results and discussion are divided into regions to focus the discussions and conclusions to a regional perspective. The Southwest region includes the states of Arizona, California, Colorado, Nevada, New Mexico, and Utah. According to Chapter 25 of the NCA¹², the Southwest regional climate change impacts noted in the recent research include increased heat, drought, and insect outbreaks that result in more wildfires, declining water supplies, reduced agricultural yields, health impacts in cities due to heat, and flooding and erosion in coastal areas. In its 2018 report, the NCA released the following “Key Messages” for the Southwest Region:

1. Water for people and nature in the Southwest has declined during droughts, due in part to human-caused climate change. Intensifying droughts and occasional large floods, combined with critical water demands from a growing population, deteriorating infrastructure, and groundwater depletion, suggest the need for flexible water management techniques that address changing risks over time, balancing declining supplies with greater demands.
2. The integrity of Southwest forests and other ecosystems and their ability to provide natural habitat, clean water, and economic livelihoods have declined as a result of recent droughts and wildfire due in part to human-caused climate change. Greenhouse gas emissions reductions, fire management, and other actions can help reduce future vulnerabilities of ecosystems and human well-being.
3. Many coastal resources in the Southwest have been affected by sea level rise, ocean warming, and reduced ocean oxygen—all impacts of human-caused climate change—and ocean acidification resulting from human emissions of carbon dioxide. Homes and other coastal infrastructure, marine flora and fauna, and people who depend on coastal resources face increased risks under continued climate change.

¹¹ FEMA, 2016, *State Mitigation Plan Review Guide*, released March 2016, effective March 2016, FP 302-094-2

¹² Gonzalez, P., G.M. Garfin, D.D. Breshears, K.M. Brooks, H.E. Brown, E.H. Elias, A. Gunasekara, N. Huntly, J.K. Maldonado, N.J. Mantua, H.G. Margolis, S. McAfee, B.R. Middleton, and B.H. Udall, 2018: Southwest. In *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II* [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 1101–1184. doi: 10.7930/NCA4.2018.CH25

4. Traditional foods, natural resource-based livelihoods, cultural resources, and spiritual well-being of Indigenous peoples in the Southwest are increasingly affected by drought, wildfire, and changing ocean conditions. Because future changes would further disrupt the ecosystems on which Indigenous peoples depend, tribes are implementing adaptation measures and emissions reduction actions.
5. The ability of hydropower and fossil fuel electricity generation to meet growing energy use in the Southwest is decreasing as a result of drought and rising temperatures. Many renewable energy sources offer increased electricity reliability, lower water intensity of energy generation, reduced greenhouse gas emissions, and new economic opportunities.
6. Food production in the Southwest is vulnerable to water shortages. Increased drought, heat waves, and reduction of winter chill hours can harm crops and livestock; exacerbate competition for water among agriculture, energy generation, and municipal uses; and increase future food insecurity.
7. Heat-associated deaths and illnesses, vulnerabilities to chronic disease, and other health risks to people in the Southwest result from increases in extreme heat, poor air quality, and conditions that foster pathogen growth and spread. Improving public health systems, community infrastructure, and personal health can reduce serious health risks under future climate change.

FEMA has established that future changes in probabilities and severity of hazard events influenced by climate change should be addressed during mitigation planning. Accordingly, a brief assessment of the potential effects that current climate change understanding may have on the Plan hazards is provided where appropriate in Section 5.3.

5.2.3 *Calculated Priority Risk Index (CPRI) Evaluation*

The first step in the vulnerability analysis (VA) is to assess the perceived overall risk for each of the plan hazards using a tool developed by the State of Arizona called the Calculated Priority Risk Index¹³ (CPRI). The CPRI value is obtained by assigning varying degrees of risk to four (4) categories for each hazard, and then calculating an index value based on a weighting scheme. Table 5-4 summarizes the CPRI risk categories and provides guidance regarding the assignment of values and weighting factors for each category.

As an example, assume that the project team is assessing the hazard of flooding, and has decided that the following assignments best describe the flooding hazard for their community:

- Probability = Likely
- Magnitude/Severity = Critical
- Warning Time = 12 to 24 hours
- Duration = Less than 6 hours

The CPRI for the flooding hazard would then be:

$$\text{CPRI} = [(3 \times 0.45) + (3 \times 0.30) + (2 \times 0.15) + (1 \times 0.10)]$$

$$\text{CPRI} = 2.65$$

5.2.4 *Asset Inventory*

A detailed asset inventory was performed for the 2016 Plan to establish a fairly accurate baseline data-set for assessing the vulnerability of each jurisdiction's assets to the hazards previously

¹³ ADEM, 2003, *Arizona Model Local Hazard Mitigation Plan*, prepared by JE Fuller/ Hydrology & Geomorphology, Inc.

identified. The asset inventory from the 2016 Plan was reviewed and updated by the Planning Team to reflect the facilities and infrastructure most important to the participating jurisdictions.

For the purposes of this Plan, assets are defined as:

Any natural or human-caused feature that has value, including, but not limited to people; buildings; infrastructure like bridges, roads, and sewer and water systems; lifelines like electricity and communication resources; or environmental, cultural, or recreational features like parks, dunes, wetlands, or landmarks.

The 2016 Plan asset inventory database was generally categorized into critical and non-critical categories. The working definition for **Critical facilities and infrastructure**, adopted for the 2016 Plan and continuing with this Plan is as follows:

Systems, structures and infrastructure within a community whose incapacity or destruction would:

- *Have a debilitating impact on the defense or economic security of that community.*
- *Significantly hinder a community's ability to recover following a disaster.*

Following the criteria set forth by the Critical Infrastructure Assurance Office (CIAO), the State of Arizona has adopted eight general categories¹⁴ that define critical facilities and infrastructure:

1. **Communications Infrastructure:** Telephone, cell phone, data services, radio towers, and internet communications, which have become essential to continuity of business, industry, government, and military operations.
2. **Electrical Power Systems:** Generation stations and transmission and distribution networks that create and supply electricity to end-users. **Gas and Oil Facilities:** Production and holding facilities for natural gas, crude and refined petroleum, and petroleum-derived fuels, as well as the refining and processing facilities for these fuels.
3. **Banking and Finance Institutions:** Banks, financial service companies, payment systems, investment companies, and securities/commodities exchanges.
4. **Transportation Networks:** Highways, railroads, ports and inland waterways, pipelines, and airports and airways that facilitate the efficient movement of goods and people.
5. **Water Supply Systems:** Sources of water; reservoirs and holding facilities; aqueducts and other transport systems; filtration, cleaning, and treatment systems; pipelines; cooling systems; and other delivery mechanisms that provide for domestic and industrial applications, including systems for dealing with water runoff, wastewater, and firefighting.
6. **Government Services:** Capabilities at the federal, state, and local levels of government required to meet the needs for essential services to the public.
7. **Emergency Services:** Medical, police, fire, and rescue systems.

¹⁴ Instituted via Executive Order 13010, which was signed by President Clinton in 1996.

Table 5-4: Summary of Calculated Priority Risk Index (CPRI) categories and risk levels

| CPRI Category | Degree of Risk | | | Assigned Weighting Factor |
|------------------------|--------------------|---|-------------|---------------------------|
| | Level ID | Description | Index Value | |
| Probability | Unlikely | <ul style="list-style-type: none"> ■ Extremely rare with no documented history of occurrences or events. ■ Annual probability of less than 0.001. | 1 | 45% |
| | Possible | <ul style="list-style-type: none"> ■ Rare occurrences with at least one documented or anecdotal historic event. ■ Annual probability that is between 0.01 and 0.001. | 2 | |
| | Likely | <ul style="list-style-type: none"> ■ Occasional occurrences with at least two or more documented historic events. ■ Annual probability that is between 0.1 and 0.01. | 3 | |
| | Highly Likely | <ul style="list-style-type: none"> ■ Frequent events with a well documented history of occurrence. ■ Annual probability that is greater than 0.1. | 4 | |
| Magnitude/ Severity | Negligible | <ul style="list-style-type: none"> ■ Negligible property damages (less than 5% of critical and non-critical facilities and infrastructure). ■ Injuries or illnesses are treatable with first aid and there are no deaths. ■ Negligible quality of life lost. ■ Shut down of critical facilities for less than 24 hours. | 1 | 30% |
| | Limited | <ul style="list-style-type: none"> ■ Slight property damages (greater than 5% and less than 25% of critical and non-critical facilities and infrastructure). ■ Injuries or illnesses do not result in permanent disability and there are no deaths. ■ Moderate quality of life lost. ■ Shut down of critical facilities for more than 1 day and less than 1 week. | 2 | |
| | Critical | <ul style="list-style-type: none"> ■ Moderate property damages (greater than 25% and less than 50% of critical and non-critical facilities and infrastructure). ■ Injuries or illnesses result in permanent disability and at least one death. ■ Shut down of critical facilities for more than 1 week and less than 1 month. | 3 | |
| | Catastrophic | <ul style="list-style-type: none"> ■ Severe property damages (greater than 50% of critical and non-critical facilities and infrastructure). ■ Injuries or illnesses result in permanent disability and multiple deaths. ■ Shut down of critical facilities for more than 1 month. | 4 | |
| Warning Time | Less than 6 hours | Self explanatory. | 4 | 15% |
| | 6 to 12 hours | Self explanatory. | 3 | |
| | 12 to 24 hours | Self explanatory. | 2 | |
| | More than 24 hours | Self explanatory. | 1 | |
| Duration | Less than 6 hours | Self explanatory. | 1 | 10% |
| | Less than 24 hours | Self explanatory. | 2 | |
| | Less than one week | Self explanatory. | 3 | |
| | More than one week | Self explanatory. | 4 | |

Other assets such as public libraries, schools, businesses, museums, parks, recreational facilities, historic buildings or sites, churches, residential and/or commercial subdivisions, apartment complexes, and so forth, are typically not classified as critical facilities and infrastructure unless they serve a secondary function to the community during a disaster emergency (e.g. - emergency housing or evacuation centers). As a part of the update process, each community was tasked with determining which of the previously identified “non-critical” assets, if any, were deemed critical by the community. The remaining “non-critical” assets were deleted from the database. New facilities were also added as appropriate and available. Each community was also tasked with making any needed changes to the geographic position, revision of asset names, updating replacement costs, etc. to bring the dataset into a current condition. The updated asset inventory is attributed with a descriptive name, physical address, geospatial position, and an estimated building/structure and contents replacement cost for each entry to the greatest extent possible and entered into a GIS geodatabase.

The 2016 Plan used a combination of tools for the geodatabase update, which included GIS data sets, on-line mapping utilities, insurance pool information, county assessors data, and manual data acquisition. This process was followed for the current Plan update effort. Table 5-5 summarizes the facility counts provided by each of the participating jurisdictions in this Plan.

It should be noted that the facility counts summarized in Table 5-5 do not represent a comprehensive inventory of all the category facilities that exist within the county. They do represent the facilities inventoried to-date by each jurisdiction and are considered to be a work-in-progress that is to be expanded and augmented with each Plan cycle.

Table 5-5: Asset inventory structure counts by category and jurisdiction as of December 2010

| | Communications Infrastructure | Electrical Power Systems | Gas and Oil Facilities | Banking and Finance Institutions | Transportation Networks | Water Supply Systems | Government Services | Emergency Services | Educational ^a | Cultural ^a | Business ^a | Flood Control ^a | Residential ^a | Recreational ^a |
|--------------------------------|-------------------------------|--------------------------|------------------------|----------------------------------|-------------------------|----------------------|---------------------|--------------------|--------------------------|-----------------------|-----------------------|----------------------------|--------------------------|---------------------------|
| County-Wide Totals | 13 | 6 | 1 | 2 | 36 | 23 | 8 | 12 | 9 | 24 | 18 | 1 | 0 | 3 |
| Clifton | 5 | 2 | 1 | 0 | 14 | 11 | 1 | 5 | 1 | 11 | 8 | 1 | 0 | 2 |
| Duncan | 2 | 2 | 0 | 1 | 2 | 7 | 2 | 3 | 5 | 12 | 7 | 0 | 0 | 1 |
| Unincorporated Greenlee County | 6 | 2 | 0 | 1 | 20 | 5 | 5 | 4 | 3 | 1 | 3 | 0 | 0 | 0 |

NOTES: a – Assets listed under these categories have been determined to be critical per the definition of this Plan by the corresponding jurisdiction .

5.2.5 Loss Estimations

Economic loss and/or human and structural exposure estimates for each of the final hazards identified in Section 5.1 begins with an assessment of the potential exposure of asset inventory structures and human populations to those hazards. Exposure estimates of asset inventory structures identified by each jurisdiction is accomplished by intersecting the asset inventory with the hazard profiles in Section 5.3. Human or population exposures are estimated by intersecting the same hazards with the 2010 block

level Census Data population statistics that have been re-organized into GIS compatible databases and distributed with HAZUS[®]-MH (HAZUS).

Additional exposure estimates for general residential, commercial, and industrial building stock not specifically identified with the asset inventory, are also accomplished using the HAZUS general building stock database, wherein the developers of the HAZUS database have made attempts to correlate building/structure counts to census block data. *It is duly noted that the HAZUS data population statistics may not exactly equate to the current population statistics provided in Section 4.2 due to actual changes in population counts associated with a particular census block, GIS positioning anomalies and the way HAZUS depicts certain census block data. It is also noted that the residential, commercial and industrial building stock estimates for each census block may severely under-predict the actual buildings present due to the substantial growth in the last decade, the general lack of commercial and industrial data for some of the more rural communities and counties, and the disparity of the HAZUS replacement cost estimates for these categories when compared to current market rates. However, without a detailed, site specific structure inventory of these types of buildings, the HAZUS database is still the best available and the results are representative of a general magnitude of population and residential, commercial and industrial facility exposures to the various hazards discussed.* Combining the exposure results from the asset inventory and the HAZUS database provides a fairly comprehensive depiction of the overall exposure of building stock and the two datasets are considered complimentary and not redundant.

Economic losses to structures and facilities are estimated by multiplying the exposed facility replacement cost estimates by an assumed loss to exposure ratio for the hazard. Structure replacement costs were estimated using various means including: accessor's data, insured value, recent construction unit cost per square foot of building, or in some cases, an order of magnitude assumption based on the planner's judgment. The ultimate replacement cost for each facility or location includes the structure replacement cost plus an additional of 50% of the structure cost to account for contents. The loss to exposure ratios used in this plan update are summarized by hazard in Section 5.3. It is important to note that the loss to exposure ratios are subjective and the estimates are solely intended to provide an understanding of relative risk from the hazards and potential losses. Real uncertainties are inherent in any loss estimation methodology due to:

- Incomplete scientific knowledge concerning hazards and our ability to predict their effects on the built environment;
- Approximations and simplifications that are necessary for a comprehensive analysis; and,
- Lack of detailed data necessary to implement a viable statistical approach to loss estimations.

Several of the hazards profiled in this Plan will not include quantitative exposure and/or loss estimates. The vulnerability of people and assets associated with some hazards are nearly impossible to evaluate given the uncertainty associated with where these hazards will occur as well as the relatively limited focus and extent of damage. Instead, a qualitative review of vulnerability will be discussed to provide insight to the nature of losses that are associated with the hazard. For subsequent updates of this Plan, the data needed to evaluate these unpredictable hazards may become refined such that comprehensive vulnerability statements and thorough loss estimates can be made.

5.2.6 *Development Trend Analysis*

The 2016 Plan development trend analysis will require updating to reflect growth and changes in Greenlee County and jurisdiction boundaries over the last planning cycle. The updated analysis will focus on the potential risk associated with projected growth patterns and their intersection with the Plan identified hazards.

5.3 Hazard Risk Profiles

The following sections summarize the risk profiles for each of the Plan hazards identified in Section 5.1. For each hazard, the following elements are addressed to present the overall risk profile:

- **Description**
- **History**

- **Probability and Magnitude**
- **Climate Change Impacts**
- **Vulnerability**
 - **CPRI Results**
 - **Loss/Exposure Estimations**
 - **Development Trend Analysis**
- **Sources**
- **Profile Maps (if applicable)**

Much of the 2016 Plan data has been updated, incorporated and/or revised to reflect current conditions and planning team changes, as well as few small changes to the plan format. County-wide and jurisdiction specific profile maps are provided at the end of the section (if applicable) and the maps are not included in the page count.

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5.3.1 Drought

Description

Drought is a normal part of virtually every climate on the planet, including areas of high and low rainfall. It is different from normal aridity, which is a permanent characteristic of the climate in areas of low rainfall. Drought is the result of a natural decline in the expected precipitation over an extended period of time, typically one or more seasons in length. The severity of drought can be aggravated by other climatic factors, such as prolonged high winds and low relative humidity (FEMA, 1997).

Drought is a complex natural hazard which is reflected in the following four definitions commonly used to describe it:

- Meteorological – drought is defined solely on the degree of dryness, expressed as a departure of actual precipitation from an expected average or normal amount based on monthly, seasonal, or annual time scales.
- Hydrological – drought is related to the effects of precipitation shortfalls on streamflows and reservoir, lake, and groundwater levels.
- Agricultural – drought is defined principally in terms of naturally occurring soil moisture deficiencies relative to water demands of plant life, usually arid crops.
- Socioeconomic – drought associates the supply and demand of economic goods or services with elements of meteorological, hydrologic, and agricultural drought. Socioeconomic drought occurs when the demand for water exceeds the supply as a result of weather-related supply shortfall. It may also be called a water management drought.

A drought's severity depends on numerous factors, including duration, intensity, and geographic extent as well as regional water supply demands by humans and vegetation. Due to its multi-dimensional nature, drought is difficult to define in exact terms and also poses difficulties in terms of comprehensive risk assessments.

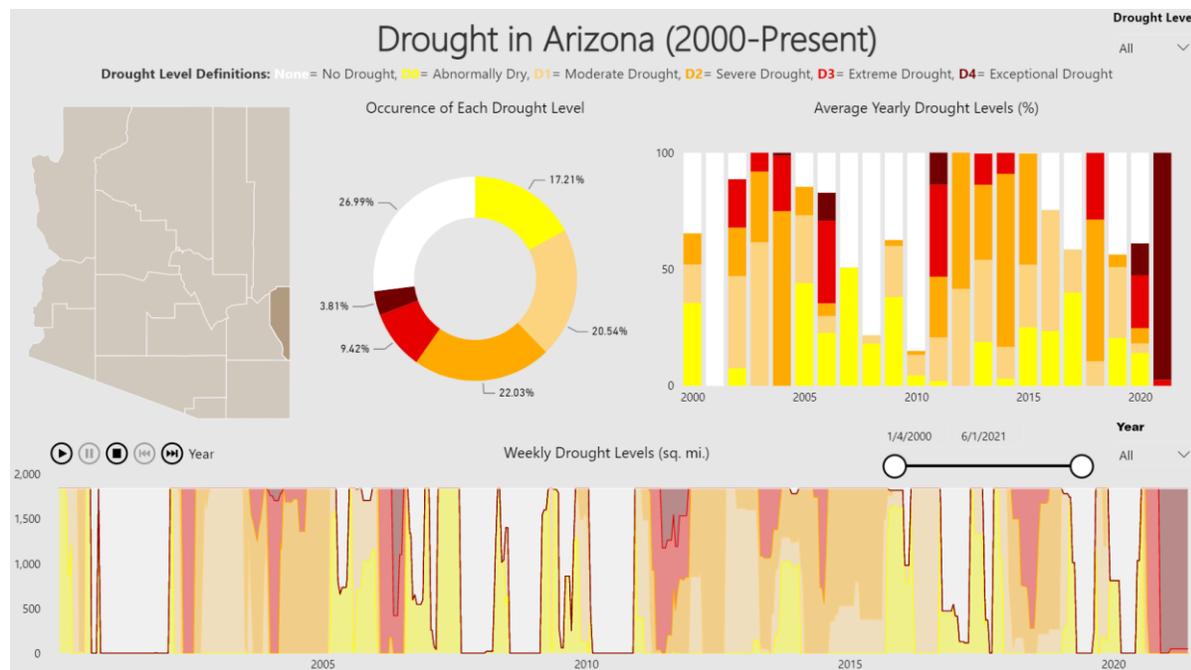
Drought differs from other natural hazards in three ways. First, the onset and end of a drought are difficult to determine due to the slow accumulation and lingering effects of an event after its apparent end. Second, the lack of an exact and universally accepted definition adds to the confusion of its existence and severity. Third, in contrast with other natural hazards, the impact of drought is less obvious and may be spread over a larger geographic area. These characteristics have hindered the preparation of drought contingency or mitigation plans by many governments.

Droughts may cause a shortage of water for human and industrial consumption, hydroelectric power, recreation, and navigation. Water quality may also decline and the number and severity of wildfires may increase. Severe droughts may result in the loss of agricultural crops and forest products, undernourished wildlife and livestock, lower land values, and higher unemployment.

History

Beginning in June 1999, Arizona has been under a continuous Gubernatorial declared drought emergency for 31 years. Over the past plan cycle (2016-2021), Greenlee County has been included as a primary county in USDA Secretarial drought disaster declarations for crop years 2017, 2018, 2019, 2020, and 2021. Figures 5-2 and 5-3 depict recent precipitation data from NCDC regarding average statewide precipitation variances from normal. Between 1849 and 1905, the most prolonged period of drought conditions in 300 years occurred in Arizona (Jacobs, 2003). Another prolonged drought occurred during the period of 1941 to 1965. The period from 1978-1997 appears to have been anomalously wet, while the rest of the historical records shows that dry conditions are most likely the normal condition for Arizona. Between 2009 and 2014, there have been more months with below normal precipitation than months with above normal precipitation.

According to the Arizona Department of Water Resources' Drought Dashboard illustrated in Figure 5-1, Greenlee County has experienced varying degrees of drought, with recent conditions worsening due to a lack of summer monsoon activity.



Source: <https://new.azwater.gov/drought/drought-dashboard>

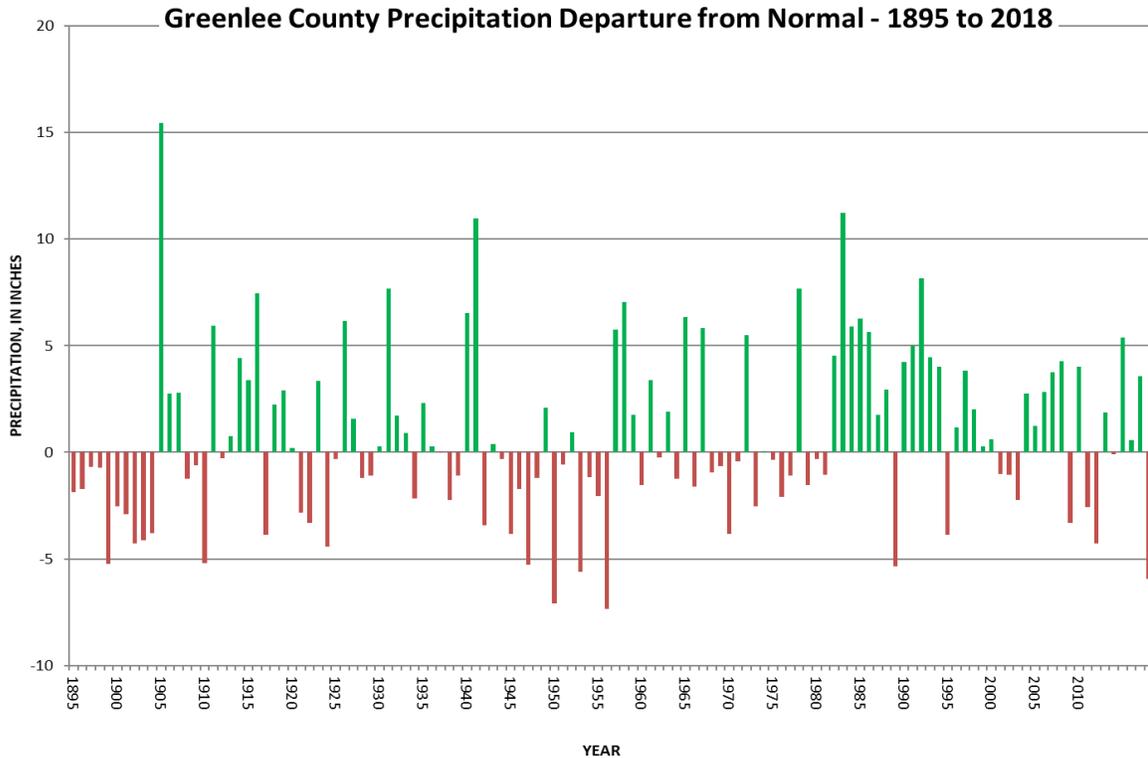
Figure 5-1: Drought in Greenlee County from 2000 to Present

Probability and Magnitude

There is no commonly accepted return period or non-exceedance probability for defining the risk from drought (such as the 100-year or 1% annual chance of flood). The magnitude of drought is usually measured in time and the severity of the hydrologic deficit. There are several resources available to evaluate drought status and even project expected conditions for the very near future.

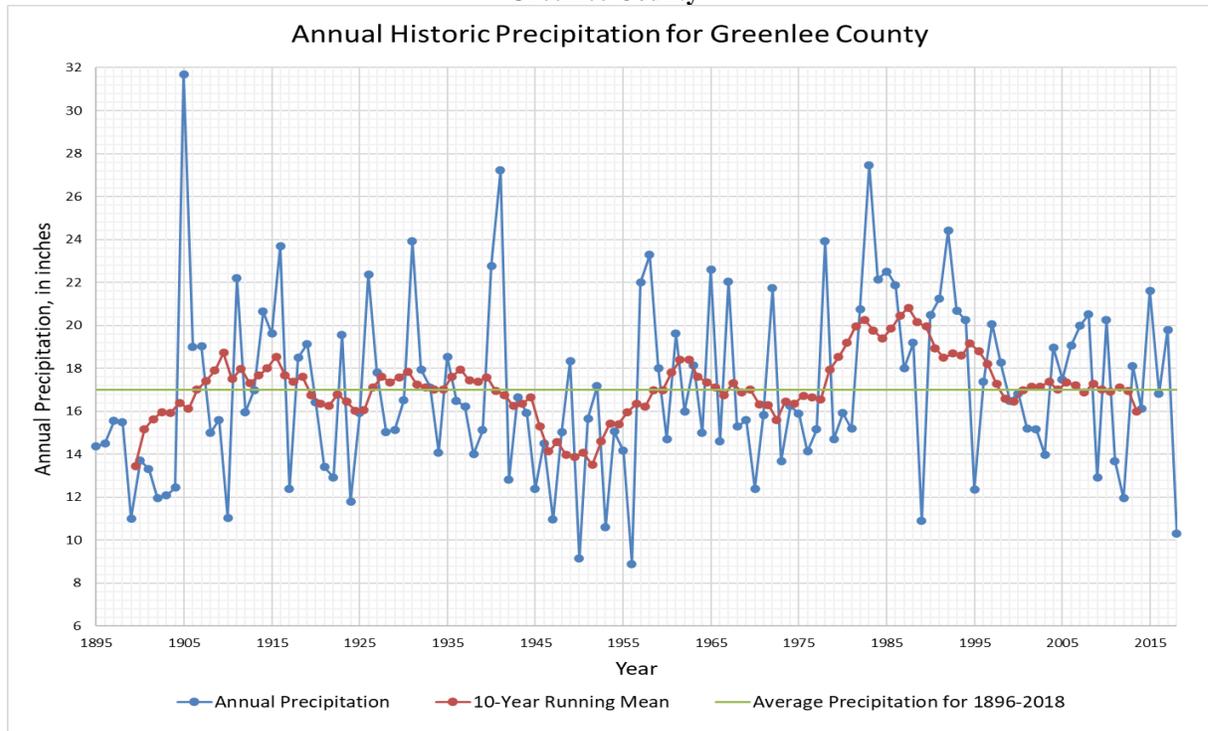
The National Integrated Drought Information System (NIDIS) Act of 2006 (Public Law 109-430) prescribes an interagency approach for drought monitoring, forecasting, and early warning (NIDIS, 2007). The NIDIS maintains the U.S. Drought Portal¹⁵ which is a centralized, web-based access point to several drought related resources including the U.S. Drought Monitor (USDM) and the U.S. Seasonal Drought Outlook (USSDO). The USDM, shown in Figure 5-3, is a weekly map depicting the current status of drought and is developed and maintained by the National Drought Mitigation Center. The USSDO, shown in Figure 5-4, is a six-month projection of potential drought conditions developed by the National Weather Service’s Climate Prediction Center. The primary indicators for these maps for the Western U.S. are the Palmer Hydrologic Drought Index and the 60-month Palmer Z-index. The Palmer Drought Severity Index (PSDI) is a commonly used index that measures the severity of drought for agriculture and water resource management. It is calculated from observed temperature and precipitation values and estimates soil moisture. However, the Palmer Index is not considered to be consistent enough to characterize the risk of drought on a nationwide basis (FEMA, 1997) and neither of the Palmer indices are well suited to the dry, mountainous western United States.

¹⁵ NIDIS U.S. Drought Portal website is located at: <https://www.drought.gov/drought/>



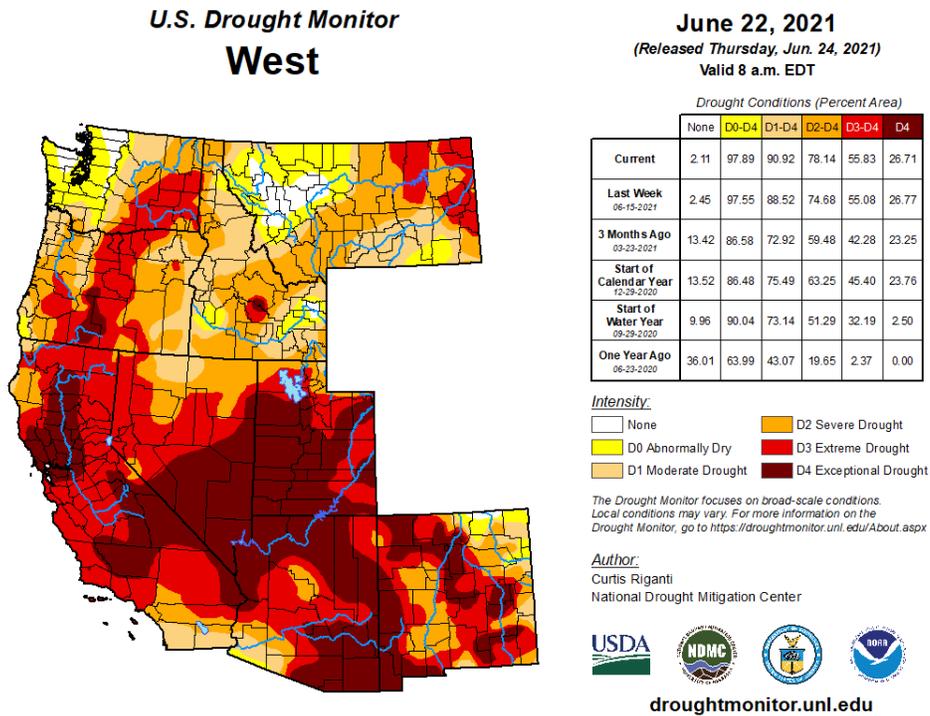
Source: <http://cefa.dri.edu/Westmap/westmappass.php>

Figure 5-2: Average annual precipitation variances from a normal based on 1895-2018 period for Greenlee County



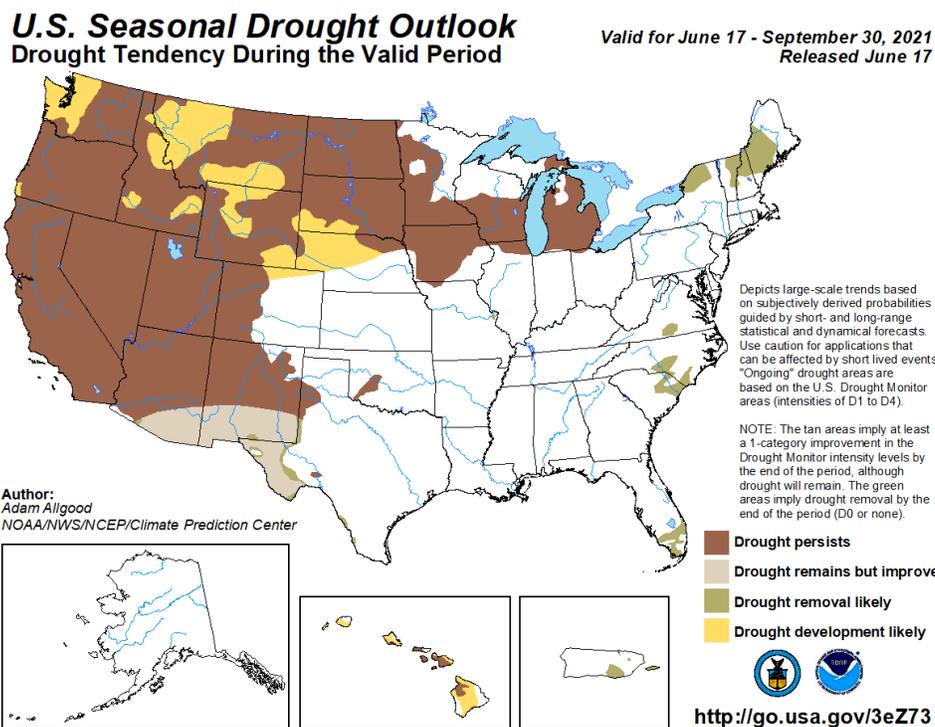
Source: <http://cefa.dri.edu/Westmap/westmappass.php>

Figure 5-3: Annual historic precipitation for Greenlee County from 1895 to 2018



Source: <https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?West>

Figure 5-4: U.S. Drought Monitor Map for June 22, 2021

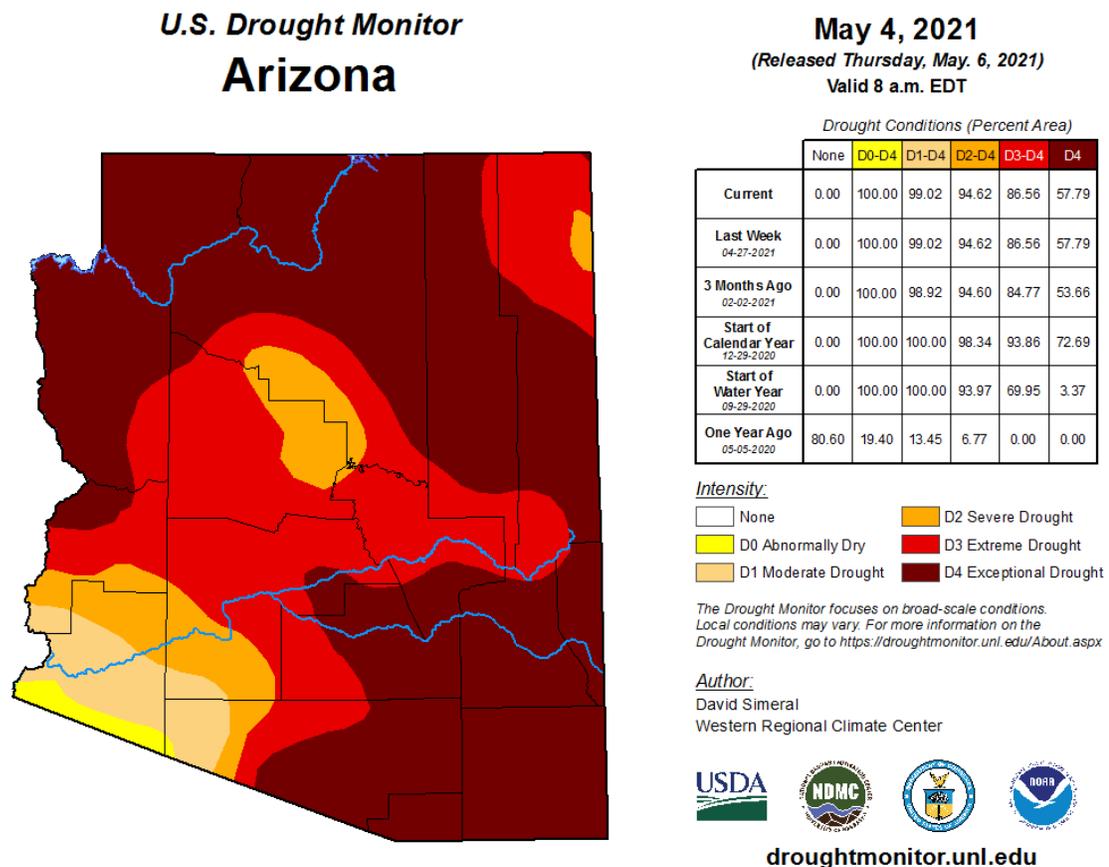


Source: http://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php

Figure 5-5: U.S. Seasonal Drought Outlook, June to September, 2021

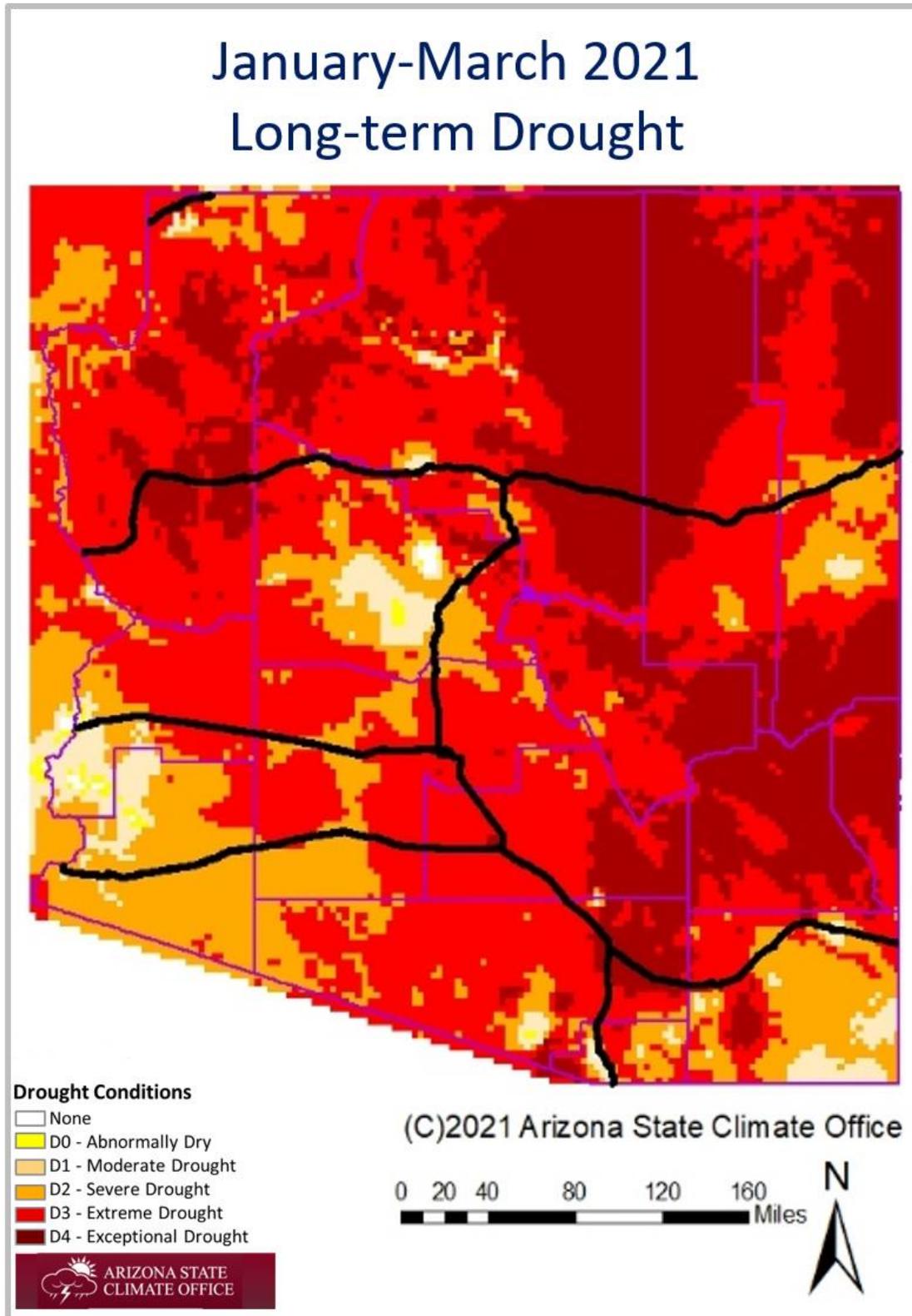
In 2003, Governor Janet Napolitano created the Arizona Drought Task Force (ADTF), led by ADWR, which developed a statewide drought plan. The plan includes criteria for determining both short and long-term drought status for each of the 15 major watersheds in the state using assessments that are based on precipitation and stream flow. The plan also provides the framework for an interagency group which reports to the governor on drought status, in addition to local drought impact groups in each county and the State Drought Monitoring Technical Committee. Twice a year this interagency group reports to the governor on the drought status and the potential need for drought declarations. The counties use the monthly drought status reports to implement drought actions within their drought plans. The State Drought Monitoring Technical Committee defers to the USDM for the short-term drought status and uses a combination of the Standardized Precipitation Index (SPI), evaporation and streamflow for the long-term drought status. Figures 5-6 and 5-7, present the most current short- and long-term maps available for Arizona as of the writing of this plan.

The current drought maps are in general agreement that Greenlee County is currently experiencing a moderate to severe drought condition for the short term and long term forecasts. Figure 5-5 indicates that the drought conditions are likely to persist and possibly improve for Greenlee County over the next few months.



Source: <https://new.azwater.gov/drought/drought-status>

Figure 5-6: Arizona short term drought status map as of May 4, 2021



Source: ADWR, 2021 as accessed at: <https://new.azwater.gov/drought/drought-status>

Figure 5-7: Arizona long term drought status map for January 2021

Vulnerability – CPRI Results

Drought CPRI results for each community are summarized in Table 5-6 below.

Table 5-6: CPRI results by jurisdiction for drought

| Participating Jurisdiction | Probability | Magnitude/ Severity | Warning Time | Duration | CPRI Score |
|-----------------------------------|--------------------|--------------------------------|-------------------------|-----------------|-----------------------|
| Clifton | Highly Likely | Limited | > 24 hours | > 1 week | 2.95 |
| Duncan | Highly Likely | Limited | > 24 hours | > 1 week | 2.95 |
| Unincorporated Greenlee County | Highly Likely | Limited | > 24 hours | > 1 week | 2.95 |
| County-wide average CPRI = | | | | | 2.95 |

Vulnerability – Loss Estimations

No standardized methodology exists for estimating losses due to drought and drought does not generally have a direct impact on critical facilities and building stock. A direct correlation to loss of human life due to drought is improbable for Greenlee County. Instead, drought vulnerability is primarily measured by its potential impact to certain sectors of the County economy and natural resources including:

- Crop and livestock agriculture
- Municipal and industrial water supply
- Recreation/tourism
- Wildlife and wildlife habitat

The Greenlee County farming and ranching industries are directly affected by extended drought conditions. The primary sources of water for irrigated farming are the San Francisco and Gila Rivers, including groundwater that is sustained by these watercourses along the valley floor. Rangeland ranching is dependent upon groundwater and captured rainfall runoff via stock tanks and rain catchments. Extended drought conditions reduce rangeland grasses and other fodder. Stock tank water levels and replenishment are also significantly reduced. This forces ranchers to feed more hay and to truck in water to sustain their rangeland herds. The expense of these activities forces ranchers to drastically reduce herd sizes, flooding the markets with excess animals and tumbling livestock prices. Then supplies in following years are drastically reduced due to lack of rangeland and water and prices soar. These expenses are translated into the Greenlee County economy as a two-fold hardship. First, as an economic hardship for merchants and retailers that provide goods and services to the ranching community. Second, as increased costs due to a reduced supply in ranching commodities.

From 1995 to 2020, Greenlee County farmers and ranchers received approximately \$3.3 million in disaster related assistance funding from the U.S Department of Agriculture (USDA) (EWG, 2021), with nearly half of that amount (\$1.2 million) being received in 2014 which was primarily due to the impacts of the Wallow Fire. The majority of those funds were received during the time period of 2000 to 2014 and are associated with livestock assistance and aid. The 2000-2014 time period also corresponds to the most severe period of the recent drought cycle for Greenlee County. Other direct impacts associated with increased pumping costs due to lowering of groundwater levels and costs to expand water infrastructure to compensate for reduced yields or to develop alternative water sources, are significant but very difficult to estimate due to a lack of documentation. There are also the intangible costs associated with lost tourism revenues, and impacts to wildlife habitat and animals. Typically, these impacts are translated into the general economy in the form of higher food and agricultural goods prices and increased utility costs.

Sustained drought conditions will also have secondary impacts by increasing risks associated with hazards such as fissures, flooding, subsidence and wildfire. Extended drought may weaken and dry the grasses, shrubs, and trees of wildfire areas, making them more susceptible to ignition. Drought also tends to reduce the vegetative cover in watersheds, and hence decrease the interception of rainfall and increase the flooding hazard. Subsidence and fissure conditions are aggravated when lean surface water supplies force the pumping of more groundwater to supply the demand without the benefit of recharge from normal rainfall.

Vulnerability – Development Trends

Growth in Greenlee County over the past five years has been very small and is not anticipated to increase significantly over the next five years. Requirements for additional surface and ground water supplies is therefore expected to be minimal. It is also unlikely that significant growth will occur in the ranching and farming sectors given the current constraints on water rights, grazing rights, and available range land. However, drought planning should be a critical component of any domestic water system expansions or land development planning. The ADTF is also working cooperatively with water providers within the State to develop System Water Plans that are comprised of three components:

- *Water Supply Plan* – describes the service area, transmission facilities, monthly system production data, historic demand for the past five years, and projected demands for the next five, 10 and 20 years.
- *Drought Preparedness Plan* – includes drought and emergency response strategies, a plan of action to respond to water shortage conditions, and provisions to educate and inform the public.
- *Water Conservation Plan* – addresses measures to control lost and unaccounted for water, considers water rate structures that encourage efficient use of water, and plans for public information and education programs on water conservation.

The combination of these requirements will work to ensure that future development in Greenlee County will recognize drought as a potential constraint.

Changes in Development in the Hazard Prone Area

Growth in Greenlee County over the past 5 years has been minimal and is not anticipated to increase significantly over the next five years. Requirements for additional surface and ground water supplies are therefore expected to be minimal. It is also unlikely that significant growth will occur in the ranching and farming sectors given the current constraints on water rights. There are no significant changes in the Towns of Clifton and Duncan or in the unincorporated area of Greenlee County that affect their exposure to drought.

Sources

Arizona Department of Water Resources, 2020, <https://new.azwater.gov/drought>

Arizona Department of Water Resources, 2019, *2019 Arizona Drought Preparedness Annual Report*

Arizona Department of Emergency and Military Affairs, 2018, *State of Arizona Multi-Hazard Mitigation Plan, 2018 Update.*

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http://farm.ewg.org/progdetail.php?fips=04013&progcode=total_dis

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National Integrated Drought Information System, 2016, *National Integrated Drought Information System Implementation Plan*, NOAA.

U.S. Department of Agriculture, 2020, <http://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/index>

Profile Maps - No profile maps are provided.

5.3.2 *Flood / Flash Flood*

Description

For the purpose of this Plan, the hazard of flooding addressed in this section will pertain to floods that result from precipitation/runoff related events. Other flooding due to dam or levee failures are addressed separately. The three seasonal atmospheric events that tend to trigger floods in Greenlee County are:

- *Tropical Storm Remnants:* Some of the worst flooding tends to occur when the remnants of a hurricane that has been downgraded to a tropical storm or tropical depression enter the State. These events occur infrequently and mostly in the early autumn, and usually bring heavy and intense precipitation over large regions causing severe flooding.
- *Winter Rains:* Winter brings the threat of low intensity; but long duration rains covering large areas that cause extensive flooding and erosion, particularly when combined with snowmelt.
- *Summer Monsoons:* A third atmospheric condition that brings flooding to Arizona is the annual summer monsoon. In mid to late summer the monsoon winds bring humid subtropical air into the State. Solar heating triggers afternoon and evening thunderstorms that can produce extremely intense, short duration bursts of rainfall. The thunderstorm rains are mostly translated into runoff and in some instances, the accumulation of runoff occurs very quickly resulting in a rapidly moving flood wave referred to as a flash flood. Flash floods tend to be very localized and cause significant flooding of local watercourses.

Damaging floods in the County include riverine, sheet, alluvial fan, and local area flooding. Riverine flooding occurs along established watercourses when the bankfull capacity of a watercourse is exceeded by storm runoff or snowmelt and the overbank areas become inundated. Sheet flooding occurs in regionally low areas with little topographic relief that generate floodplains over a mile wide, Alluvial fan flooding is generally located on piedmont areas near the base of the local mountains and are characterized by multiple, highly unstable flowpaths that can rapidly change during flooding events. Local area flooding is often the result of poorly designed or planned development wherein natural flowpaths are altered, blocked or obliterated, and localized ponding and conveyance problems result. Erosion is also often associated with damages due to flooding.

Another major flood hazard comes as a secondary impact of wildfires in the form of dramatically increased runoff from ordinary rainfall events that occur on newly burned watersheds. Denuding of the vegetative canopy and forest floor vegetation, and development of hydrophobic soils are the primary factors that contribute to the increased runoff. Canopy and floor level brushes and grasses intercept and store a significant volume of rainfall during a storm event. They also add to the overall watershed roughness which generally attenuates the ultimate peak discharges. Soils in a wildfire burn area can be rendered hydrophobic, which according the NRCS is the development of a thin layer of nearly impervious soil at or below the mineral soil surface that is the result of a waxy substance derived from plant material burned during a hot fire. The waxy substance penetrates into the soil as a gas and solidifies after it cools, forming a waxy coating around soil particles. Hydrophobic soils, in combination with a denuded watershed, will significantly increase the runoff potential, turning a routine annual rainfall event into a raging flood with drastically increased potential for soil erosion and mud and debris flows.

History

Flooding is clearly a major hazard in Greenlee County as shown in Tables 5-2 and 5-3. Greenlee County has been part of 10 federal disaster declarations for flooding, with the most recent declaration occurring in 2010. There has been at least one other non-declared flooding incident that met the thresholds outlined in Section 5.1, in the last five years. The following incidents represent examples of major flooding that has impacted the County:

- In October 1972, severe flooding occurred in Graham and Greenlee County with Clifton, Safford and Duncan being hit the hardest. Tropical moisture caused heavy rain over most of

the state. The ground was already saturated from tropical storm Joanne earlier in the month. The heaviest flooding occurred along the San Francisco and Gila Rivers, with the Towns of Clifton and Duncan suffering extremely heavy losses due to flooding. Nearly \$8 million in property damage occurred, with most of this in Graham and Greenlee counties. Agricultural losses in Greenlee County totaled \$2 million and some deaths were caused by drowning (NWS, 2011).

- In March 1978, heavy spring rains coupled with snowmelt caused significant flooding on the Gila River in Duncan and farmlands all along the river. Statewide damages were estimated to exceed \$60,000,000, with thousands of homes damaged and over 100 homes destroyed. More than 7,000 people had to be sheltered and four people lost their lives (ADEM, 2010).
- In December 1978, widespread heavy rainfall from December 16-20 caused some of the costliest and widespread flooding in Arizona history. Waters from the Gila River rose to seven feet deep in the town of Duncan, and 75 homes were destroyed when a dike broke. Along the San Francisco River near Clifton, 1,000 people were evacuated from homes. Statewide damage estimates exceeded \$450 million and at least 10 deaths were reported (ADEM, 2010).
- In early October 1983, tropical storm remains, including those from Hurricane Octave, caused heavy rain over Arizona during a 10-hour period. Southeast Arizona, Yavapai and Mohave Counties were particularly hard hit with severe flooding occurring in Tucson, Clifton and Safford. Fourteen fatalities and 975 injuries were attributed to the flooding. At least 1,000 Arizonans were left temporarily homeless. Damages were estimated at \$370 million in 2001 currency. Record water levels in the Santa Cruz, Gila, San Pedro and San Francisco Rivers contributed to heavy flooding statewide. Greenlee County was hit hard. Damages in Clifton alone were over \$20 million where approximately 41 businesses were destroyed and over 231 homes and 57 businesses suffered major damages. The U. S. Army Corps of Engineers constructed an emergency dike in the Winkelman Flats area to try and protect 112 homes. There were flood-fight activities at Florence to protect a sewage treatment plant and at Safford to protect critical arterial bridge embankment from severe damage (ADEM, 2010; NWS Tucson, 2016).
- In late December 1992 - early January 1993, a series of winter storms produced record breaking precipitation amounts and severe weather across much of Arizona. Heavy rains combined with melting snowpack caused heavy flooding of both local washes and regional rivers within Greenlee County. Nearly every community and city within the county was impacted by the storms at some level. Most of the heavy damage was associated with the Gila, San Pedro, and Santa Cruz Rivers. According to the USACE Flood Damages Report, the total public and private damages from the 1993 floods were estimated to exceed \$55.5 million in Greenlee County alone, with the majority of damages occurring at the Phelps Dodge mine.¹⁶ The flooding prompted a federal disaster declaration (FEMA-977-DR-AZ) for almost the entire state. Greenlee County received approximately \$1.1 million dollars in federal aid to restore or repair flood damages at 86 locations across the county (USACE, 1994; ADEM, 2010).
- In February 2005, heavy winter rains caused extensive flooding throughout much of the state and Greenlee County. The precipitation event began the night of February 10th and lasted through the early hours February 14th. Rainfall totals of 2 to 3 inches were common in many locations. Many roadways and utilities within the County were impacted. The U.S. Army Corps of Engineers was mobilized to Duncan to provide flood fight measures to protect the Town. Estimated damages within the County were at least \$1.2 million. The flooding prompted a federal disaster declaration (FEMA-1586-DR-AZ) for Gila, Graham, Greenlee, Yavapai,

¹⁶ US Army Corps of Engineers, Los Angeles District, 1994, *Flood Damage Report – State of Arizona – Floods of 1993*

Maricopa, and Mohave Counties. Total disaster expenditures exceeded \$9.5 million. (ADEM, 2005, JEF, 2006).

- In August 2005, a flash flood along Ward’s Canyon near Clifton caused damage to existing utilities and bridges. A three to four foot wall of water was reported to travel down the canyon creating a sizable scour hole just downstream of the U.S. 191 bridge. The Town of Clifton’s sewer main and lift station were completely destroyed (The Copper Era, 2005).
- In late July and early August 2006, several areas of the state were struck by severe storms and flooding during the period of July 25 to August 4, 2006. Tropical moisture poured into Southeast Arizona, saturating the ground at most locations. As rainfall continued, additional runoff quickly filled rivers and washes, exceeding bank full capacities and flooding homes and businesses as well as nearby roads. Some roadways were washed away due to the strong flood waters. The flooding prompted a federal disaster declaration (FEMA-1660-DR-AZ) for Gila, Graham, Greenlee, Pima, and Greenlee Counties. Total disaster expenditures exceeded \$13.6 million (ADEM, 2010).
- On July 19, 2010 through July 29, 2010, a series of potent monsoon thunderstorms causing high winds and flash floods damaged many locations in southeastern Arizona. The heavy rains resulted in unusually strong flooding events and caused extreme peril to public health and safety in Wards Canyon. On July 29, 2010 both the Town of Clifton and Greenlee County declared a state of emergency for this event. Flooding within Wards Canyon caused extensive damages to roads and sewer lines (ADEM, 2010).
- On September 22, 2010, An upper level disturbance as well as tropical moisture from remnants of Tropical Storm Georgette caused thunderstorms to develop over Clifton around 4:30 pm and intense rainfall resulted. According to Clifton officials, 2.25 inches fell in about 45 minutes on already saturated soil. The storm resulted in tons of mud and rock piled on city streets. Two unoccupied vehicles parked on Turner Avenue were washed down Ward’s Canyon and into the San Francisco River. A third vehicle was tossed onto its side in the canyon about 100 yards from the canyon’s confluence with the river. Flash flooding also resulted in damage to a main water line feeding Clifton. Total damages were estimated to exceed \$50,000 (NCDC, 2011)
- On September 14, 2013, heavy rain occurred along the Campbell Blue Creek near the headwaters of the Blue River in Arizona, which was an area that was affected by the 2011 Wallow Fire. Heavy rain also fell along Turkey Creek in Arizona and the Dry Blue Creek in New Mexico. Runoff continued downstream to the confluence of the Campbell Blue and Dry Blue Creeks, which forms the Blue River. Multiple crests of two to four feet above flood stage resulted, washing out sections of Blue River Road and isolating residents of the community. A Campbell Blue Ridge 30 foot concrete bridge just across the state line in New Mexico, was completely washed out. Electrical and telephone lines were damaged by the flooding. A utility company truck rolled into Turkey Creek after the adjacent flood-compromised road gave way. The driver was able to escape the six foot deep flowing water without injury. Total Arizona damages were estimated to exceed \$50,000 (NCDC, 2016).
- On August 1, 2014, three inches of rain in less than an hour caused flash flooding in Duncan. One home was flooded with water up to 3 feet deep and damage was sustained to a car wash structure. Two to three feet of water covered part of Highway 70 on the northwest edge of Duncan. Total damages were estimated to exceed \$20,000 (NCDC, 2016).
- On August 29, 2020, between 2 and 3 inches of rainfall in some areas of Greenlee County. Brief heavy rain caused mud to slide downhill, temporarily closing Highway 191 in Clifton near the old train depot. Debris was up to four feet deep across the roadway. (NCDC, 2021)

Probability and Magnitude

For the purposes of this Plan, the probability and magnitude of flood hazards in Greenlee County jurisdictions are primarily based on the 1% (100-year) and 0.2% (500-year) probability floodplains delineated on FEMA Flood Insurance Rate Maps (FIRMs), plus any provisional floodplain

delineations used for in-house purposes by participating jurisdictions or Planning Team delineated areas. The effective date for the current digital FIRM (DFIRM) maps is September 28, 2007. The current National Flood Hazard Layer (NFHL) digital database for Greenlee County was downloaded from FEMA’s servers in April 2021. The NFHL files and the Planning Team delineated provisional floodplains were used as a basis for depicting the flood hazard in this Plan. Therefore, the vulnerability analysis results in this plan are likely conservative.

Two designations of flood hazard are used. Any “A” zone is designated as a high hazard area. Medium flood hazard areas are all “Shaded X” zones. All “A” zones (e.g. – A, A1-99, AE, AH, AO, etc.) represent areas with a 1% probability of being flooded at a depth of one-foot or greater in any given year. All “Shaded X” zones represent areas with a 0.2% probability of being flooded at a depth of one-foot or greater in any given year. These two storms are often referred to as the 100-year and 500-year storm, respectively. High and medium hazard designations were also assigned to the non-FEMA areas by the Planning Team based on the anticipated level of flood hazard posed.

Maps 1A and 1B show the flood hazard areas for the entire county. Maps 1C and 1D show the flood hazard areas for Clifton and Duncan, respectively.

Climate Change Impacts

The NCA report (Gonzalez, et.al., 2018) notes that one of the anticipated impacts of climate change for the Southwest is a reduction in average annual precipitation and streamflow volumes. The report and supporting documents also indicate that winter storm intensities are anticipated to increase, which may lead to increased event-based flooding. This could be exacerbated by watersheds with reduced vegetation due to climate change induced drought or wildfire. Collectively these impacts could result in more severe winter season flooding and warrant mitigation efforts that design to less frequent storm events such as the 250- or 500-year (0.4 or 0.2% probability) recurrence intervals in anticipation of the impacts. Executive Order 13690¹⁷, titled “Federal Flood Risk Management Standard”, is a first step by the federal government in implementing requirements to look at less frequent storm events when establishing finished floor and flood elevation design standards for certain federally identified or funded facilities that are located with special flood hazard areas. Expansion of these policies to all floodplain development and flood mitigation may be warranted under the current climate change thinking.

Vulnerability – CPRI Results

Flooding CPRI results for each community are summarized in Table 5-7 below.

| Table 5-7: CPRI results by jurisdiction for flooding | | | | | |
|---|--------------------|--------------------------------|-------------------------|-----------------|-----------------------|
| Participating Jurisdiction | Probability | Magnitude/ Severity | Warning Time | Duration | CPRI Score |
| Clifton | Highly Likely | Critical | 6-12 hours | < 24 hours | 3.35 |
| Duncan | Highly Likely | Catastrophic | 6-12 hours | < 1 week | 3.75 |
| Unincorporated Greenlee County | Highly Likely | Catastrophic | < 6 hours | < 1 week | 3.90 |
| County-wide average CPRI = | | | | | 3.67 |

Vulnerability – Loss Estimations

The estimation of potential exposure to high and medium flood hazards was accomplished by intersecting the human and critical facility assets with the flood hazard limits depicted on Maps 1A, 1B, 1C and 1D. No loss estimations were made for this update. Only exposure of the human, residential and asset facilities are reported. Table 5-8 summarizes the Planning Team identified critical facilities potentially exposed to high and medium flood hazards, and the corresponding estimates of losses. Table 5-9 summarizes population sectors exposed to the high and medium flood hazards. Residential structure exposures to high hazard flood areas are summarized in Table 5-10.

¹⁷ FEMA website access at: <https://www.fema.gov/federal-flood-risk-management-standard-ffrms>

In summary, \$59.7 million in asset related losses are estimated for high flood hazards, for all the participating jurisdictions in Greenlee County. An additional \$51.3 million in high flood hazard losses to HAZUS defined residential facilities is estimated for all participating Greenlee County jurisdictions. Regarding human vulnerability, a total population of 1,017 people, or 12.05% of the total population, is potentially exposed to a high hazard flood event. Based on the historic record, multiple deaths and injuries are plausible and a substantial portion of the exposed population is subject to displacement depending on the event magnitude.

It is duly noted that the loss and exposure numbers presented above represent a comprehensive evaluation of the County as a whole. It is unlikely that a storm event would occur that would flood all of the delineated high and medium flood hazard areas at the same time. Accordingly, actual event based losses and exposure are likely to be only a fraction of those summarized above. Furthermore, it should be noted that any flood event that exposes assets or population to a medium hazard will also expose assets and populations to the high hazard flood zone. That is, the 100-year floodplain would be entirely inundated during a 500-year flood.

Table 5-8: Asset inventory exposure to high and medium hazard flooding and corresponding replacement estimates

| Community | Total Facilities Reported by Community | Impacted Facilities | Percentage of Total Community Facilities Impacted | Estimated Replacement Cost (x \$1000) |
|--------------------------------|--|---------------------|---|---------------------------------------|
| HIGH | | | | |
| County-Wide Totals | 155 | 56 | 36.13% | \$59,680 |
| Clifton | 61 | 24 | 39.34% | \$23,720 |
| Duncan | 44 | 15 | 34.09% | \$13,860 |
| Unincorporated Greenlee County | 50 | 17 | 34.00% | \$22,100 |
| MEDIUM | | | | |
| County-Wide Totals | 155 | 9 | 5.81% | \$12,900 |
| Clifton | 61 | 7 | 11.48% | \$12,200 |
| Duncan | 44 | 0 | 0.00% | \$0 |
| Unincorporated Greenlee County | 50 | 2 | 4.00% | \$700 |

Table 5-9: Population sectors exposed to high and medium hazard flooding

| Community | Total Population | Population Exposed | Percent of Population Exposed | Total Population Over 65 | Population Over 65 Exposed | Percent of Population Over 65 Exposed |
|--------------------------------|------------------|--------------------|-------------------------------|--------------------------|----------------------------|---------------------------------------|
| HIGH | | | | | | |
| County-Wide Totals | 8,438 | 1,017 | 12.05% | 1,015 | 183 | 18.03% |
| Clifton | 3,319 | 242 | 7.29% | 313 | 31 | 9.90% |
| Duncan | 699 | 146 | 20.89% | 109 | 28 | 25.69% |
| Unincorporated Greenlee County | 4,420 | 629 | 14.23% | 593 | 123 | 20.74% |
| MEDIUM | | | | | | |
| County-Wide Totals | 8,438 | 479 | 5.68% | 1,015 | 78 | 7.68% |
| Clifton | 3,319 | 291 | 8.77% | 313 | 40 | 12.78% |
| Duncan | 699 | 0 | 0.00% | 109 | 0 | 0.00% |
| Unincorporated Greenlee County | 4,420 | 188 | 4.25% | 593 | 37 | 6.24% |

| Table 5-10: Residential structures exposed to High and Medium hazard flood zones | | | | | | |
|---|-----------------------------------|--------------------------------------|----------------|---|---|----------------|
| Community | Residential Building Count | Residential Building Exposure | | Residential Building Replacement Value (x\$1000) | Residential Building Value Exposed | |
| | | Total | Percent | | Total (x\$1000) | Percent |
| HIGH | | | | | | |
| County-Wide Totals | 3,061 | 552 | 18.03% | \$287,960 | \$51,348 | 17.83% |
| Clifton | 1,246 | 139 | 11.16% | \$112,685 | \$12,576 | 11.16% |
| Duncan | 201 | 90 | 44.78% | \$14,910 | \$6,669 | 44.73% |
| Unincorporated Greenlee County | 1,614 | 323 | 20.01% | \$160,365 | \$32,103 | 20.01% |
| MEDIUM | | | | | | |
| County-Wide Totals | 3,061 | 253 | 8.27% | \$287,960 | \$23,670 | 8.22% |
| Clifton | 1,246 | 172 | 13.8% | \$112,685 | \$15,577 | 13.82% |
| Duncan | 201 | 0 | 0.00% | \$14,910 | \$0 | 0.00% |
| Unincorporated Greenlee County | 1,614 | 81 | 5.02% | \$160,365 | \$8,093 | 5.05% |

Vulnerability – Repetitive Loss Properties

Repetitive Loss (RL) properties are those NFIP-insured properties that since 1978, have experienced multiple flood losses. FEMA tracks RL property statistics, and in particular to identify Severe RL (SRL) properties. RL properties demonstrate a track record of repeated flooding for a certain location and are one element of the vulnerability analysis. RL properties are also important to the NFIP, since structures that flood frequently put a strain on the National Flood Insurance Fund. FEMA records dated February 2016 (provided by ADWR) indicate that there are 6 identified RL properties in Greenlee County, with a total of over \$284,510 in associated building and contents claim payments. The payout amounts and distribution are slightly different than those reported in the 2011 Plan due to a more accurate representation of the current RL data. Even though there is an increase in the RL payments shown herein when compared to the 2011 Plan, it is still true that none of the payments have occurred within the last five years and none of the properties are currently carrying NFIP insurance. Table 5-11 summarizes the RL property characteristics by jurisdiction.

| Table 5-11: Repetitive Loss property statistics for Greenlee County jurisdictions | | | |
|---|--------------------------|------------------------------------|-----------------------|
| Jurisdiction | No. of Properties | No. of Properties Mitigated | Total Payments |
| Clifton | 4 | 0 | \$139,311 |
| Duncan | 1 | 1 ^a | \$46,160 |
| Unincorporated Greenlee County | 1 | 0 | \$99,039 |
| Source: FEMA NFIPSTAT web query provided by ADWR, 2016 (data as of February 29, 2016) | | | |
| Notes: | | | |
| a – FEMA database does not show property to be mitigated, but Town officials believe it is. | | | |

Vulnerability – Development Trends

Most floodprone properties in Greenlee County pre-date the planning jurisdictions’ entry into the NFIP and were constructed prior to current floodplain management practices. The development of new properties or substantial re-development of existing structures is now subject to regulatory review procedures implemented by each jurisdiction. New development, adequate planning and regulatory tools are in place to regulate future development. For many areas within the county, challenges for the management of new growth include the need for master drainage planning and additional detailed floodplain delineations to identify and map the flood hazards within the growth areas where no mapping currently exists, or where approximate zones lack accuracy and detail.

Changes in Development in the Hazard Prone Area

There has been little growth within the Unincorporated County, the Town of Duncan, and the Town of Clifton. Where new developments are proposed or have been completed, they have not been within the areas identified to be at risk from flooding. The County and incorporated jurisdictions have worked over the past 5 years to maintain and improve drainage along transportation routes and to better define the flood risk within the County.

Sources

Arizona Division of Emergency Management, 2018, State of Arizona Multi-Hazard Mitigation Plan.

FEMA, 2001, Understanding Your Risks; Identifying Hazards and Estimating Losses, FEMA Document No. 386-2.

JE Fuller/ Hydrology & Geomorphology, 2016, Greenlee County Multi-Jurisdictional Hazard Mitigation Plan

NOAA, National Weather Service Forecast Office – Tucson, 2011, website data accessed via the following URL: <http://www.wrh.noaa.gov/twc/hydro/floodhis.php>

U.S. Dept of Commerce, National Climatic Data Center, 2021, Storm Events Database, accessed via the following URL: <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms>

U.S. Army Corps of Engineers, Los Angeles District, 1994, Flood Damage Report, State of Arizona, Floods of 1993.

FEMA National Flood Hazard Layer database downloaded January 2021.

Profile Maps

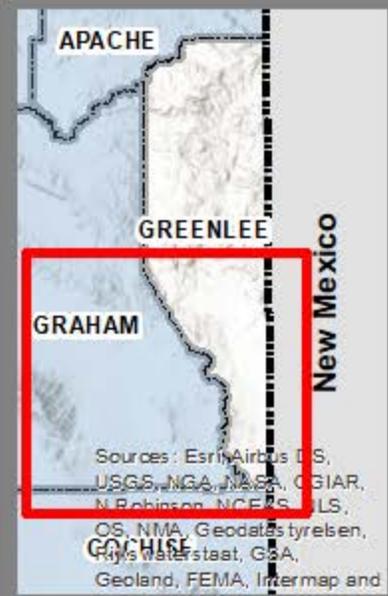
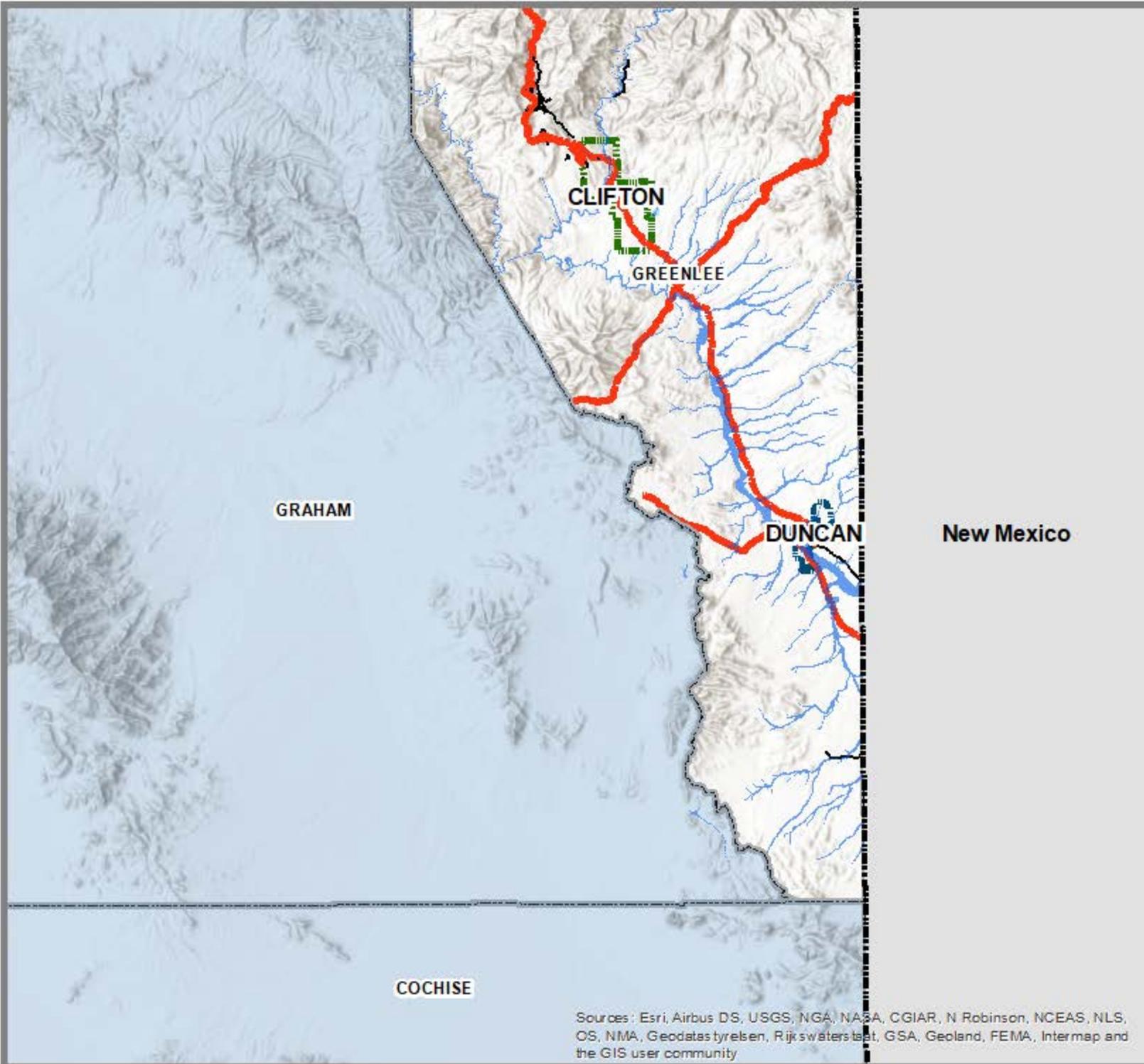
Maps 1A and 1B – County-Wide Flood Hazard Maps

Maps 1C and 1D – Clifton and Duncan Flood Hazard Maps

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Greenlee County
Multi-Jurisdictional
Hazard Mitigation Plan

Map1A
Greenlee County
Flood Hazard Map
as of June 2021



Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N. Robinson, NCEAS, NLS, OS, NMA, Geodatas tyresen, Rijks watersstaat, GSA, Geoland, FEMA, Intermap and the GIS user community

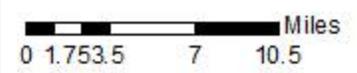
Legend

Flood Hazard Rating

- High
- Medium

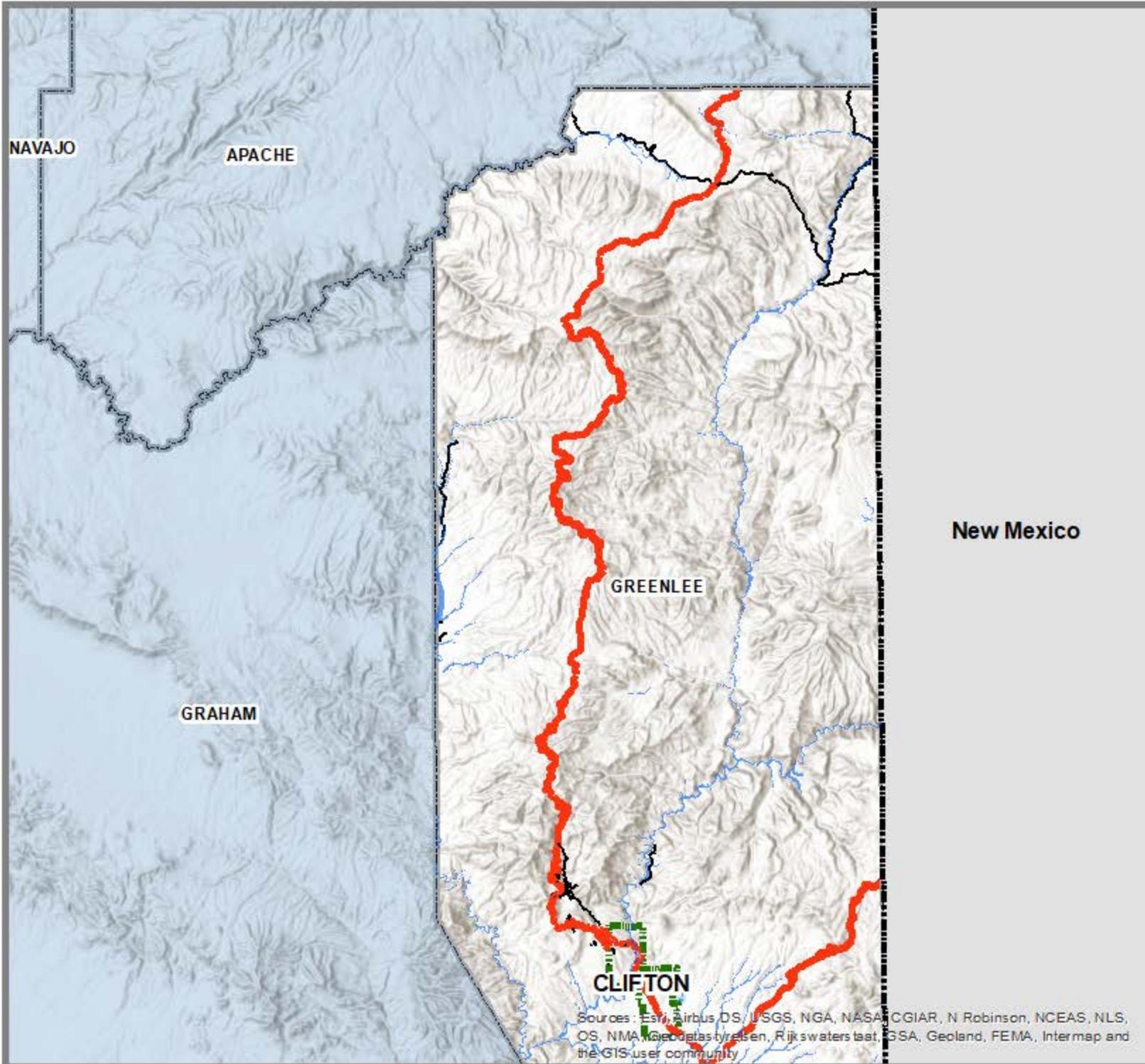
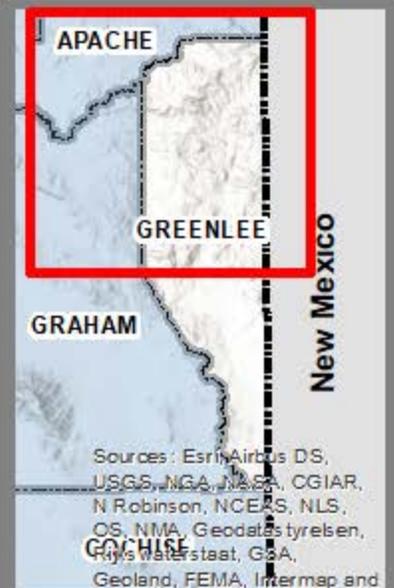
Major Roadways

- Interstate
- US, State, County Hwys
- Major Roads



Greenlee County
Multi-Jurisdictional
Hazard Mitigation Plan

Map1B
Greenlee County
Flood Hazard Map
as of June 2021



New Mexico

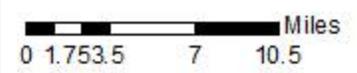
Legend

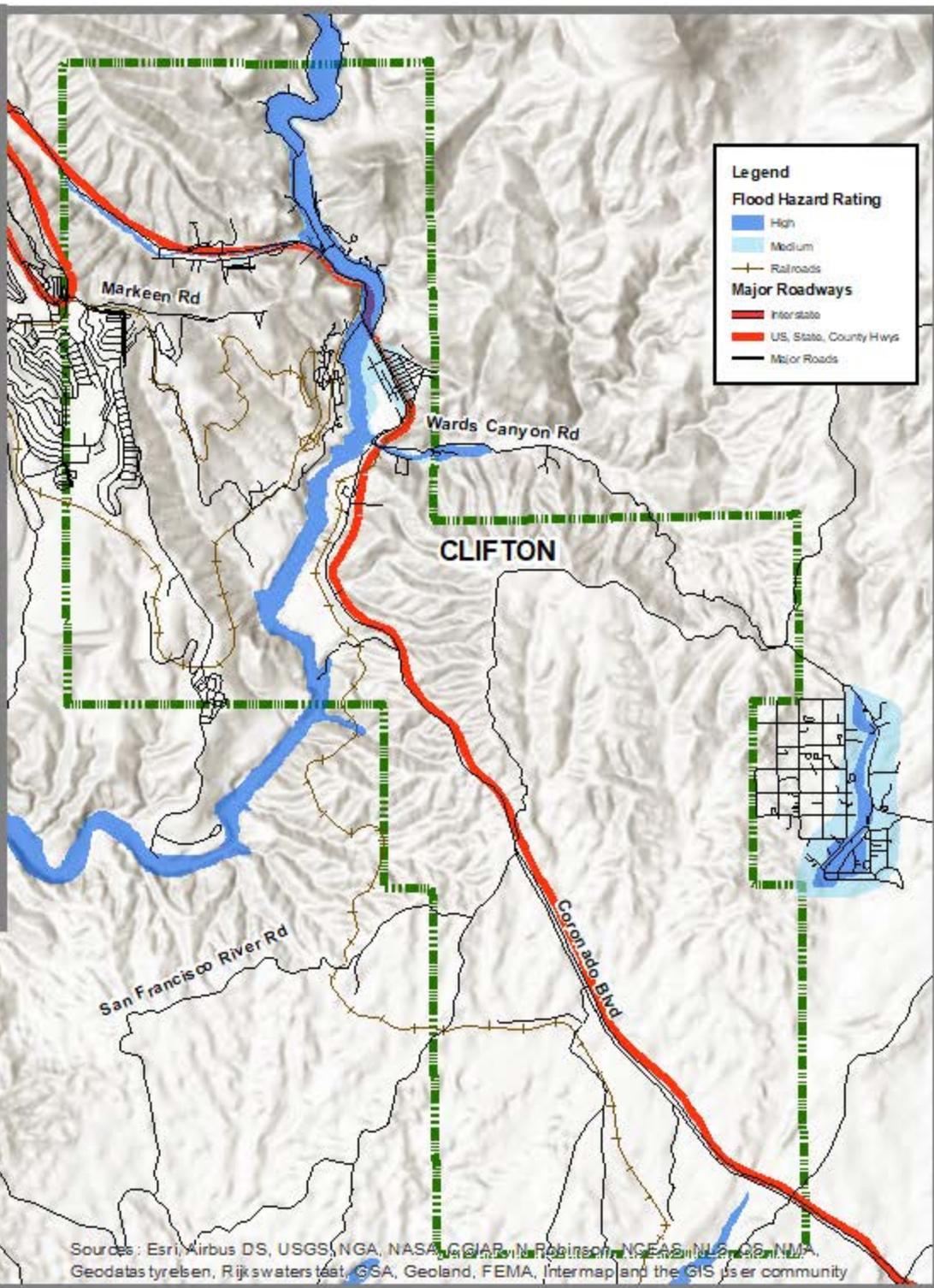
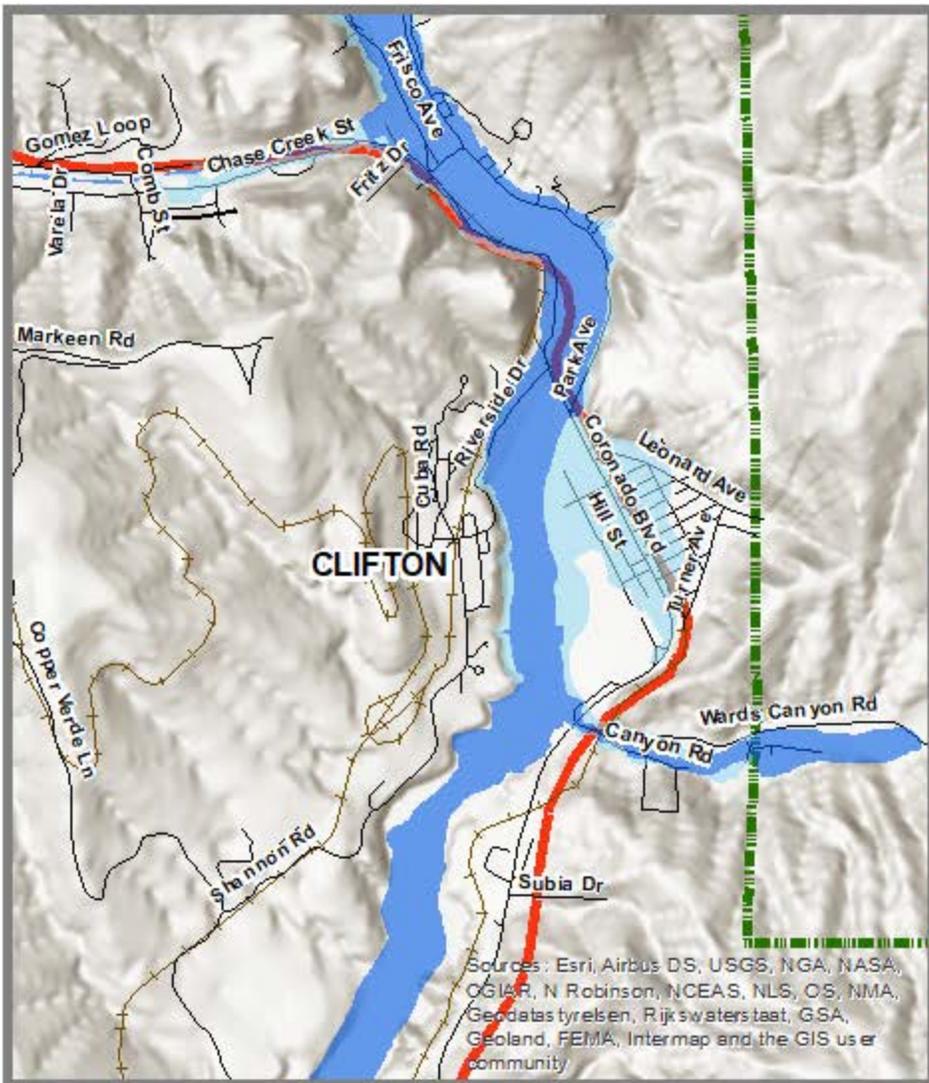
Flood Hazard Rating

- High
- Medium

Major Roadways

- Interstate
- US, State, County Hwys
- Major Roads





Legend

Flood Hazard Rating

- High (Dark Blue)
- Medium (Light Blue)

Major Roadways

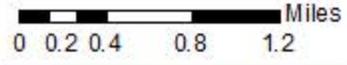
- Railroads (Yellow line with cross-ticks)
- Interstate (Red line)
- US, State, County Hwys (Orange line)
- Major Roads (Black line)



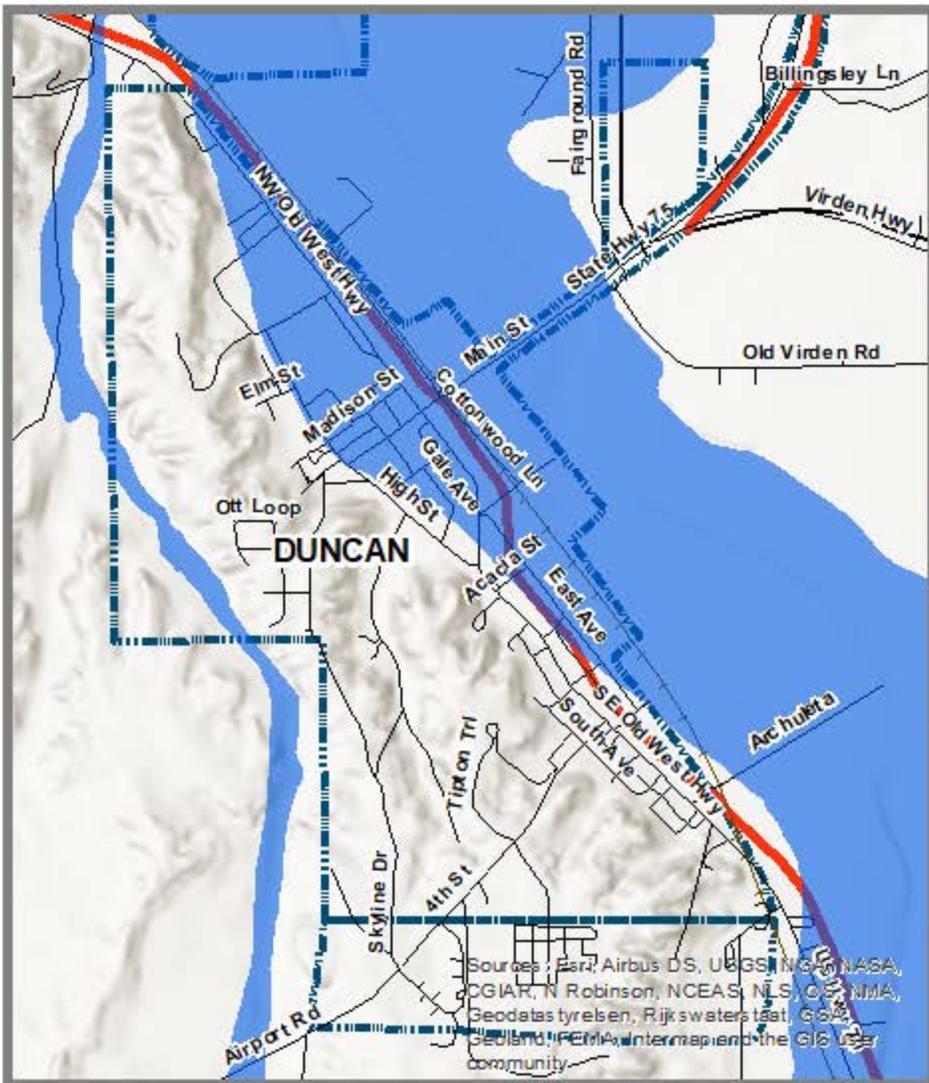
Greenlee County
Multi-Jurisdictional
Hazard Mitigation Plan



Map1C
Town of Clifton
Flood Hazard Map
as of June 2021



Sources: Esri, Airbus DS, USGS, NGA, NASA, OGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatas tyreisen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community



Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, GSA, NIMA, Geodatas tyresen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community

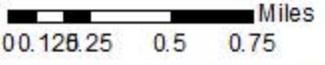
Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, Geodatas tyresen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community



Greenlee County
Multi-Jurisdictional
Hazard Mitigation Plan



Map1D
Town of Duncan
Flood Hazard Map
as of June 2021



Legend

Flood Hazard Rating

- High
- Medium

Major Roadways

- Interstate
- US, State, County Hwys
- Major Roads

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5.3.3 *Levee Failure*

Description

FEMA defines levees as man-made structures (usually earthen embankments) that are designed and constructed in accordance with sound engineering practices to contain, control or divert the flow of water so as to provide protection from temporary flooding (FEMA, 2009). National flood policy now recognizes the term “levee” to mean only those structures which were designed and constructed according to sound engineering practices, have up-to-date inspection records and current maintenance plans, and have been certified as to their technical soundness by a professional engineer or certain federal agencies. FEMA has classified all other structures that impound, divert, and/or otherwise impede the flow of runoff as “non-levee embankments”. In Greenlee County, these “non-levee embankments” might be comprised of features such as non-certified levees, roadway and railway embankments, canals, irrigation ditches and drains, and agricultural dikes.

In November 2017, Governor Ducey received a letter from the notifying the Governor of the Congressional authorization of USACE to work with interested states and levee owners/operators to conduct an inventory and review of levees across the nation. The purpose of the action is to work with Arizona agencies to inventory, review and assess critical information for levees within Arizona, with a particular focus on levees not currently identified to be within USACE authority. The collected information will be included in the USACE’s National Levee Database (NLD), which is publicly available and used to promote awareness of the benefits and flood risks associated with levees.

In recent years, the United States Army Corps of Engineers (USACE) has been working with Arizona to assess and update the USACE’s National Levee Database (NLD), which is publicly available and used to promote awareness of the benefits and flood risks associated with levees. The Arizona Department of Water Resources (ADWR) will serve as the state’s lead agency for levee safety. By participating in the USACE project and coordinating with FEMA through the Cooperating Technical Partnership (CTP) program, ADWR will work with FEMA, USACE and local officials to better inspect, maintain, and track levees within their communities.

By design, a levee and many non-levee embankments increase the conveyance capacity of a watercourse by artificially creating a deeper channel through embankments that extend above the natural overbank elevation. Upon failure, floodwaters will return to the natural overbank areas. FEMA urges communities to recognize that all areas downstream of levees and non-levee embankments are at some risk of flooding and that there are no guarantees that a levee or non-levee embankment will not fail or breach if a large quantity of water collects upstream.

Mechanisms for levee and non-levee embankment failure are similar to those for dam failure. Failure by overtopping could occur due to an inadequate design capacity, sediment deposition and vegetation growth in the channel, subsidence, and/or a runoff that exceeds the design recurrence interval. Failure by piping could be due to embankment cracking, fissures, animal borings, embankment settling, or vegetal root penetrations.

History

Levees and non-levee embankments have been used in Greenlee County for many years to protect communities and agricultural assets from flooding, as well as to facilitate the delivery and removal of irrigation water. These levees range from simple earthen embankments pushed up by small equipment to large engineered embankments placed on one or both sides of a watercourse. The structural integrity of levees with regard to flood protection and policy has been discussed at a national level since the early 1980s but was elevated to a high priority after the collapse and breach of New Orleans’ levees after Hurricane Katrina in 2005. In 2009, a draft report was issued to Congress by the National Committee on Levee Safety (NCLS, 2009) summarizing recommendations and a strategic plan for implementation of a National Levee Safety Program.

There are no documented failures of certified levees within Greenlee County. Non-levee embankment failures, however, occur on a regular basis and the risk posed by the many uncertified embankments in the county can be significant depending on their location. This is especially true in the Duncan area where there have been documented flooding events involving a breached or failed non-

levee embankment. It is noted that the term dike is often used in the literature to describe a non-levee embankment. The following are a few examples of flooding that involved non-levee embankment failures:

- In December 1978, widespread heavy rainfall from December 16-20 caused some of the costliest and widespread flooding in Arizona history. Waters from the Gila River rose to seven feet deep in the town of Duncan, and 75 homes were destroyed when a dike broke (ADEM, 2010).
- In late December 1992 - early January 1993, a series of winter storms produced record breaking precipitation amounts and severe weather across much of Arizona. Heavy rains combined with melting snowpack caused heavy flooding of both local washes and regional rivers within Greenlee County. A 400 foot breach in a protective dike caused five businesses and six residences to be inundated by water up to two feet deep (USACE, 1994; ADEM, 2010).
- In February 2005, a rain on snow event produced moderate flooding along the Gila River at Duncan where a section in the town's dike system broke flooding one occupied structure and the state highway near the Duncan high school (NWS Tucson, 2011).

Probability and Magnitude

There are varied probability or magnitude criteria regarding levee failure due to variability in levee design, ownership and maintenance. For flood protection credit under the NFIP, FEMA has established certain deterministic design criteria that are based on the 1 percent (100-year) storm event and corresponding minimum freeboard requirements. Federally constructed levees are usually designed for larger, more infrequent events such as the 0.04% and 0.02% probability (250 to 500 year) events plus freeboard. Recent recertification procedures proposed by U.S. Army Corps of Engineers, require that a certifiable levee have at least a 90% assurance of providing protection from overtopping by the 1% chance exceedance flood for all reaches of a levee system with a design freeboard height of at least three feet. For levees with more than three feet of design freeboard, the assurance is increased to 95%, and no certification will be made for levees with less than two feet of freeboard unless approved via a waiver process. This assurance is only for containment (overtopping failure) and does not include probability of failure by other modes such as piping (USACE, 2007).

As of the writing of this Plan, the only FEMA certified levee within Greenlee County is the Clifton Levee. The landside of the levee is delineated as a Shaded Zone X with an "Area Protected by Levee" description. This area was chosen by the Planning Team to represent the High hazard levee failure limits. Risk associated with other non-certified dikes and levees are represented in the Flooding profile of Section 5.3.2 and will not be duplicated here. The currently identified High hazard levee failure zone in Clifton is indicated on Map 2.

Climate Change Impacts

The climate change impacts to levee failure are nearly identical to those discussed in the Flooding section. Increases in winter flood intensities, combined with the effects of reduced watershed vegetation due to drought and/or wildfire, could elevate the probability of levee failures in the county, and especially for levees that were not designed to convey/contain flows greater than the 100-year (1% probability) standard. Most federally sponsored levee design and construction will use, or have used, discharges that exceed the 100-year standard, but not all. Mitigation activities should consider using the 500-year event as the minimum design standard to anticipate the impacts of climate change.

Vulnerability – CPRI Results

Levee Failure CPRI results for each community are summarized in Table 5-12 below.

Table 5-12: CPRI results by jurisdiction for levee failure

| Participating Jurisdiction | Probability | Magnitude/ Severity | Warning Time | Duration | CPRI Score |
|-----------------------------------|--------------------|--------------------------------|-------------------------|-----------------|-----------------------|
| Clifton | Possible | Catastrophic | < 6 hours | < one week | 3.00 |
| Duncan | Highly Likely | Catastrophic | < 6 hours | < one week | 3.90 |
| Unincorporated Greenlee County | Possible | Catastrophic | < 6 hours | < 24 hours | 2.90 |
| County-wide average CPRI = | | | | | 3.27 |

Vulnerability – Loss Estimations

There are no commonly accepted methods for estimating potential levee failure related losses. Many variables including storm size and duration, as well as size, speed, and timing at which a levee breach forms, all contribute to the potential for human and economic losses. Accordingly, no estimates of prior or potential losses are made in this Plan. Potential exposure of human and facility assets to the high hazard levee failure areas will be estimated instead. Table 5-13 summarizes the Planning Team defined critical facilities potentially exposed to a high hazard levee failure zone. Table 5-14 summarizes population sectors exposed to the high hazard levee failure zones. Residential structure exposures to high hazard levee failure areas are summarized in Table 5-15.

In summary, \$1.0 million in county-wide assets are exposed to a high hazard levee failure. An additional \$13.4 million in county-wide high hazard levee failure exposure of HAZUS defined residential facilities is estimated. Regarding human vulnerability, a total population of 247 people, or 2.93% of the total county-wide population, is potentially exposed to a high hazard levee failure event. Should a significant levee structure fail suddenly, it is plausible that death and injury might occur. It can also be expected that a substantial portion of the exposed population is subject to displacement depending on the event magnitude.

Table 5-13: Asset inventory exposure to levee failure

| Community | Total Facilities Reported by Community | Impacted Facilities | Percentage of Total Community Facilities Impacted | Estimated Replacement Cost (x \$1000) |
|--------------------------------|---|----------------------------|--|--|
| HIGH | | | | |
| County-Wide Totals | 155 | 4 | 2.58% | \$1,000 |
| Clifton | 61 | 4 | 6.56% | \$1,000 |
| Duncan | 44 | 0 | 0.00% | \$0 |
| Unincorporated Greenlee County | 50 | 0 | 0.00% | \$0 |

Table 5-14: Population sectors exposed to levee failure

| Community | Total Population | Population Exposed | Percent of Population Exposed | Total Population Over 65 | Population Over 65 Exposed | Percent of Population Over 65 Exposed |
|--------------------------------|-------------------------|---------------------------|--------------------------------------|---------------------------------|-----------------------------------|--|
| HIGH | | | | | | |
| County-Wide Totals | 8,438 | 247 | 2.93% | 1,015 | 29 | 2.84% |
| Clifton | 3,319 | 247 | 7.44% | 313 | 29 | 9.27% |
| Duncan | 699 | 0 | 0.00% | 109 | 0 | 0.00% |
| Unincorporated Greenlee County | 4,420 | 0 | 0.00% | 593 | 0 | 0.00% |

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| Table 5-15: Residential structures with High hazard exposure to levee failure | | | | | | |
|--|-----------------------------------|--------------------------------------|----------------|---|---|----------------|
| Community | Residential Building Count | Residential Building Exposure | | Residential Building Replacement Value (x\$1000) | Residential Building Value Exposed | |
| | | Total | Percent | | Total (x\$1000) | Percent |
| HIGH | | | | | | |
| County-Wide Totals | 3,061 | 148 | 4.84% | \$287,960 | \$13,389 | 4.65% |
| Clifton | 1,246 | 148 | 11.88% | \$112,685 | \$13,389 | 11.88% |
| Duncan | 201 | 0 | 0.00% | \$14,910 | \$0 | 0.00% |
| Unincorporated Greenlee County | 1,614 | 0 | 0.00% | \$160,365 | \$0 | 0.00% |

It is duly noted that the loss and exposure numbers presented above represent a comprehensive evaluation of the County as a whole. It is unlikely that a storm event would occur that would fail all of the levees at the same time. Accordingly, actual event based losses and exposure are likely to be only a fraction of those summarized above.

Vulnerability – Development Trend Analysis

With the new focus on residual downstream risk for the land-side of levees and a general refocusing of national levee regulation and policy, it is likely that new and old developments in these areas will need to be revisited to determine if additional measures are necessary for adequate flood protection. Many structures located downstream of non-certified levee embankments are being re-mapped into Special Flood Hazard Zones. New developments should be evaluated to determine if sufficient protection is proposed to mitigate damages should the levee protecting them fail.

New development and redevelopment of the areas protected by the Clifton levee has been and will continue to be limited. The best mitigation for this area is for structure owners to be thoroughly made aware of the residual risks and to carry flood insurance. For the Town of Clifton, continued performance of routine maintenance and inspection of the existing levee facilities is critical to mitigating failures.

Changes in Development in the Hazard Prone Area

The only defined high hazard levee failure area lies within the Town of Clifton, in area which is largely developed. Changes in development in the Town of Clifton have not occurred within the hazard prone area. The Town continues to test and maintain the levee gates in ensure that they are operational in the event of a flood.

Within the Unincorporated County and the Town of Duncan there are no areas of development within a designated high hazard levee failure area.

Sources

Arizona Division of Emergency Management, 2018, *State of Arizona Multi-Hazard Mitigation Plan*.

FEMA, 2001, *Understanding Your Risks; Identifying Hazards and Estimating Losses*, FEMA Document No. 386-2.

FEMA, 2009, Web page at URL: http://www.fema.gov/plan/prevent/fhm/lv_intro.shtm#3

National Committee on Levee Safety, 2009, *Draft Recommendation For A National Levee Safety Program*.

National Weather Service – Tucson FO, web page at URL: <http://www.wrh.noaa.gov/twc/hydro/floodhis.php>

USACE, 2007, *Certification of Levee Systems for the National Flood Insurance Program (NFIP) – DRAFT*, ETL 1110-2-570.

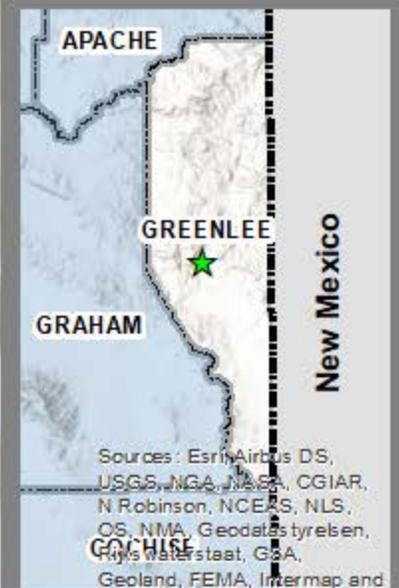
Profile Maps

Map 2 – Potential Levee Failure Hazard Map

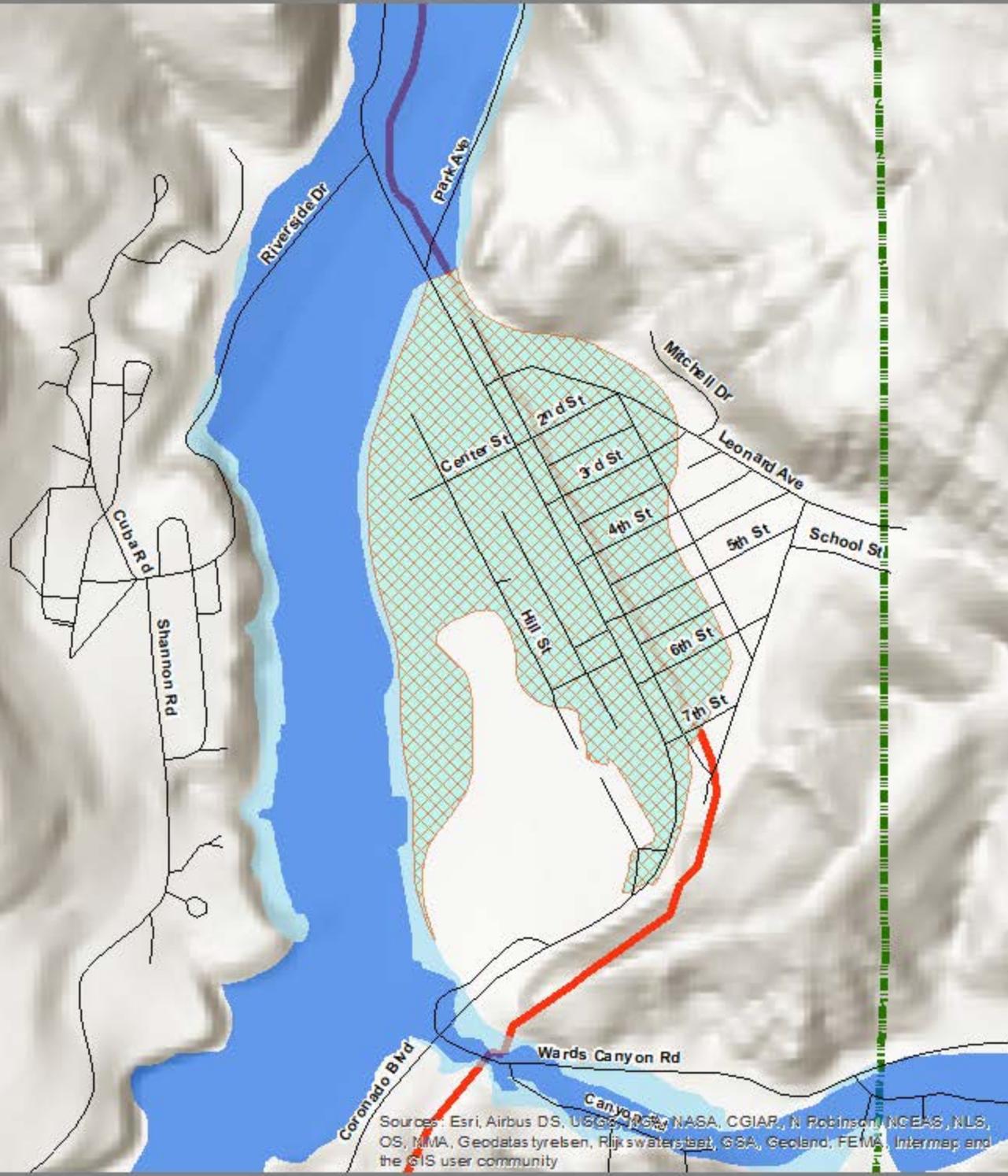
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Greenlee County
Multi-Jurisdictional
Hazard Mitigation Plan

Map2
Clifton Area
Levee Failure Hazard Map
as of June 2021



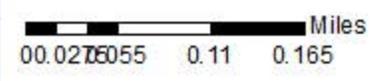
CLIFTON
GREENLEE



Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatas tyresen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community

Legend

- High Flood Hazard Rating (Green cross-hatch pattern)
- High (Blue)
- Medium (Light Blue)
- Major Roadways
 - Interstate (Red)
 - US, State, County Hwys (Orange)
 - Major Roads (Black)



5.3.4 *Wildfire*

Description

A wildfire is an uncontrolled fire spreading through wildland vegetative fuels and/or urban interface areas where fuels may include structures. They often begin unnoticed, spread quickly, and are usually signaled by dense smoke that may fill the area for miles around. Wildfires can be human-caused through acts such as arson or campfires, or can be caused by natural events such as lightning. If not promptly controlled, wildfires may grow into an emergency or disaster. Even small fires can threaten lives, resources, and destroy improved properties.

The indirect effects of wildfires can also be catastrophic. In addition to stripping the land of vegetation and destroying forest resources and personal property, large, intense fires can harm the soil, waterways and the land itself. Soil exposed to intense heat may temporarily lose its capability to absorb moisture and support life. Exposed soils in denuded watersheds erode quickly and are easily transported to rivers and streams thereby enhancing flood potential, harming aquatic life and degrading water quality. Lands stripped of vegetation are also subject to increased landslide hazards.

History

For the period of 1980 to 2008, data compiled by the Arizona State Forestry Division for the 2010 State Plan update indicates that at least 63 wildfires greater than 100 acres in size, have occurred in all of Greenlee County. According to National Interagency Fire Center Data (NIFC, 2021), there have been four fires larger than 10,000 acres, that have burned within Greenlee County during the period of 2020 to 2021. Several of the County's largest fires are described below in chronological order:

- In June of 2003, the Thomas Fire was started by lightning and burned an area 16 miles south of Alpine, Arizona. The fire started June 6, 2003 and burned a total of 10,618 acres with over \$3,500,000 in fire suppression costs.
- In July of 2003, the Blue River Fire Complex was started by lightning and burned an area south of Alpine, Arizona. The fire started July 12, 2003 and burned a total of 18,600 acres with over \$6,233,034 in fire suppression costs.
- In May of 2004, the KP Fire was started by human causes and burned an area 20 miles south of Alpine, Arizona. The fire started May 17, 2004 and was controlled August 19, 2004, burning a total of 16,625 acres with \$2,024,202 in fire suppression costs. There were also six firefighting related injuries.
- In June of 2007, the Chitty Fire was started by lightning and burned an area 6 miles south-southwest of Hannagan Meadow, Arizona. The fire started June 30, 2007 and was controlled July 16, 2007, burning a total of 14,200 acres with one reported injury.
- In May-July of 2011, the Wallow Fire - the largest fire in the history of Arizona - burned a significant portion of the White Mountains near Springerville and Alpine, Arizona. For Greenlee County, the fire impacted the northern limits of the county including Beaverhead, Hannigan Meadow, and a portion of the Blue River wilderness, as well as traffic along Highway 191. The fire started May 29, 2011 and was controlled July 12, 2011, burning a total of 538,049 acres with over \$109 million in fire suppression costs. Five residences and one outbuilding were damaged, and 32 residences, 36 outbuildings and 4 commercial structures were completely destroyed. Total damages are estimated to exceed \$10 million and 8 firefighting related injuries were reported.
- On April 11, 2018, The human-caused Rattlesnake Fire started just north of the Black River in Apache County. The wildfire spread southeast into Graham and Greenlee Counties on April 13th and continued to grow until becoming contained during May. Most of the 26,072 acres that were consumed by the Rattlesnake Fire were located in Greenlee County, such that by the end of the month it had consumed about 26,000 acres.
- In June of 2020, Lightning ignited the Brigham Fire in the White Mountains, 22 miles north of Morenci. The fire spread rapidly, driven by multiple days of strong winds before becoming fully contained on July 29th after consuming a total of 23,142 acres. The cost of fighting the fire was

estimated at over \$9 million. Over 30 miles of U.S. Highway 191 were closed to traffic for most of the duration of the wildfire. By the end of June, the fire consumed its maximum acreage of 23,142 acres, but was only 40% contained. Full containment of 100% did not occur until July 29th

- On August 18, 2020, The Cow Canyon Fire was ignited by lightning southeast of Blue in Greenlee County. The fire grew only minimally for several weeks until hot, dry and breezy conditions caused more rapid growth toward the end of September. By the end of the month the fire had consumed 1500 acres.
- On June 16, 2021 the Horton Fire started 5 miles northeast of Hannagan Meadow, AZ. The fire was lightening started and is the result of four fires within the Horton Complex which merged into one fire on June 25, 2021. The fire has consumed 12,263 acres to date and is 33 percent contained.

There have been 14 wildfires impacting Greenlee County in excess of 100 acres for the period of 2014 to 2021. Maps 3A and 3B provide a graphical depiction of the 100 acre plus wildfires.

The Planning Team recognized that the declared disaster and historic hazard data collected and summarized in Section 5.1 does not adequately reflect the true cost of a wildfire. Particularly, the cost of wildfire suppression efforts to prevent structure and human loss. For example, the KP Fire did not result in any structure losses, however, the suppression costs exceeded \$6.2 million. Furthermore, the County, State, Forest Service, and other agencies spend millions of dollars every year in wildfire mitigation in fuel treatment projects.

Probability and Magnitude

The probability and magnitude of wildfire incidents for Greenlee County are influenced by numerous factors including vegetation densities, previous burn history, hydrologic conditions, climatic conditions such as temperature, humidity, and wind, ignition source (human or natural), topographic aspect and slope, and remoteness of area. Two sources were used to map the wildfire risk for Greenlee County. The first is the data developed for the Greenlee County Community Wildfire Protection Plan (LSD, 2005). The second is a regional fire risk coverage provided by the Arizona State Forestry Office. Each of these is discussed below.

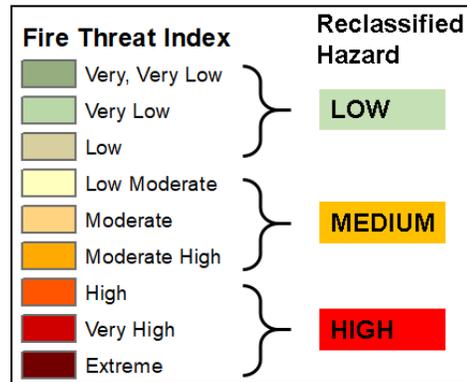
Greenlee County and various cooperating stakeholders collaborated to prepare the Greenlee County Community Wildfire Protection Plan (GCCWPP). The GCCWPP established the Wildland Urban Interface (WUI) areas for the County, and mapped various wildfire risk elements such as vegetative fuels and densities, topographical slope and aspect, previous burn areas and ignition points, and prior treatment areas. Using these elements, a comprehensive fuels hazard risk map¹⁸ was developed for the WUI and are shown in Figures 5-7 and 5-8. The High, Medium and Low hazard classifications are used for the Wildfire profile of this Plan in the WUI.

Following the State of Arizona's lead, the 2003/04 Arizona Wildland Urban Interface Assessment (AWUIA) project (Fisher, 2004) used in the 2015 Plan has been replaced with an updated regional dataset used to depict the threat of wildfire in Arizona as a part of the West Wide Wildfire Risk Assessment (WWWRA) (Sanborn Map Company, 2013) for the western U.S. The data and assessment results are hosted by the Arizona State Forestry and Fire Management Department on its website¹⁹. The wildfire hazards are derived from the Fire Threat Index (FTI) data distributed with the WWWRA. The FTI reflects the likelihood of one acre burning if a fire started at a specific grid location. The calculation process integrates the probability of an acre igniting and the expected final fire size into a single measure of wildland fire susceptibility. The assessed fire size is based on the rate of spread in four weather percentile categories. The key inputs used in the wildfire model to produce the FTI wildfire hazard layer are:

¹⁸ Figures 3.6 in the GCCWPP

¹⁹ Arizona Wildfire Risk Assessment Portal (AZWRAP), accessed at: <https://arizonawildfirerisk.com/>

- Probability of fire occurrence, derived from:
 - Historic fire locations and fire occurrence areas
 - Weather influence zones (historic weather observations)
- Fire behavior (rate of spread) derived from:
 - Surface fuels
 - Canopy closure
 - Canopy characteristics
 - Topography
- Fire suppression effectiveness, derived from:
 - Historic fire sizes
 - Historic protection organization



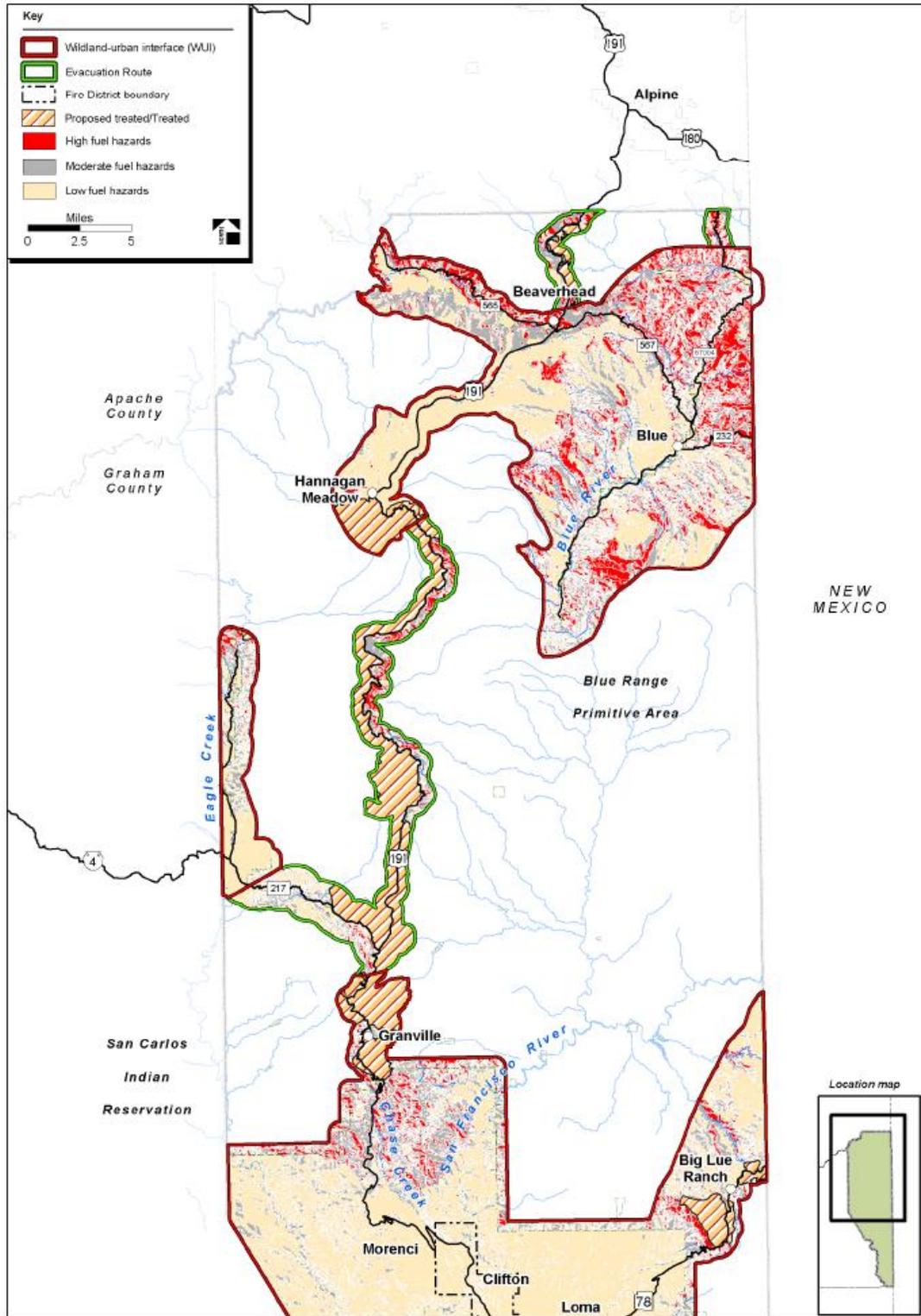
For the purposes of this Plan, the nine FTI

categories were reclassified into three generalized categories, Low, Medium and High wildfire hazard and applied as appropriate to compliment or augment the GCCWPP coverages.

The final wildfire hazard profile map for this Plan depicts a mosaic of the High, Medium and Low risk areas identified in the GCCWPP and the WWWWRA. The GCCWPP risk areas are assigned to the WUI and the wildfire risk for the rest of the county, outside of the WUI, is assigned based on the statewide WWWWRA layer. Maps 3A through 3D indicate the various wildfire hazard areas for Greenlee County and the incorporated boundaries of Clifton and Duncan.

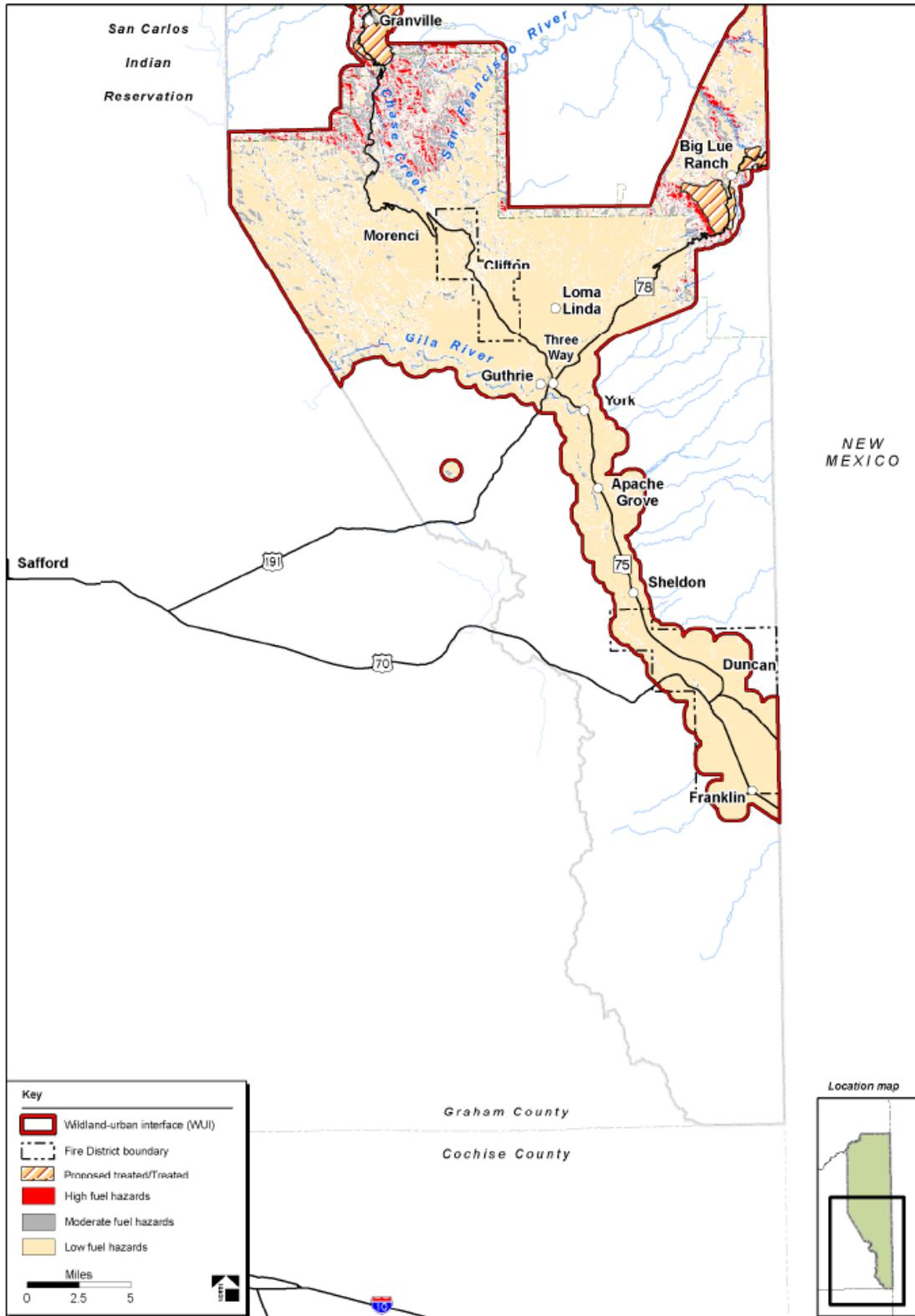
Climate Change Impacts

One of the “Key Messages” from the NCA report (Gonzalez, et.al., 2018) is the projection that wildfire risk and incidents within the Southwest region will likely increase due to climate change. Reduced precipitation, increased temperatures and longer, more severe periods of drought all factor into the assessment. Response to this amplification of current wildfire risk will likely include a greater need for vegetation management planning and greater enforcement of wildland urban interface best building practices. Incorporation of climate change impacts into the GCCWPP is also something the county and participating jurisdictions should consider.



Source: Greenlee County CWPP, 2005

Figure 5-7: Greenlee County CWPP Fuel Hazards Map – North Half



Source: Greenlee County CWPP, 2005

Figure 5-8: Greenlee County CWPP Fuel Hazards Map – South Half

The following table is an excerpt from the GCCWPP that summarizes the WUI risk for community areas within Greenlee County.

Table 3.6. Cumulative risk levels, by percentage of WUI area

| GCWPP communities | High risk (%) | acres | Moderate risk (%) | acres | Low risk (%) | acres | Total Acres |
|--------------------------|----------------------|--------------|--------------------------|--------------|---------------------|--------------|--------------------|
| Blue Area | 50 | 70,042 | 37 | 51,831 | 13 | 18,211 | 140,084 |
| Eagle Creek Area | 8 | 1,107 | 53 | 7,336 | 39 | 5,398 | 13,841 |
| Clifton Area | 4 | 3,500 | 33 | 28,879 | 63 | 55,133 | 87,512 |
| Morenci Area | 10 | 9,098 | 61 | 55,503 | 29 | 26,387 | 90,988 |
| Duncan Area | 0 | 0 | 47 | 23,001 | 53 | 25,937 | 48,938 |
| Evacuation Routes | 100 | 37,813 | 0 | 0 | 0 | 0 | 37,813 |
| Total Acres | | 121,560 | | 166,550 | | 131,066 | 419,176 |

Source: Logan Simpson Design Inc.

Vulnerability – CPRI Results

Wildfire CPRI results for each community are summarized in Table 5-16 below.

Table 5-16: CPRI results by jurisdiction for wildfire

| Participating Jurisdiction | Probability | Magnitude/ Severity | Warning Time | Duration | CPRI Score |
|-----------------------------------|--------------------|----------------------------|---------------------|-----------------|-------------------|
| Clifton | Possible | Limited | > 24 hours | < 1 week | 1.95 |
| Duncan | Possible | Negligible | < 6 hours | < 24 hours | 2.00 |
| Unincorporated Greenlee County | Highly Likely | Critical | < 6 hours | > 1 week | 3.70 |
| County-wide average CPRI = | | | | | 2.52 |

Vulnerability – Loss Estimations

The estimation of potential exposure to high and medium wildfire hazards was accomplished by intersecting the human and facility assets with the wildfire hazard limits depicted on Maps 3A – 3D. No wildfire related losses were estimated with this update. Table 5-17 summarizes the Planning Team identified critical and non-critical facilities potentially exposed to high and medium wildfire hazards. Table 5-18 summarizes population sectors exposed to the high and medium wildfire hazards. Residential structure exposure to high and medium wildfire hazards are summarized in Table 5-19.

In summary, \$0 and \$2.75 million in asset related exposure to high and medium wildfire hazards, for all the participating jurisdictions in Greenlee County. An additional \$7.7 and \$21.3 million in high and medium hazard wildfire exposure to residential facilities, is estimated for all participating Greenlee County jurisdictions. It should be noted that typical damage estimates do not include the cost of wildfire suppression which can be substantial. For example, a Type 1 wildfire fighter crew costs about \$1 million per day.

Regarding human vulnerability, a county-wide population of 95 and 327 people, or 1.12% and 3.88% of the total, are potentially exposed to a high and medium hazard wildfire event, respectively. Typically, deaths and injuries not related to firefighting activities are rare. However, it is feasible to assume that at least one death and/or injury may be plausible. There is also a high probability of population displacement during a wildfire event, and especially in the urban wildland interface areas.

Table 5-17: Asset inventory exposure to high and medium hazard wildfire and corresponding loss estimates

| Community | Total Facilities Reported by Community | Impacted Facilities | Percentage of Total Community Facilities Impacted | Estimated Replacement Cost (x \$1000) |
|--------------------------------|--|---------------------|---|---------------------------------------|
| HIGH | | | | |
| County-Wide Totals | 155 | 0 | 0.00% | \$0 |
| Clifton | 61 | 0 | 0.00% | \$0 |
| Duncan | 44 | 0 | 0.00% | \$0 |
| Unincorporated Greenlee County | 50 | 0 | 0.00% | \$0 |
| MEDIUM | | | | |
| County-Wide Totals | 155 | 4 | 2.58% | \$2,750 |
| Clifton | 61 | 1 | 1.64% | \$750 |
| Duncan | 44 | 0 | 0.00% | \$0 |
| Unincorporated Greenlee County | 50 | 3 | 6.00% | \$2,000 |

Table 5-18: Population sectors exposed to high and medium hazard wildfire

| Community | Total Population | Population Exposed | Percent of Population Exposed | Total Population Over 65 | Population Over 65 Exposed | Percent of Population Over 65 Exposed |
|--------------------------------|------------------|--------------------|-------------------------------|--------------------------|----------------------------|---------------------------------------|
| HIGH | | | | | | |
| County-Wide Totals | 8,438 | 95 | 1.12% | 1,015 | 18 | 1.82% |
| Clifton | 3,319 | 0 | 0.00% | 313 | 0 | 0.00% |
| Duncan | 699 | 0 | 0.00% | 109 | 0 | 0.00% |
| Unincorporated Greenlee County | 4,420 | 95 | 2.15% | 593 | 18 | 3.11% |
| MEDIUM | | | | | | |
| County-Wide Totals | 8,438 | 327 | 3.88% | 1,015 | 69 | 6.80% |
| Clifton | 3,319 | 122 | 3.68% | 313 | 26 | 8.31% |
| Duncan | 699 | 11 | 1.57% | 109 | 2 | 1.83% |
| Unincorporated Greenlee County | 4,420 | 194 | 4.39% | 593 | 41 | 6.91% |

| Table 5-19: Residential structures with High and Medium hazard exposure to wildfire | | | | | | |
|--|-----------------------------------|--------------------------------------|----------------|---|---|----------------|
| Community | Residential Building Count | Residential Building Exposure | | Residential Building Replacement Value (x\$1000) | Residential Building Value Exposed | |
| | | Total | Percent | | Total (x\$1000) | Percent |
| HIGH | | | | | | |
| County-Wide Totals | 3,061 | 78 | 2.55% | \$287,960 | \$7,752 | 2.69% |
| Clifton | 1,246 | 0 | 0.00% | \$112,685 | \$0 | 0.00% |
| Duncan | 201 | 0 | 0.00% | \$14,910 | \$0 | 0.00% |
| Unincorporated Greenlee County | 1,614 | 78 | 4.83% | \$160,365 | \$7,752 | 4.83% |
| MEDIUM | | | | | | |
| County-Wide Totals | 3,061 | 222 | 7.25% | \$287,960 | \$21,335 | 7.41% |
| Clifton | 1,246 | 71 | 5.70% | \$112,685 | \$6,444 | 5.72% |
| Duncan | 201 | 6 | 2.99% | \$14,910 | \$477 | 3.20% |
| Unincorporated Greenlee County | 1,614 | 145 | 8.98% | \$160,365 | \$14,414 | 8.99% |

It is duly noted that the loss and exposure numbers presented above represent a comprehensive evaluation of the County as a whole. It is unlikely that a wildfire would occur that would impact all of the high and medium wildfire hazard areas at the same time. Accordingly, actual event based losses and exposure are likely to be only a fraction of those summarized above.

Vulnerability – Development Trend Analysis

By its very definition, the WUI represents the fringe of urban development as it intersects with the natural environment. As previously discussed, wildfire risks are significant for a sizeable portion of the county. Any future development will only increase the WUI areas and expand the potential exposure of structures to wildfire hazards. The GCCWPP addresses mitigation opportunities for expanding WUI areas and provides recommended guidelines for safe building and land-use practices in wildfire hazard areas.

Changes in Development in the Hazard Prone Area

Within the unincorporated areas of Greenlee County and the Town of Clifton, ongoing efforts to clear overgrowth of vegetation within jurisdictional limits and proximity to existing development continues. There are no changes in development in the Towns of Duncan and Clifton that impact wildfire hazard.

Sources

Arizona Department of Emergency and Military Affairs, 2018, *State of Arizona Multi-Hazard Mitigation Plan, 2018 Update*.

Arizona Wildfire Risk Assessment Portal (AZWRAP), accessed at: <https://arizonawildfirerisk.com/>

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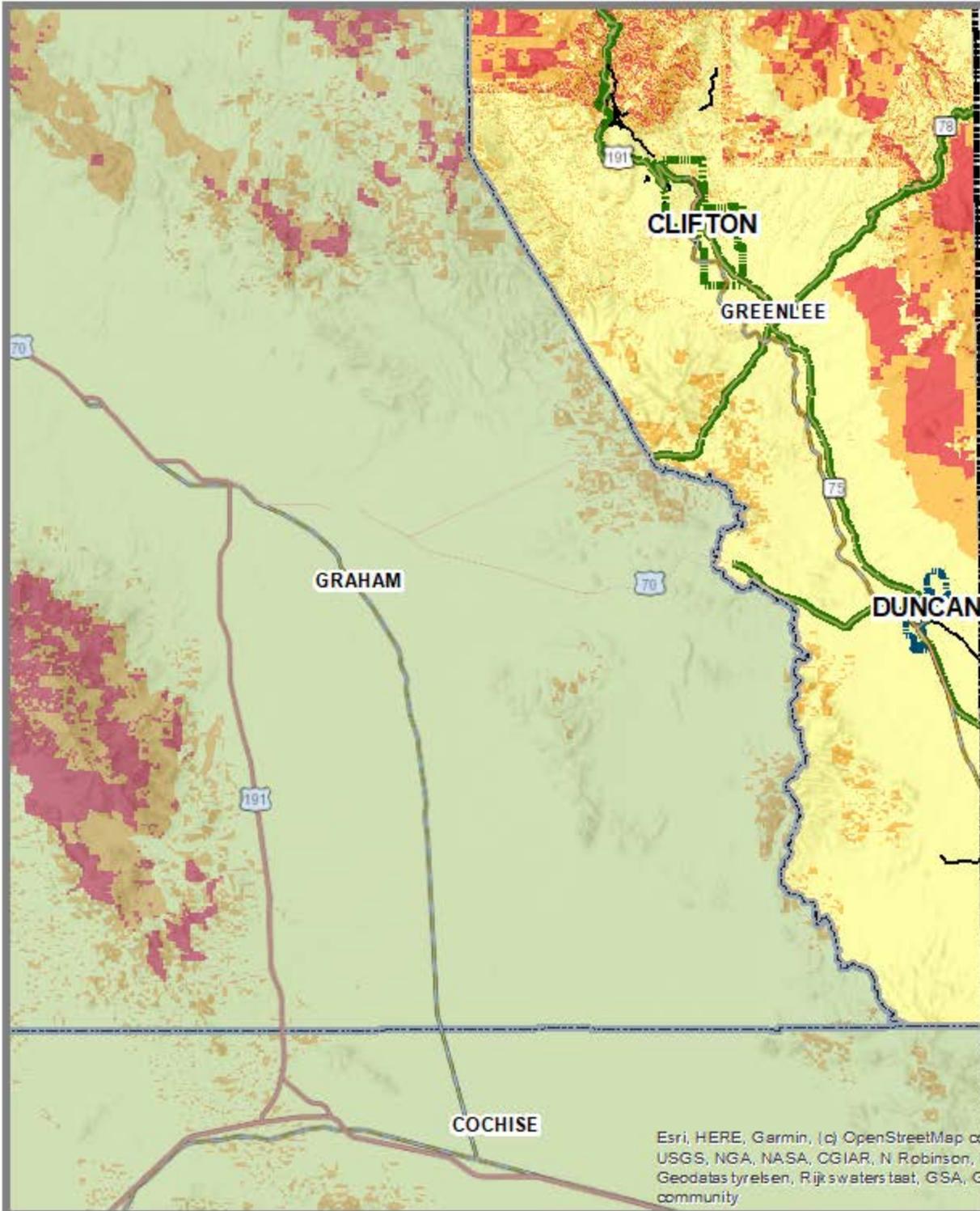
Profile Maps

Maps 3A and 3B – County-Wide Wildfire Hazard Maps

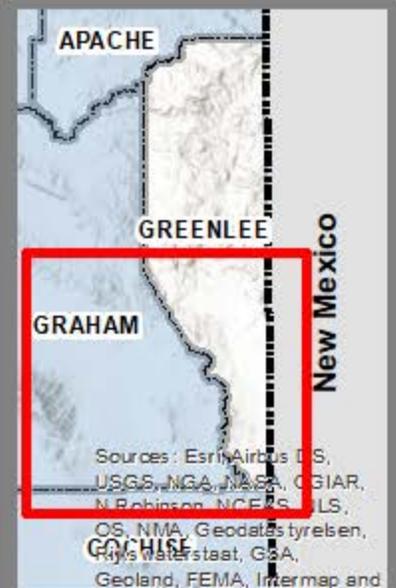
Maps 3C and 3D – Clifton and Duncan Wildfire Hazard Maps

Greenlee County
Multi-Jurisdictional
Hazard Mitigation Plan

Map3A
Greenlee County
Wildfire Hazard Map
as of June 2021



New Mexico



Sources: Esri, Airbus DS,
USGS, NGA, NASA, CGIAR,
N. Robinson, NCEAS, NLS,
OS, NMA, Geodatas tyrselen,
Rijks waters taat, GSA,
Geoland, FEMA, Intermap and

Legend

Major Roadways

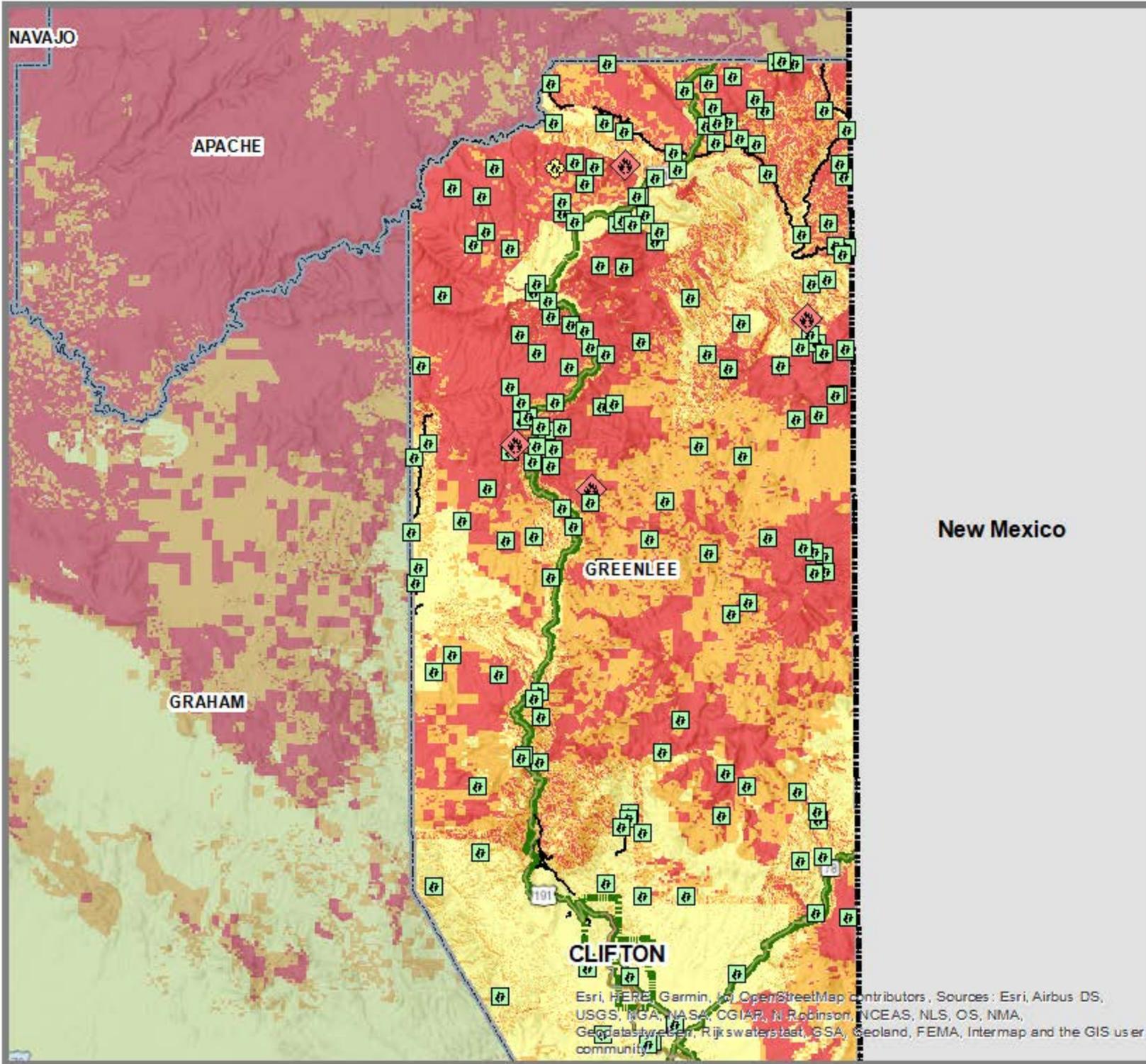
- Interstate
- US, State, County Hwys
- Major Roads

Wildfire
Haz_rating

- High
- Medium
- Low

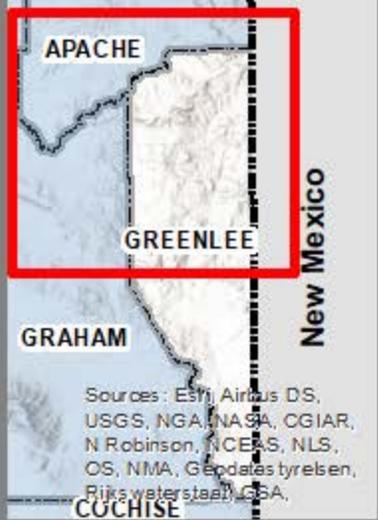


Esri, HERE, Garmin, (c) OpenStreetMap contributors, Sources: Esri, Airbus DS,
USGS, NGA, NASA, CGIAR, N. Robinson, NCEAS, NLS, OS, NMA,
Geodatas tyrselen, Rijks waters taat, GSA, Geoland, FEMA, Intermap and the GIS user
community



Greenlee County
Multi-Jurisdictional
Hazard Mitigation Plan

Map3B
Greenlee County
Wildfire Hazard Map
as of June 2021



New Mexico

Legend

Calculated

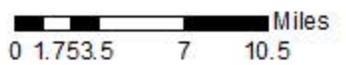
- 0 - 1000
- 1001 - 10000
- 10001 - 50000

Major Roadways

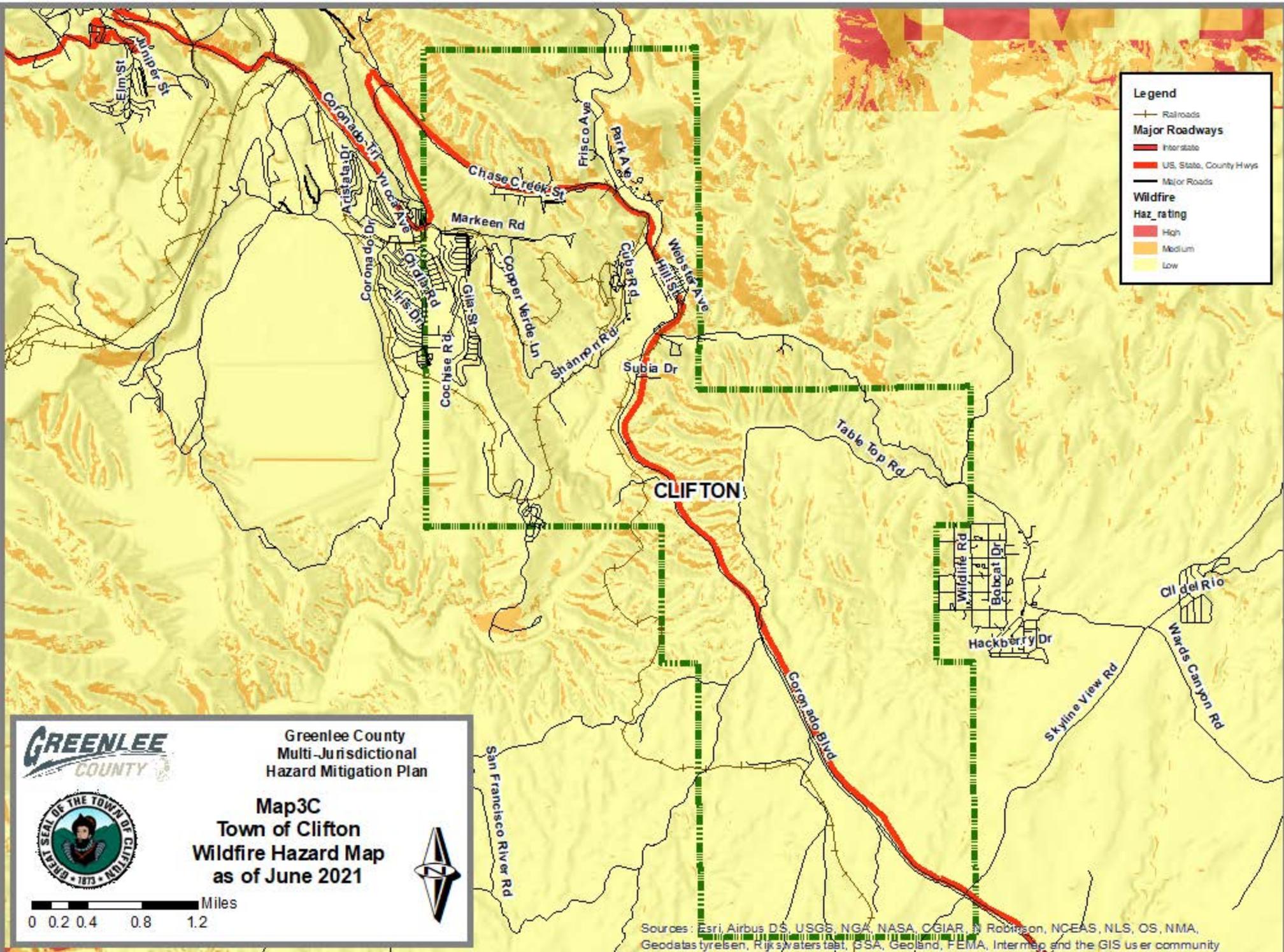
- Interstate
- US, State, County Highways
- Major Road

Wildfire Haz. rating

- High
- Medium
- Low



Esri, HERE, Garmin, OpenStreetMap contributors, Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatas tyrselen, Rijks waterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community



Legend

- Railroads
- Major Roadways**
 - Interstate
 - US, State, County Hwys
 - Major Roads
- Wildfire**
- Haz_rating**
 - High
 - Medium
 - Low



Greenlee County
Multi-Jurisdictional
Hazard Mitigation Plan

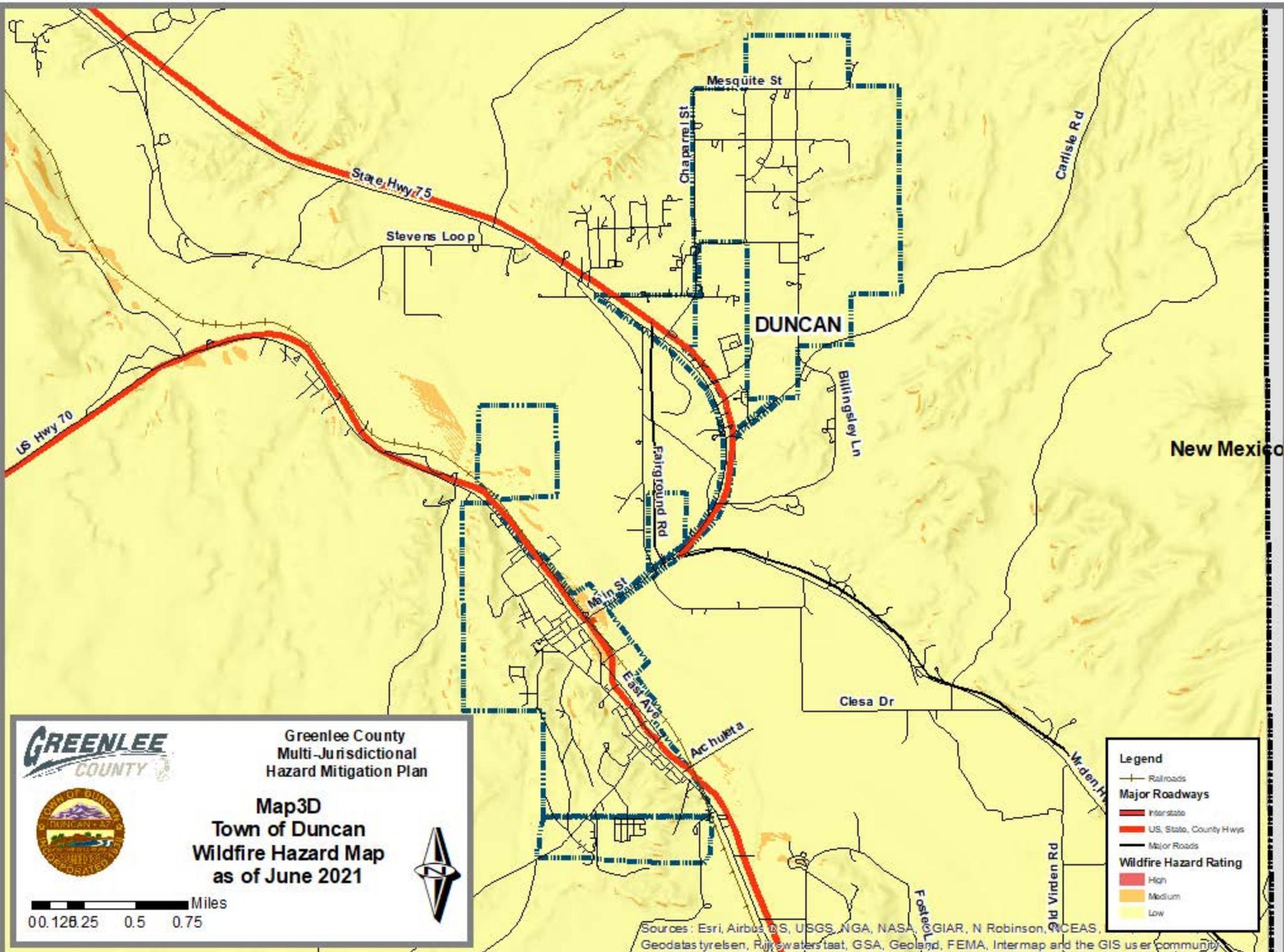


Map3C
Town of Clifton
Wildfire Hazard Map
as of June 2021



Miles
0 0.2 0.4 0.8 1.2

Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, Robinson, NCEAS, NLS, OS, NMA, Geodatas byreisen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community



Greenlee County
Multi-Jurisdictional
Hazard Mitigation Plan



Map3D
Town of Duncan
Wildfire Hazard Map
as of June 2021



Miles
0.0 0.125 0.25 0.5 0.75

Legend

- Railroads
- Major Roadways**
 - Interstate
 - US, State, County Hwys
 - Major Roads
- Wildfire Hazard Rating**
 - High
 - Medium
 - Low

Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, OCEAS, Geodatas tyresen, Rijswatersstaat, GSA, Geoland, FEMA, Intermap and the GIS user community

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5.4 Risk Assessment Summary

The jurisdictional variability of risk associated with each hazard assessed in Section 5.3 is demonstrated by the various CPRI and loss estimation results. Each jurisdiction has varying levels of risk regarding the Plan hazards and their need for mitigation, and may not consider all of the hazards as posing a great risk to their individual communities.

Table 5-20 summarizes the hazards selected for mitigation by each jurisdiction and will be the basis for each jurisdictions mitigation strategy. It is noted that for Levee Failure and Wildfire, the priorities of Clifton and Duncan differ from Greenlee County. These differences are further discussed below.

| Table 5-20: Summary of hazards to be mitigated by each participating jurisdiction | | | | |
|---|----------------|-----------------|----------------------|-----------------|
| Jurisdiction | Drought | Flooding | Levee Failure | Wildfire |
| Unincorporated Greenlee County | M | M | NH | M |
| Clifton | M | M | M | NH |
| Duncan | M | M | M | NH |
| M – Mitigation A/Ps will be identified NH – Nuisance hazard - no mitigation is warranted NV – Jurisdiction is not vulnerable to hazard – no mitigation is warranted | | | | |

5.4.1 Levee Failure

For Levee Failure, the unincorporated areas of the county do not have levees per se, however, there are several small berms and dikes that exist in remote rural areas of the county. These features are not owned or maintained by the county and pose very minor risk should they fail or be overtopped. In contrast, as explained in Section 5.3.3, the Towns of Clifton and Duncan are protected by levees or levee-like structures and consider the risk of failure to be significant. Accordingly, the County ranked Levee Failure as a Nuisance Hazard, while the Towns of Clifton and Duncan consider mitigation as a necessary part of this plan.

5.4.2 Wildfire

As summarized in Section 5.3.4, the threat of wildfire in Clifton and Duncan is low and essentially in-significant except on a nuisance and infrequent basis. In contrast, the northern part of Greenlee County is heavily forested and presents a significant wildfire threat to the small communities and county-owned facilities in those areas. Accordingly, the County considers wildfire mitigation as a priority, whereas Clifton and Duncan consider wildfire as a nuisance hazard.

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SECTION 6: MITIGATION STRATEGY

§201.6(c)(3): [The plan shall include...] (3) A **mitigation strategy** that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools. This section shall include:

- (i) A description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.
- (ii) A section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.
- (iii) An action plan describing how the actions identified in paragraph (c)(3)(ii) of this section will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.
- (iv) For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.

The mitigation strategy provides the “what, when, and how” of actions that will reduce or possibly remove the community’s exposure to hazard risks. According to DMA 2000, the primary components of the mitigation strategy are generally categorized into the following:

- Goals and Objectives**
- Capability Assessment**
- Mitigation Actions/Projects and Implementation Strategy**

The entire 2016 Plan mitigation strategy was reviewed and updated by the MJPT, including the addition or augmentation of the section describing National Flood Insurance Program (NFIP) compliance. Specifics of the changes and updates are discussed in the subsections below.

6.1 Hazard Mitigation Goals and Objectives

The 2016 Plan goals and objectives were developed using the 2013 State Plan²⁰ goals and objectives as a starting point. Each jurisdiction then edited and modified those goals and objectives to fit the mitigation planning vision for their community. An assessment of those goals and objectives by the Planning Team and the Local Planning Team for each jurisdiction was made with consideration of the following²¹:

- Do the goals and objectives identified in the 2016 Plan reflect the updated risk assessment?
- Did the goals and objectives identified in the 2016 Plan lead to mitigation projects and/or changes to policy that helped the jurisdiction(s) to reduce vulnerability?
- Do the goals and objectives identified in the 2016 Plan support any changes in mitigation priorities?
- Are the goals and objectives identified in the 2016 Plan reflective of current State goals?

After discussion and comparison of the 2016 Plan goals and objectives to the 2018 State Plan, the Planning Team chose to keep the 2016 Plan goal and objectives as-is and without change, as documented below:

- **GOAL:** Reduce or eliminate the risk to people and property from natural hazards.
 - ◆ **Objective 1:** Reduce or eliminate risks that threaten life and property in the incorporated and unincorporated jurisdictions within Greenlee County.
 - ◆ **Objective 2:** Reduce risk to critical facilities and infrastructure from natural hazards.

²⁰ State of Arizona, 2013, *State of Arizona All Hazard Mitigation Plan*

²¹ FEMA, 2008, *Local Multi-Hazard Mitigation Planning Guidance*

- ◆ **Objective 3:** Promote hazard mitigation throughout the incorporated and unincorporated jurisdictions within Greenlee County.
- ◆ **Objective 4:** Increase public awareness of hazards and risks that threaten the incorporated and unincorporated jurisdictions within Greenlee County.

6.2 Capability Assessment

An important component of the Mitigation Strategy is a review of each participating jurisdiction's resources in order to identify, evaluate, and enhance the capacity of local resources to mitigate the effects of hazards. The capability assessment is comprised of several components:

- ✓ Legal and Regulatory Review – a review of the legal and regulatory capabilities, including ordinances, codes, plans, manuals, guidelines, and technical reports that address hazard mitigation activities.
- ✓ Technical Staff and Personnel – this assessment evaluates and describes the administrative and technical capacity of the jurisdiction's staff and personnel resources.
- ✓ Fiscal Capability – this element summarizes each jurisdiction's fiscal capability to provide the financial resources to implement the mitigation strategy.
- ✓ National Flood Insurance Program (NFIP) Participation – the NFIP contains specific regulatory measures that enable government officials to determine where and how growth occurs relative to flood hazards. Participation in the NFIP is voluntary for local governments, but the program is promoted by FEMA as a basic first step for implementing and sustaining an effective flood hazard mitigation program, and is a key indicator for measuring local capability as part of this assessment.

For this update, the MJPT reviewed the information provided in Section 6.2 of the 2016 Plan and updated data in the tables of Section 6.2.1 as appropriate.

6.2.1 Jurisdictional Capabilities

Tables 6-1-1 through 6-1-3 summarize the legal and regulatory mitigation capability for each participating jurisdiction. Information provided includes a brief listing of current codes, mitigation relevant ordinances, plans, and studies/reports. Tables 6-2-1 through 6-2-3 summarize the staff and personnel resources employed by each jurisdiction that serve as a resource for hazard mitigation. Tables 6-3-1 through 6-3-3 summarize the fiscal capability and budgetary tools available to each participating jurisdiction. Each of these three tables are listed below by jurisdiction. For each jurisdiction, a brief summary of opportunities to enhance their mitigation capabilities is provided.

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| Table 6-1-1: Legal and regulatory capabilities for Greenlee County | | |
|---|---|---|
| Regulatory Tools for Hazard Mitigation | Description | Responsible Department/Agency |
| CODES | <ul style="list-style-type: none"> To be added within next 5 years | <ul style="list-style-type: none"> A position of Building Inspector to be added in the next 5 years |
| ORDINANCES | <ul style="list-style-type: none"> Floodplain Management Ordinance (9/2007 and updated 4/2016) Zoning Ordinance (2/1985) Subdivision Ordinance (1/1978) Hazard Abatement Ordinance (11/2005) | <ul style="list-style-type: none"> County Engineer |
| PLANS, MANUALS, and/or GUIDELINES | <ul style="list-style-type: none"> Comprehensive Plan (3/2003) - Includes sections related to Land Use, Transportation, Water Resources, Open Space. Airport Master Plan (4/2008) - Master plan developed to address issues regarding the airport and future expansion. Loma Linda Landfill C&D Landfill Facility Plan (1998) - Municipal Solid Waste Loma Linda Landfill APP (1/2002) - Construction and Demolition HAZMAT Response Plan (2015) Greenlee County Community Wildfire Protection Plan (9/2005) - A plan to identify and guide wildfire hazards and potential mitigation measure for the wildland urban interface areas. Greenlee County Multi-Hazard Mitigation Plan (2016). Greenlee County Emergency Operations Plan (2021) | <ul style="list-style-type: none"> County Administrator County Engineer Board of Supervisors Public Works Director Emergency Manager |
| STUDIES | <ul style="list-style-type: none"> FEMA Flood Insurance Study for Greenlee County (2007). Southern Greenlee County Small Area Transportation Study – Final Report (2008) | <ul style="list-style-type: none"> County Engineer |

Table 6-2-1: Technical staff and personnel capabilities for Greenlee County

| Staff/Personnel Resources | <input checked="" type="checkbox"/> | Department/Agency - Position |
|---|-------------------------------------|--|
| Planner(s) or engineer(s) with knowledge of land development and land management practices | <input checked="" type="checkbox"/> | Public Works Department – County Engineer |
| Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure | <input checked="" type="checkbox"/> | Public Works Department – County Engineer |
| Planner(s) or engineer(s) with and understanding of natural and/or human-caused hazards | <input checked="" type="checkbox"/> | Public Works Department – County Engineer Emergency Management – Emergency Manager |
| Floodplain Manager | <input checked="" type="checkbox"/> | Public Works Department – County Engineer |
| Surveyors | | None |
| Staff with education or expertise to assess the community’s vulnerability to hazards | <input checked="" type="checkbox"/> | Public Works Department – County Engineer Emergency Management – Emergency Manager |
| Personnel skilled in GIS and/or HAZUS | <input checked="" type="checkbox"/> | Information Technology Dept. – Information Systems Manager |
| Scientists familiar with the hazards of the community | | None |
| Emergency Manager | <input checked="" type="checkbox"/> | Administration – County Administrator Emergency Management – Emergency Manager Public Works Department – County Engineer |
| Grant writer(s) | <input checked="" type="checkbox"/> | Economic Developer |

Table 6-3-1: Fiscal capabilities for Greenlee County

| Financial Resources | Accessible or Eligible to Use (Yes, No, Don’t Know) | Comments |
|--|---|------------------------|
| Community Development Block Grants | Yes | None |
| Capital Improvements Project funding | Yes | General Funds – 5-year |
| Authority to levee taxes for specific purposes | Yes | By vote |
| Fees for water, sewer, gas, or electric service | No | None |
| Impact fees for homebuyers or new developments/homes | Yes | Some development |
| Incur debt through general obligation bonds | Yes | None |
| Incur debt through special tax bonds | Yes | By vote only |
| Other | | |

Opportunities to Improve Existing Capabilities

Greenlee County has identified two areas where their capabilities to implement hazard mitigation can be improved in the future. The County will work toward adopting the most recent International Building Codes and hiring a Building Inspector to better implement hazard mitigation in development within County. The County also is looking at updating existing Ordinances having hazard mitigation components and will reference the Plan in this effort.

| Regulatory Tools for Hazard Mitigation | Description | Responsible Department/Agency |
|---|---|--|
| CODES | <ul style="list-style-type: none"> • 2009 International Building Codes | <ul style="list-style-type: none"> • Town Manager • Building Official |
| ORDINANCES | <ul style="list-style-type: none"> • Flood Damage Prevention (2007) | <ul style="list-style-type: none"> • Town Manager/ Flood Plain Manager |
| PLANS, MANUALS, and/or GUIDELINES | <ul style="list-style-type: none"> • Town of Clifton General Plan (2020) A plan that provides an inventory of existing conditions for key planning elements and future economic development and zoning. • Greenlee County Community Wildfire Protection Plan (9/2005) - A plan to identify and guide wildfire hazards and potential mitigation measure for the wildland urban interface areas. • Town of Clifton Emergency Operations Plan (1995) • Town of Clifton Multi-Hazard Mitigation Plan (2016). • Operation, Maintenance, Repair, Replacement, and Rehabilitation Manual – Clifton Flood Control Project (1996) | <ul style="list-style-type: none"> • Town Manager • Town Council • Police Chief • Fire Chief |
| STUDIES | <ul style="list-style-type: none"> • South Clifton Drainage Study (2000) • FEMA Flood Insurance Study 2007 • FEMA Flood Insurance Study 1983 | <ul style="list-style-type: none"> • Town Manager • Public Works • Consulting Engineers |

| Staff/Personnel Resources | <input checked="" type="checkbox"/> | Department/Agency - Position |
|---|-------------------------------------|--|
| Planner(s) or engineer(s) with knowledge of land development and land management practices | <input checked="" type="checkbox"/> | <ul style="list-style-type: none"> • Town Manager • Building Inspector |
| Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure | <input checked="" type="checkbox"/> | <ul style="list-style-type: none"> • Building Inspector • Consulting Engineers |
| Planner(s) or engineer(s) with and understanding of natural and/or human-caused hazards | <input checked="" type="checkbox"/> | <ul style="list-style-type: none"> • Building Inspector • Police Chief • Fire Chief |
| Floodplain Manager | <input checked="" type="checkbox"/> | <ul style="list-style-type: none"> • Town Manager |
| Surveyors | | None |
| Staff with education or expertise to assess the community’s vulnerability to hazards | <input checked="" type="checkbox"/> | <ul style="list-style-type: none"> • Town Manager • Public Works Director • Building Inspector |
| Personnel skilled in GIS and/or HAZUS | | None |
| Scientists familiar with the hazards of the community | | None |
| Emergency Manager | <input checked="" type="checkbox"/> | <ul style="list-style-type: none"> • Town Manager • Chief of Police • Greenlee County Emergency Manager |

| Staff/Personnel Resources | <input checked="" type="checkbox"/> | Department/Agency - Position |
|----------------------------------|-------------------------------------|---|
| Grant writer(s) | <input checked="" type="checkbox"/> | <ul style="list-style-type: none"> • Town Manager • Town Clerk • Code Enforcement Officer/Building Inspector • Police Chief |

| Financial Resources | Accessible or Eligible to Use (Yes, No, Don't Know) | Comments |
|--|--|---|
| Community Development Block Grants | Yes | |
| Capital Improvements Project funding | Yes | |
| Authority to levee taxes for specific purposes | Yes | Vote of Residents |
| Fees for water, sewer, gas, or electric service | Yes | Sewer only |
| Impact fees for homebuyers or new developments/homes | Yes | Not currently applying, but are eligible. |
| Incur debt through general obligation bonds | Yes | Vote of Residents |
| Incur debt through special tax bonds | Yes | Vote of Residents |
| Other: Hazard Mitigation Grants – FEMA | Yes | |

Opportunities to Improve Existing Capabilities

The Town of Clifton is presently reviewing existing Codes and Ordinances, with the goal of updating these documents to fill gaps in regulation as it pertains to hazard mitigation. Other opportunities identified by the Town include improving existing education and outreach efforts, with the goal of increasing public awareness of existing hazards, their risk, and mitigation, and working with Greenlee County to update the existing Community Wildfire Protection Plan, last updated in 2005.

| Regulatory Tools for Hazard Mitigation | Description | Responsible Department/Agency |
|---|---|--|
| CODES | <ul style="list-style-type: none"> Uniform Building Code 1997 | <ul style="list-style-type: none"> Town Manager/ Building Inspector |
| ORDINANCES | <ul style="list-style-type: none"> Zoning Ordinance - Town of Duncan Codebook, Chapter 15 Subdivision Ordinance - Town of Duncan Codebook, Chapter 15 Special Purpose Ordinance - Town of Duncan Codebook, Chapter 15 and 17 Greenlee County Floodplain Ordinance Growth Management Ordinance - Town of Duncan Codebook, Chapter 15 Site Plan Review Requirements Ordinance - Town of Duncan Codebook, Chapter 15 | <ul style="list-style-type: none"> Town Manager/Planning and Zoning |
| PLANS, MANUALS, and/or GUIDELINES | <ul style="list-style-type: none"> Town of Duncan General Plan (12/2004) - A plan that provides an inventory of existing conditions for key planning elements and future economic development and zoning. Town of Duncan Multi-Hazard Mitigation Plan (2016). Town of Duncan Emergency Operations Plan and Procedures (2007) | <ul style="list-style-type: none"> Town Manager/ Town Council |
| STUDIES | <ul style="list-style-type: none"> FEMA Flood Insurance Study (2007) | <ul style="list-style-type: none"> Town Manager/ Town Council |

| Staff/Personnel Resources | <input checked="" type="checkbox"/> | Department/Agency - Position |
|---|-------------------------------------|---|
| Planner(s) or engineer(s) with knowledge of land development and land management practices | | None (use contract engineer -Bowman Engineering, 305 East 4 th Street, Safford, AZ, 85546, Phone: 928-428-3898) |
| Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure | | None (use contract engineer -Bowman Engineering, 305 East 4 th Street, Safford, AZ, 85546, Phone: 928-428-3898) |
| Planner(s) or engineer(s) with and understanding of natural and/or human-caused hazards | <input checked="" type="checkbox"/> | None (use contract engineer -Bowman Engineering, 305 East 4 th Street, Safford, AZ, 85546, Phone: 928-428-3898) |
| Floodplain Manager | <input checked="" type="checkbox"/> | <ul style="list-style-type: none"> Town Manager Greenlee County Public Works Department – County Engineer |
| Surveyors | | None (use contract engineer -Bowman Engineering, 305 East 4 th Street, Safford, AZ, 85546, Phone: 928-428-3898) |
| Staff with education or expertise to assess the community’s vulnerability to hazards | | <ul style="list-style-type: none"> NO FULL TIME STAFF |
| Personnel skilled in GIS and/or HAZUS | | None |

| Table 6-2-3: Technical staff and personnel capabilities for Duncan | | |
|---|-------------------------------------|---|
| Staff/Personnel Resources | <input checked="" type="checkbox"/> | Department/Agency - Position |
| Scientists familiar with the hazards of the community | | None |
| Emergency Manager | <input checked="" type="checkbox"/> | <ul style="list-style-type: none"> Town Manager |
| Grant writer(s) | <input checked="" type="checkbox"/> | <ul style="list-style-type: none"> Grant Coordinator Town Manager |

| Table 6-3-3: Fiscal capabilities for Duncan | | |
|--|--|--|
| Financial Resources | Accessible or Eligible to Use (Yes, No, Don't Know) | Comments |
| Community Development Block Grants | Yes | |
| Capital Improvements Project funding | Yes | 5-Year |
| Authority to levee taxes for specific purposes | Yes | Through Voters |
| Fees for water, sewer, gas, or electric service | Yes | Town of Duncan and Duncan Valley Electric Coop |
| Impact fees for homebuyers or new developments/homes | Yes | Chapter 15-13 Building Permits |
| Incur debt through general obligation bonds | Yes | Currently have bonds for water and sewer |
| Incur debt through special tax bonds | No | |
| Other | | |

Opportunities to Improve Existing Capabilities

The Town of Duncan has identified several areas they will target in order to improve their existing hazard mitigation capabilities. These include pursuing funding for proposed projects through Freeport McMoRan, Inc, adopting a Floodplain Ordinance for the Town, and adopting higher floodplain standards to better protect residence from the impacts of flooding.

6.2.4 National Flood Insurance Program Participation

Participation in the NFIP is a key element of any community’s local floodplain management and flood mitigation strategy. Greenlee County, Clifton and Duncan all participate in the NFIP at varying levels.

Joining the NFIP requires the adoption of a floodplain management ordinance that requires jurisdictions to follow established minimum standards set forth by FEMA and the State of Arizona when developing in the floodplain. These standards require that all new buildings and substantial improvements to existing buildings will be protected from damage by the 100-year flood, and that new floodplain development will not aggravate existing flood problems or increase damage to other properties. Greenlee County and some other communities, have adopted standards that are more stringent than the federal minimum to ensure better flood mitigation practices. As a participant in the NFIP, communities also benefit from having Flood Insurance Rate Maps (FIRM) that map identified flood hazard areas and can be used to assess flood hazard risk, regulate construction practices and set flood insurance rates. FIRMs are also an important source of information to educate residents, government officials and the private sector about the likelihood of flooding in their community. Table 6-4 summarizes the NFIP status and statistics for each of the jurisdictions participating in this Plan.

| Table 6-4: NFIP status and statistics for Greenlee County and participating jurisdictions | | | | | | |
|--|---------------------|------------------------|-----------------------------------|---------------------------|---------------------------------------|---|
| Jurisdiction | Community ID | NFIP Entry Date | Current Effective Map Date | Number of Policies | Amount of Coverage (x \$1,000) | Floodplain Management Role |
| Greenlee County (Unincorporated) | 040110 | 7/18/1985 | 9/28/2007 | 7 | \$1,074 | County manages floodplains for unincorporated areas of the County and provides assistance to Clifton and Duncan |
| Clifton | 040035 | 3/1/1984 | 9/28/2007 | 10 | \$3,067.8 | Town manages floodplains within Town limits with assistance from the County |
| Duncan | 040036 | 8/2/1982 | 9/28/2007 | 7 | \$775.9 | Town manages floodplains within Town limits with assistance from the County |
| Sources: Policy Statistics - https://nfipservices.floodsmart.gov/reports-flood-insurance-data (5/31/2021) ; NFIP Status - https://www.fema.gov/cis/AZ.html (6/30/2021) | | | | | | |

Each of the participating jurisdictions performed an overall assessment of their participation in the NFIP program by responding to the following questions:

- Question 1:** Describe your jurisdiction’s current floodplain management / regulation process for construction of new or substantially improved development within your jurisdiction.
- Question 2:** Describe the status and/or validity of the current floodplain hazard mapping for your jurisdiction.
- Question 3:** Describe any community assistance activities (e.g. – help with obtaining Elevation Certificates, flood hazard identification assistance, flood insurance acquisition guidance, public involvement activities, etc.)

Question 4: Describe identified needs in your floodplain management program. This could include things like updating the floodplain management code/regulation, establishing written review procedures, modifying or adding flood hazard area mapping, etc.

Responses were provided by all jurisdictions regardless of their participation status in the NFIP program. Table 6-5 summarizes the responses provided by each of the currently participating jurisdictions

| Table 6-5: NFIP program assessment for Greenlee County and participating jurisdictions | | |
|---|-----------------------------------|--|
| Participating Jurisdiction | Responses to Questions 1-4 | |
| Clifton | Q1 | <ul style="list-style-type: none"> • Building permit process identifies floodplain (FP) status • Properties identified to be in a FP trigger an administrative review by the FP manager • Depending on the complexity, will require a study or analyses to determine base flood elevation and/or other compliance with NFIP • Require that an elevation certificate be produced for all new or substantially improved structures in a special flood hazard area |
| | Q2 | <ul style="list-style-type: none"> • Effective Maps from 2007 • Maps are good |
| | Q3 | <ul style="list-style-type: none"> • Coordinate with ADWR to get information to pass along to citizens • Assist the public with determining flood hazards • Test flood sirens every month, test flood gates annually in September • Public outreach on flood sirens |
| | Q4 | <ul style="list-style-type: none"> • None identified at this time |
| Duncan | Q1 | <ul style="list-style-type: none"> • Residential/Commercial/Industrial: Check BFE to determine FF elevation. Provide a minimum FF per ordinance • RV Parks: All must have quick connects to allow for moving the RVs in case of flood • Town does not allow building of permanent structures within the areas where FEMA acquired flood properties and dedicated back to Town • Where Elevation Certificates are required, citizens are directed to get with an engineer/surveyor to get those • Staff regularly attends NFIP related training events |
| | Q2 | <ul style="list-style-type: none"> • There is a need to map additional floodplains within the Town boundary, and particularly along an unnamed wash corridor within the Hunter Flat (northeast quadrant) area. See Map 1D in Section 5.3.2 for the approximate limits of the Town identified limits. |
| | Q3 | <ul style="list-style-type: none"> • Provide assistance in determining the BFE and proper FF elevations • Provide FEMA developed NFIP brochures to interested residents • Make copies of DFIRMs and floodplain workmaps as needed |

| Table 6-5: NFIP program assessment for Greenlee County and participating jurisdictions | | |
|---|-----------------------------------|---|
| Participating Jurisdiction | Responses to Questions 1-4 | |
| | Q4 | <ul style="list-style-type: none"> • Adding the new flood hazard area discussed above • Converting the Zone As to Zone AEs |
| Greenlee County | Q1 | <u>When a permit application comes in:</u> <ul style="list-style-type: none"> • Property is reviewed to determine if it lies within a special flood hazard area • Permittee is provided with information regarding FEMA DFIRM Panel • For Zone As, information is provided regarding resources for determining base flood elevations |
| | Q2 | <ul style="list-style-type: none"> • All of the Zone A's are not very good and need to be re-studied an re-mapped. • Zone AE's are pretty good |
| | Q3 | <ul style="list-style-type: none"> • NFIP brochures regarding floodplain management and flood insurance requirements are kept on-hand for distribution to the public as needed / warranted |
| | Q4 | <ul style="list-style-type: none"> • There is definitely a need for better mapping (both topographic and SFHA) • The County needs to update the floodplain management code to be consistent with the current State Code (process is currently underway) |

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6.3 Mitigation Actions/Projects and Implementation Strategy

Mitigation actions/projects (A/P) are those activities identified by a jurisdiction that, when implemented, will have the effect of reducing the community’s exposure and risk to the particular hazard or hazards being mitigated. The implementation strategy addresses the “*how, when, and by whom?*” questions related to implementing an identified A/P.

The update process for defining the new list of mitigation A/Ps for the Plan was accomplished in three steps. First, an assessment of the actions and projects specified in Section 6 of the 2016 Plan was performed, wherein each jurisdiction reviewed and evaluated their jurisdiction specific list. Second, a new list of A/Ps for the Plan was developed by combining the carry forward results from the assessment with new A/Ps. Third, an implementation strategy for the combined list of A/Ps was formulated. Details of each step and the results of the process are summarized in the following sections.

6.3.1 Previous Mitigation Actions/Projects Assessment

The MJPT and LPT for each jurisdiction reviewed and assessed their jurisdiction’s actions and projects listed in Tables 6-8-1 through 6-8-28 of the 2016 Plan. The assessment included evaluating and classifying each of the previously identified A/Ps based on the following criteria:

| STATUS | | DISPOSITION | |
|----------------------|--|--------------------|--------------------------|
| Classification | Explanation Requirement: | Classification | Explanation Requirement: |
| “No Action” | Reason for no progress | “Keep” | None required |
| “In Progress” | What progress has been made | “Revise” | Revised components |
| “Complete” | Date of completion and final cost of project (if applicable) | “Delete” | Reason(s) for exclusion. |

Any A/P with a disposition classification of “Keep” or “Revise” was carried forward to become part of the A/P list for the Plan. All A/Ps identified for deletion were removed and are not included in this Plan. The results of the assessment for each of the 2016 Plan A/Ps is summarized by jurisdiction in Tables A6-6-1 through A6-6-3 within Appendix A of this document.

6.3.2 New Mitigation Actions / Projects and Implementation Strategy

The first step in developing new mitigation actions/projects for each participating jurisdiction was to conduct a brainstorming session during the individual jurisdictional workshops. Using the goals, results of the vulnerability analysis and capability assessment, and the Planning Team’s institutional knowledge of hazard mitigation needs in the county and jurisdictions, the MJPT brainstormed to develop a comprehensive list of potential mitigation A/Ps that address the various hazards identified. The results of that brainstorming effort are summarized as follows:

| GENERAL MULTI-HAZARD: |
|--|
| Install/maintain early warning sirens in select strategic locations as a part of a comprehensive emergency notification system to inform citizens of impending hazards such as flooding, levee failure, severe weather conditions, and severe wind events. ***Addresses: <i>Levee Failure, Flood, Wildfire</i> *** |
| Use utility bill inserts, website notices, social media and newspaper articles to educate the public about hazards impacting the county and how to be prepared in the case of a disaster event. ***Addresses: <i>Levee Failure, Drought, Flood, Wildfire</i> *** |
| Provide links on the community’s website to sources of hazard mitigation educational materials (e.g. – www.fema.gov) encouraging private citizens to be prepared for hazard emergencies. ***Addresses: <i>Levee Failure, Drought, Flood, Wildfire</i> *** |
| Review and assess building and residential codes currently in use to determine if newer, more up-to-date codes are available or required ***Addresses: <i>Levee Failure, Drought, Flood, Wildfire</i> *** |
| Promote the use of weather radios, especially in schools, hospitals and other locations where people congregate to inform them of the approach of severe weather events. ***Addresses: <i>Levee Failure, Drought, Flood, Wildfire</i> *** |

| |
|--|
| <u>DROUGHT:</u> |
| Public education of water conservation best practices through utility bill inserts, social media and website notices. |
| Develop and/or update an ordinance requiring strategic watering times and volumes during times of drought. |
| Mandate/Encourage/Incentivize the use of drought resistant landscaping through ordinance development and/or enforcement. |
| <u>FLOOD:</u> |
| Develop a community-wide, stormwater management plan that will analyze and identify problem flooding areas and propose long-term mitigation alternatives designed to reduce or eliminate the flood problems. |
| Review, update and/or augment flood control ordinances to provide a greater level of protection than the minimum required by the NFIP. |
| Identify and map flood hazards in areas expected to grow or develop in the foreseeable future. |
| <u>LEVEE FAILURE:</u> |
| Perform regular inspection and maintenance of existing levees to mitigate potential failure. |
| Perform public outreach to citizens located within levee failure flood risk areas to provide awareness of potential increase in flood elevations with a levee failure. |
| <u>WILDFIRE:</u> |
| Develop and/or enforce a weed abatement ordinance. |
| Educate public on proper fuels thinning, setbacks, and water storage for wildfire mitigation using Firewise type of programs and guidance documents. |
| Enact and enforce burn and fireworks bans as needed during extraordinarily dry and extreme wildfire conditions / seasons to mitigate possible, unintended wildfire starts. |
| Perform, or encourage the performance of, routine roadside vegetation control to mitigate wildfire starts within the right-of-way areas along roadways and highways. |
| Clear vegetation and wildfire fuels to create a defensible space around critical or key structures within the community and along perimeter areas of the wildland urban interface. |

Upon completion of the assessment summarized in Section 6.3.1, each jurisdiction’s LPT met and developed a new list of A/Ps using the goals and objectives, results of the vulnerability analysis and capability assessment, the above list of seed ideas, and the planning team’s institutional knowledge of hazard mitigation needs in their community. The A/Ps can be generally classified as either structural or non-structural. Structural A/Ps typify a traditional “bricks and mortar” approach where physical improvements are provided to affect the mitigation goals. Examples may include channels, culverts, bridges, detention basins, dams, emergency structures, and structural augmentations of existing facilities. Non-structural A/Ps deal more with policy, ordinance, regulation and administrative actions or changes, buy-out programs, and legislative actions. For each A/P, the following elements were identified:

- **ID No.** – a unique alpha-numeric identification number for the A/P.
- **Description** – a brief description of the A/P including a supporting statement that tells the “what” and “why” reason for the A/P.
- **Hazard(s) Mitigated** – a list of the hazard or hazards mitigated by action.
- **Community Assets Mitigated** – a brief descriptor to qualify the type of assets (existing, new, or both) that the proposed mitigation A/P addresses.
- **Estimated Costs** – concept level cost estimates that may be a dollar amount or estimated staff time.

Once the full list of A/Ps was completed to the satisfaction of the LPT, the team then set to work developing the implementation strategy for those A/Ps. The implementation strategy addresses the “priority, how, when, and by whom?” questions related to the execution and completion of an identified A/P. Specific elements identified as part of the implementation strategy included:

- **Priority Ranking** – each A/P was assigned a priority ranking of either “High”, “Medium”, or “Low”. The assignments were subjectively made using a simple process that assessed how well the A/P satisfied the following considerations:
 - A favorable benefit versus cost evaluation, wherein the perceived direct and indirect benefits outweighed the project cost.
 - A direct beneficial impact on the ability to protect life and/or property from natural hazards.
 - A mitigation solution with a long-term effectiveness.
- **Planning Mechanism(s) for Implementation** – where applicable, a list of current planning mechanisms or processes under which the A/P will be implemented. Examples could include CIPs, General Plans, Area Drainage Master Plans, etc.
- **Anticipated Completion Date** – a realistic and general timeframe for completing the A/P. Examples may include a specific target date, a timeframe contingent upon other processes, or recurring timeframes.
- **Primary Agency and Job Title Responsible for Implementation** – this would be the agency, department, office, or other entity and corresponding job title that will have responsibility for the A/P and its implementation.
- **Funding Source** – the source or sources of anticipated funding for the A/P.

Tables 6-7-1 through 6-7-3 summarize the updated mitigation A/P and implementation strategy for each participating Plan jurisdiction.

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| Mitigation Action/Project | | | | | Implementation Strategy | | | | |
|---------------------------|---|---------------------|-------------------------------------|--|-------------------------|---|---|---|-------------------|
| ID No. | Description | Hazard(s) Mitigated | Community Assets Mitigated (Ex/New) | Estimated Cost | Priority Ranking | Planning Mechanism(s) for Implementation | Anticipated Completion Date | Primary Agency / Job Title Responsible for Implementation | Funding Source(s) |
| 1 | Enforcement of Zoning and Building Code Ordinances. Continue to enforce zoning and building codes through current site plan, subdivision, and building permit review processes to reduce the effects of drought, flood, severe wind, and other hazards on new buildings and infrastructure. | Drought, Flood | New | Staff Time | High | None | Ongoing | Code Enforcement/ Code Enforcement Officer/Building Inspector | General Fund |
| 2 | Flood Alert System for Town of Clifton. Continue to update and maintain the flood alert system for the San Francisco River through the Town of Clifton. | Flood | Both | \$10,000 annually | High | Clifton Highwater Event Plan | Ongoing (monthly testing with annual maintenance) | Town Admin/ Town Manager Public Works/ Director Police/ Chief | General Fund |
| 3 | San Francisco River Salt Cedar Removal. Remove salt cedar from floodplain areas upstream and downstream of the bridges through town to mitigate debris accumulation and improve the hydraulic conveyance. | Flood, Wildfire | Both | Staff Time plus \$8,000 annually | Medium | Clifton Highwater Event Plan | Annually | Public Works/ Director | General Fund |
| 5 | The Town will continue to enforce floodplain standards that are NFIP compliant per the current floodplain ordinance. | Flood | Both | \$5,000 annual plus Staff Time | High | Floodplain Ordinance | Ongoing as needed | Town Admin/ Town Manager | General Fund |
| 6 | Perform regular inspection and maintenance of existing levee facilities on at least an annual basis. | Levee Failure | Existing | \$30,000 annually | High | Clifton Highwater Plan USACE Inspection Rotation | Monthly | Town Admin/ Town Manager Public Works/ Director | General Fund |
| 7 | Perform public outreach to citizens located within the levee failure flood risk areas to provide awareness of potential exposure during a levee failure event. Methods could be social media, website, and possibly brochures. | Levee Failure | Existing | Staff Time plus \$5,000 for newsletter | Low | None | Ongoing | Town Admin/ Town Manager Account Specialist | General Fund |

| Mitigation Action/Project | | | | | Implementation Strategy | | | | |
|---------------------------|---|---------------------|-------------------------------------|--------------------------------------|-------------------------|--|-----------------------------|---|-------------------|
| ID No. | Description | Hazard(s) Mitigated | Community Assets Mitigated (Ex/New) | Estimated Cost | Priority Ranking | Planning Mechanism(s) for Implementation | Anticipated Completion Date | Primary Agency / Job Title Responsible for Implementation | Funding Source(s) |
| 8 | Coordinate with local public utilities to perform public education of water conservation best practices through social media, newsletters, flyers, and website notices. | Drought | Both | Staff Time plus \$500 For newsletter | Low | None | Annually | Town Admin/ Town Manager Account Specialist | General Fund |

| Mitigation Action/Project | | | | | Implementation Strategy | | | | |
|---------------------------|--|---------------------|-------------------------------------|----------------|-------------------------|--|-----------------------------|---|---------------------------|
| ID No. | Description | Hazard(s) Mitigated | Community Assets Mitigated (Ex/New) | Estimated Cost | Priority Ranking | Planning Mechanism(s) for Implementation | Anticipated Completion Date | Primary Agency / Job Title Responsible for Implementation | Funding Source(s) |
| 1 | Enforcement of Zoning and Building Code Ordinances. Continue to enforce zoning and building codes through current site plan, subdivision, and building permit review processes to reduce the effects of drought, flood, severe wind, and other hazards on new buildings and infrastructure | Drought, Flood | New | Staff Time | High | Building Codes (IBC) | Ongoing As-Needed | Town Administration/ Town Manager | General Fund, Permit Fees |
| 2 | Review and update as needed, zoning ordinance to provide more stringent floodplain management policy and ordinance. | Flood | Both | Staff Time | Medium | Current Floodplain Ordinance | Annually | Town Administration/ Town Manager | General Fund |
| 3 | Establish written floodplain management procedures and compliance criteria for the NFIP program. | Flood | Both | Staff Time | Medium | 5-year CIP for storm drainage | Aug 2016 | Town Administration/ Town Manager | General Fund |
| 4 | Highway 70 Drainage Evaluation. Work with ADOT to analyze and evaluate the existing Highway 70 drainage system to identify hazard areas and identify alternative drainage solutions. | Flood | Both | Staff Time | Low | None | Ongoing | Town Administration/ Town Manager | General Fund |

| Mitigation Action/Project | | | | | Implementation Strategy | | | | |
|---------------------------|--|----------------------|-------------------------------------|--------------------------------|-------------------------|--|-----------------------------|---|--|
| ID No. | Description | Hazard(s) Mitigated | Community Assets Mitigated (Ex/New) | Estimated Cost | Priority Ranking | Planning Mechanism(s) for Implementation | Anticipated Completion Date | Primary Agency / Job Title Responsible for Implementation | Funding Source(s) |
| 5 | Roadside Drainage Ditch Maintenance. Perform regular maintenance of roadside drainage ditches and cross culverts with the Town. Cost reported is an annual cost. | Flood, Wildfire | Both | Staff Time plus \$40K per year | High | None | Ongoing | Town Administration/ Town Manager Public Works/ Director | General Fund, USDA Grant |
| 6 | Drainage Master Plan for Duncan. Analyze and evaluate drainage conditions within the Town of Duncan to identify drainage problem areas and develop alternative solutions and mitigation actions. | Flood | Both | Staff Time plus \$100K | High | None | Aug 2016 | Town Administration/ Town Manager | General Fund, USACE PAS or FPMS |
| 7 | Flood Alert System for Town of Duncan. Test and maintain flood alert system for the Gila River through the Town of Duncan. | Flood, Levee Failure | Both | Staff Time | Low | None | Annually | Town Administration/ Town Manager | General Fund |
| 8 | Duncan Floodplain Levee. Design, construct and maintain a 100-year floodplain levee to protect the Town of Duncan. | Flood, Levee Failure | Both | \$1.5 million | High | None | 2019 | Town Administration/ Town Manager | USACE CAP, General Fund |
| 9 | Gila River Sewer Line. Relocate the existing sewer line under the Gila River to protect it from Gila River flooding and erosion | Flood | Existing | \$300K | Low | 5-year CIP | Jan 2017 | Town Administration/ Town Manager | WIFA, FMI Grant, USDA Grant, Fees |
| 10 | Gila River Sediment. Remove over growth of weeds and sediment deposits to increase the conveyance capacity of the river through Town limits as well as reduce wildfire potential. | Flood, Wildfire | Existing | \$30K per year | Medium | None | Annual Ongoing | Public Works/ Crew | General Fund |
| 11 | Well Sources. Conduct hydrogeological investigations to identify 3 new well locations that are located outside of the 100-year floodplain | Drought | Existing | Staff Time | Medium | 5-year CIP | 2018 | Town Administration/ Town Manager | WIFA, FMI Grant, USDA Grant, Fees |

| Mitigation Action/Project | | | | | Implementation Strategy | | | | |
|---------------------------|--|---------------------|-------------------------------------|--|-------------------------|--|--|---|---|
| ID No. | Description | Hazard(s) Mitigated | Community Assets Mitigated (Ex/New) | Estimated Cost | Priority Ranking | Planning Mechanism(s) for Implementation | Anticipated Completion Date | Primary Agency / Job Title Responsible for Implementation | Funding Source(s) |
| 1 | Flood Alert System for Town of Duncan. Maintain a flood alert system for the Gila River through the Town of Duncan. Redo Glenwood Station/ Add 2 new stations | Flood | Both | \$52K per year plus \$30K for new stations | High | ALERT System Maintenance Plan | Annual * New stations to be implemented within 2 years | Emergency Management/ Emergency Manager | Flood Control District Funds, EMPG |
| 2 | Duncan West Drainage Project. Design and install a backflow gate and pertinent drainage improvements to prevent drainage from the Gila River from backing up into Duncan. The County has some right of way and ADOT holds other portions of the right of way for drainage purposes. Work on Blackfield Wash is included in this project to provide positive drainage. An off-line detention basin may also be incorporated into the project, subject to the design | Flood | Both | \$600K | Low | None | Within 3-years of receipt of grant funding | Engineering/ County Engineer | HMA Grants, NRCS Grants, Az Water Protection Fund, 319 Grant through ADEQ |
| 3 | Ward Canyon Watercourse Master Plan. Develop a floodplain management and land-use plan for Ward Canyon, for the reach extending one-mile upstream of the San Francisco River confluence. The management plan will consider socio-economic factors as well as standard floodplain and erosion hazard management elements. | Flood | Both | \$500K | Low | None | Within 3-years of receipt of grant | Engineering/ County Engineer | USACE PAS, FPMS, NRCS EWP, FEMA HMA Grants |
| 4 | Public Drought and Wildfire Outreach and Education. Perform public outreach activities, including fliers, town hall meetings, safety fairs, and others to educate the public on drought related conservation measures and wildfire protection activities and best management practices. | Drought, Wildfire | Both | Staff Time plus \$10K for materials | Medium | None | Seasonal - Ongoing | Emergency Management/ Emergency Manager | General Fund, FEMA HMA Grants, NRCS, ADHS, USFS |

| Mitigation Action/Project | | | | | Implementation Strategy | | | | |
|---------------------------|--|--------------------------|-------------------------------------|-------------------------------------|-------------------------|--|--|---|--|
| ID No. | Description | Hazard(s) Mitigated | Community Assets Mitigated (Ex/New) | Estimated Cost | Priority Ranking | Planning Mechanism(s) for Implementation | Anticipated Completion Date | Primary Agency / Job Title Responsible for Implementation | Funding Source(s) |
| 5 | Claridge Repetitive Loss Structure Mitigation. Work with homeowner to mitigate this RL structure, by raising home 7 to 10 feet to avoid flooding. The structure has had 4 flood claims. | Flood | Existing | \$70K | Medium | None | Within 2-years of receipt of grant funds | Engineering/ County Engineer | FEMA HMA Grants |
| 7 | Duncan Flood Protection Plan. Develop a working plan to provide flood protection for the Town of Duncan and the local landowners. The plan will also address the sewer siphon and lift station at the old treatment plant. | Flood | Both | \$200K | Medium | None | Within 2-years of receipt of grant | Engineering/ County Engineer | WIFA (sewer), USACE PAS and FPMS |
| 8 | Educate public on proper fuels thinning, setbacks, and water storage for wildfire mitigation. | Wildfire | Existing | Staff Time plus \$10K for materials | Medium | None | Seasonal-Ongoing | Emergency Management/ Emergency Manager | General Fund, FEMA HMA Grants, NRCS, USFS |
| 9 | Remove non-native vegetation from watercourses within the County to improve conveyance capacity and reduce fuels for wildfire potential. Replace with native species to sustain erosion and sediment control. | Flood, Wildfire | Both | \$300K | Low | None | Within 1-year of receipt of grant funds | Engineering/ County Engineer | FEMA HMA Grants, Private River Restoration, State Forestry |
| 10 | Research and adopt current building codes for use in the unincorporated areas of the County. | Drought, Flood, Wildfire | New | Staff Time plus \$5K | Medium | None | 2022 | Engineering/ County Engineer | General Fund |

| Table 6-7-3: Mitigation actions and projects and implementation strategy for Greenlee County | | | | | | | | | |
|---|--|----------------------------|--|-----------------------|--------------------------------|---|------------------------------------|--|---|
| Mitigation Action/Project | | | | | Implementation Strategy | | | | |
| ID No. | Description | Hazard(s) Mitigated | Community Assets Mitigated (Ex/New) | Estimated Cost | Priority Ranking | Planning Mechanism(s) for Implementation | Anticipated Completion Date | Primary Agency / Job Title Responsible for Implementation | Funding Source(s) |
| 11 | 2019 NRCS Greenlee County Watershed Protection and Flood Prevention. The scope of work is to reduce flooding, minimize upslope erosion, minimize sediment transport, restore and maintain drainage capacity, and avoid transportation interruptions within the area of interest. The area of interest includes the Gila River from the AZ/NM state line to approximately Sands Wash, and all watersheds reporting to the Gila River from the AZ/NM state line to approximately Sands Wash. | Flood | Both | \$584,848 | High | None | 2022 | Engineering/ County Engineer | NRCS Grant, County Flood District Funds |

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SECTION 7: PLAN MAINTENANCE PROCEDURES

§201.6(c)(4): [The plan shall include...] (4) A **plan maintenance process** that includes:

- (i) A section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.
- (ii) A process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.
- (iii) Discussion on how the community will continue public participation in the plan maintenance process.

§201.6(d)(3): Plans must be reviewed, revised if appropriate, and resubmitted for approval within five years in order to continue to be eligible for HMGP project grant funding.

According to the DMA 2000 requirements, each plan must define and document processes or mechanisms for maintaining and updating the hazard mitigation plan within the established five-year planning cycle. Elements of this plan maintenance section include:

- Monitoring and Evaluating the Plan**
- Updating the Plan**
- Continued Public Participation**

The following sections provide a description of the past plan maintenance procedures and activities, and documents the proposed procedures and schedule for the next planning cycle.

7.1 Monitoring and Evaluation

7.1.1 Past Plan Cycle

Greenlee County, Clifton and Duncan recognize that this hazard mitigation plan is intended to be a “living” document with regularly scheduled monitoring, evaluation, and updating. Section 7.1 of the 2016 Plan outlined a schedule of specific activities for annual evaluations of the 2016 Plan. A poll of the MJPT regarding the past execution of the plan maintenance strategy was taken and the following tasks were accomplished:

- The plan is reviewed annually by the County LEPC
- Plan has been reviewed by county engineering when considering applications for mitigation grants.

MJPT discussed ways to improve on the Plan review and maintenance process over the next five years. The results of those discussions are outlined in the following sections.

7.1.2 Proposed Schedule and Scope

Having a multi-jurisdictional plan can aid in the plan monitoring and evaluation through the consolidation of information for all participating jurisdictions into one document. The MJPT reviewed the current DMA 2000 rules and October 2011 FEMA guidance document and discussed a strategy for performing the required monitoring and evaluation of the Plan over the next 5-year cycle. The MJPT has established the following monitoring and evaluation procedures:

- **Schedule** – The Plan shall be reviewed on at least an annual basis as an agenda item on the Local Emergency Planning Committee (LEPC). The LEPC includes representation from Clifton, Duncan and Greenlee County. In addition, Greenlee County Emergency Management will take the lead to send out an email to each jurisdiction via the jurisdiction’s PPOC on or around the month of January, requesting a review of the Plan.
- **Review Content** – Within the email request distributed by Greenlee County Emergency Management, each of the jurisdictions will be asked to provide responses to the following questions:

- **Hazard Identification:** *Have the risks and hazards changed?*
- **Goals and Objectives:** *Are the goals and objectives still able to address current and expected conditions?*
- **Mitigation Projects and Actions:** *For each mitigation action/project summarized in Section 6.3.2:*
 - *Has there been activity on the project – Yes or No?*
 - *If Yes, briefly describe what has been done and the current status of the action/project.*
- **Documentation** – Each jurisdiction will review and evaluate the Plan as it relates to their community and document responses to the above questions in the form of an email. Responsibility for this review and response will lie with the PPOC, or his/her appointed representative, for each jurisdiction. Greenlee County Emergency Management will archive email responses by printing and filing with the Plan for incorporation during the next Plan update.

7.2 Plan Update

According to DMA 2000, the Plan requires updating and re-approval from FEMA every five years. The plan update will adhere to that set schedule using the following procedure:

- ✓ One year prior to the plan expiration date, the MJPT will re-convene to review and assess the materials accumulated in Appendix E.
- ✓ The MJPT will update and/or revise the appropriate or affected portions of the plan and produce a revised plan document.
- ✓ The revised plan document will be presented before the respective councils and boards for an official concurrence/adoption of the changes.
- ✓ The revised plan will be submitted to ADEM and FEMA for review, comment and approval.

7.3 Continued Public Involvement

Greenlee County, Clifton and Duncan are committed to keeping the public informed about hazard mitigation planning efforts, actions and projects. Continued public involvement activities pursued by the Plan jurisdictions over the 2016 Plan cycle are summarized in Table 7-1.

| Jurisdiction | Public Involvement Activity or Opportunity |
|---------------------|--|
| Clifton | <ul style="list-style-type: none"> ● Provide information to insurance companies on floodplain properties ● Do seasonal informational postings on social media regarding hazards impacting the communities ● Provide notice in utility bill regarding availability of sand and bags at public work stations to the public during monsoon season |
| Duncan | <ul style="list-style-type: none"> ● Public hearings for input on development of the Town’s 5-year CIP ● Provide information to insurance companies on floodplain properties ● Published the updated Plan on the Town’s website. Considering expanding to other social media outlets (Facebook) ● Performed public surveys regarding Gila River flood management regarding maintenance of vegetation and sedimentation |

| Table 7-1: Continued public involvement activities performed by jurisdictions during the 2011 Plan cycle | |
|---|---|
| Jurisdiction | Public Involvement Activity or Opportunity |
| Greenlee County | <ul style="list-style-type: none"> • Publish the Plan to the County website • Provide public education materials at the Greenlee County Fair and the annual FMI health fair • Perform one-on-one education of wildfire mitigation practices with residents • Provide comment opportunity for all mitigation actions that require board approval |

Table 7-2 summarizes activities for public involvement and dissemination of information that shall be pursued whenever possible and appropriate by the Plan jurisdictions.

| Table 7-2: Continued public involvement activities or opportunities identified by each participating jurisdiction | |
|--|--|
| Jurisdiction | Public Involvement Activity or Opportunity |
| Clifton | <ul style="list-style-type: none"> • Provided mitigation oriented brochures in a rack at Town Hall offices • Provide hazard mitigation information to the community through social media and Town website. • Provide sand and bags at public work stations to the public during monsoon season |
| Duncan | <ul style="list-style-type: none"> • Public hearings for input on development of the Town’s 5-year CIP • Provide information to insurance companies on floodplain properties • Published the updated Plan on the Town’s website. Considering expanding to other social media outlets (Facebook) • Performed public surveys regarding Gila River flood management regarding maintenance of vegetation and sedimentation |
| Greenlee County | <ul style="list-style-type: none"> • Publish the Plan to the County website • Provide public education materials at the Greenlee County Fair and the annual FMI health fair. • Perform one-on-one education of wildfire mitigation practices with residents. • Provide comment opportunity for all mitigation actions that require board approval. • Perform public involvement and comment opportunity on LOMRs and other NFIP flood map changes |

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SECTION 8: PLAN TOOLS

8.1 Acronyms

| | |
|----------|--|
| A/P | Mitigation Action/Project |
| ADEM | Arizona Division of Emergency Management |
| ADEQ | Arizona Department of Environmental Quality |
| ADWR | Arizona Department of Water Resources |
| AGFD | Arizona Game and Fish Department |
| ARS | Arizona Revised Statutes |
| ASCE | American Society of Civil Engineers |
| ASERC | Arizona State Emergency Response Commission |
| ASLD | Arizona State Land Department |
| ASU | Arizona State University |
| AZDEQ | Arizona Department of Environmental Quality |
| AZGS | Arizona Geological Survey |
| BLM | Bureau of Land Management |
| CAP | Central Arizona Project |
| CAP | Community Assistance Program |
| CFR | Code of Federal Regulations |
| CRS | Community Rating System |
| CWPP | Community Wildfire Protection Plan |
| DEMA | Arizona Department of Emergency and Military Affairs |
| DFIRM | Digital Flood Insurance Rate Map |
| DMA 2000 | Disaster Mitigation Act of 2000 |
| DOT | Department of Transportation |
| EHS | Extremely Hazardous Substance |
| EPA | Environmental Protection Agency |
| EPCRA | Emergency Planning and Community Right to Know Act |
| FEMA | Federal Emergency Management Agency |
| FIS | Flood Insurance Study |
| FMA | Flood Mitigation Assistance Grant Program |
| GIS | Geographic Information System |
| GCDEM | Greenlee County Department of Emergency Management |
| HAZMAT | Hazardous Material |
| HAZUS-MH | Hazards United States Multi-Hazard |
| HMA | Hazard Mitigation Assistance |
| IFCI | International Fire Code Institute |
| LEPC | Local Emergency Planning Committee |
| MJHMP | Multi-Jurisdictional Hazard Mitigation Plan |
| MMI | Modified Mercalli Intensity |
| NCA | National Climate Assessment |
| NCDC | National Climate Data Center |
| NDMC | National Drought Mitigation Center |
| NESDIS | National Environmental Satellite, Data and Information Service |
| NFHL | National Flood Hazard Layer |
| NFIP | National Flood Insurance Program |
| NFPA | National Fire Protection Association |
| NHC | National Hurricane Center |
| NIBS | National Institute of Building Services |
| NID | National Inventory of Dams |
| NIST | National Institute of Standards and Technology |
| NSF | National Science Foundation |
| NOAA | National Oceanic and Atmospheric Administration |
| NRC | National Response Center |

| | |
|--------------|--|
| NWS | National Weather Service |
| PDSI | Palmer Drought Severity Index |
| RL | Repetitive Loss |
| SARA | Superfund Amendments and Reauthorization Act |
| SFHA..... | Special Flood Hazard Area |
| SRLP | Severe Repetitive Loss Properties |
| SRL | Severe Repetitive Loss |
| SRP | Salt River Project |
| UBC | Uniform Building Code |
| USACE | United States Army Corps of Engineers |
| USDA | United States Department of Agriculture |
| USFS | United States Forest Service |
| USGCRP | U.S. Global Change Research Program |
| USGS | United States Geological Survey |
| VA | Vulnerability Analysis |
| WUI | Wildland Urban Interface |

8.2 Definitions

The following terms and definitions are provided for reference and are taken from the 2013 State Plan with a few minor modifications.

ARIZONA HAZARDS

Dam Failure

A dam failure is a catastrophic type of failure characterized by the sudden, rapid and uncontrolled release of impounded water. Dam failures are typically due to either overtopping or piping and can result from a variety of causes including natural events such as floods, landslides or earthquakes, deterioration of foundation or compositional materials, penetration by vegetative roots or animal burrows, fissures or improper design and construction. Such a failure presents a significant potential for a disaster as significant loss of life and property would be expected in addition to the possible loss of power and water resources.

Drought

A drought is a deficiency of precipitation over an extended period of time, resulting in water shortage for some activity, group or environmental sector. "Severe" to "extreme" drought conditions endanger livestock and crops, significantly reduce surface and ground water supplies, increase the potential risk for wildland fires, increase the potential for dust storms, and cause significant economic loss. Humid areas are more vulnerable than arid areas. Drought may not be constant or predictable and does not begin or end on any schedule. Short term droughts are less impacting due to the reliance on irrigation and groundwater in arid environments.

Earthquake

An earthquake is a naturally-induced shaking of the ground, caused by the fracture and sliding of rock within the Earth's crust. The magnitude is determined by the dimensions of the rupturing fracture (fault) and the amount of displacement that takes place. The larger the fault surface and displacement, the greater the energy. In addition to deforming the rock near the fault, this energy produces the shaking and a variety of seismic waves that radiate throughout the Earth. Earthquake magnitude is measured using the Richter Scale and earthquake intensity is measured using the Modified Mercalli Intensity Scale.

Fissure

Earth fissures are tension cracks that open as the result of subsidence due to severe overdrafts (i.e., pumping) of groundwater, and occur about the margins of alluvial basins, near exposed or shallow buried bedrock, or over zones of differential land subsidence. As the ground slowly settles, cracks form at depth and propagate towards the surface, hundreds of feet above. Individual fissures range in length from hundreds of feet to several miles, and from less than an inch to several feet wide. Rainstorms can erode fissure walls rapidly causing them to widen and lengthen suddenly and dangerously, forming gullies five to 15- feet wide and tens of feet deep.

Flooding

Flooding is an overflowing of water onto normally dry land and is one of the most significant and costly of natural disasters. Flooding tends to occur in Arizona during anomalous years of prolonged, regional rainfall (typical of an El Nino year), and is typified by increased humidity and high summer temperatures.

Flash flooding is caused by excessive rain falling in a small area in a short time and is a critical hazard in Arizona. Flash floods are usually associated with summer monsoon thunderstorms or the remnants of a tropical storm. Several factors contribute to flash flooding: rainfall intensity and duration, topography, soil conditions, and ground cover. Most flash flooding is caused by slow-moving thunderstorms or thunderstorms repeatedly moving over the same area and can occur within a few minutes or hours of excessive rainfall, or a quick release from a dam or levee failure. Thunderstorms produce flash flooding, often far from the actual storm and at night when natural warnings may not be noticed.

Landslide / Mudslide

Landslides like avalanches are massive downward and outward movements of slope-forming materials. The term landslide is restricted to movement of rock and soil and includes a broad range of velocities. Slow movements, although rarely a threat to life, can destroy buildings or break buried utility lines. A landslide occurs when a portion of a hill slope becomes too weak to support its own weight. The weakness is generally initiated when rainfall or some other source of water increases the water content of the slope, reducing the shear strength of the materials. A mud slide is a type of landslide referred to as a flow. Flows are landslides that behave like fluids: mud flows involve wet mud and debris.

Levee Failure / Breach

Levee failures are typically due to either overtopping or erosive piping and can result from a variety of causes including natural events such as floods, hurricane/tropical storms, or earthquakes, deterioration of foundation or compositional materials, penetration by vegetative roots or animal burrows, fissures, or improper design, construction and maintenance. A levee breach is the opening formed by the erosion of levee material and can form suddenly or gradually depending on the hydraulic conditions at the time of failure and the type of material comprising the levee.

Severe Wind

Thunderstorms are characterized as violent storms that typically are associated with high winds, dust storms, heavy rainfall, hail, lightning strikes, and/or tornadoes. The unpredictability of thunderstorms, particularly their formation and rapid movement to new locations heightens the possibility of floods. Thunderstorms, dust/sand storms and the like are most prevalent in Arizona during the monsoon season, which is a seasonal shift in the winds that causes an increase in humidity capable of fueling thunderstorms. The monsoon season in Arizona typically is from late-June or early-July through mid-September.

Tornadoes are violently rotating columns of air extending from a thunderstorm to the ground. The most violent tornadoes are capable of tremendous destruction with wind speeds in excess of 250 mph. Damage paths can exceed a mile wide and 50 miles long. The damage from tornadoes is due to high winds. The Fujita Scale of Tornado Intensity measures tornado / high wind intensity and damage.

Tropical Storms are storms in which the maximum sustained surface wind ranges from 39-73 mph. Tropical storms are associated with heavy rain and high winds. High intensity rainfall in short periods is typical. A tropical storm is classified as a hurricane when its sustained winds reach or exceed 74 mph. These storms are medium to large in size and are capable of producing dangerous winds, torrential rains, and flooding, all of which may result in tremendous property damage and loss of life, primarily in coastal populated areas. The effects are typically most dangerous before a hurricane makes landfall, when most damage occurs. However, Arizona has experienced a number of tropical storms that caused extensive flooding and wind damage.

Subsidence

Land subsidence in Arizona is primarily attributed to substantial groundwater withdrawal from aquifers in sedimentary basins. As the water is removed, the sedimentary layers consolidate resulting in a general lowering of the corresponding ground surface. Subsidence frequently results in regional bowl-shaped depressions, with loss of elevation greatest in the center and decreasing towards the perimeter. Subsidence can measurably change or reverse basin gradients causing expensive localized flooding and adverse impacts or even rupture to long-baseline infrastructure such as canals, sewer systems, gas lines and roads. Earth fissures are the most spectacular and destructive manifestation of subsidence-related phenomena.

Wildfire

Wildfire is a rapid, persistent chemical reaction that releases heat and light, especially the exothermic combination of a combustible substance with oxygen. Wildfires present a significant potential for disaster in the southwest, a region of relatively high temperatures, low humidity, low precipitation, and during the spring moderately strong daytime winds. Combine these severe burning conditions with people or lightning and the stage is set for the occurrence of large, destructive wildfires.

Winter Storm

Winter storms bring heavy snowfall and frequently have freezing rain and sleet. Sleet is defined as pellets of ice composed of frozen or mostly frozen raindrops or refrozen partially melted snowflakes. These pellets of ice usually bounce after hitting the ground or other hard surfaces. Freezing rain begins as snow at higher altitudes and melts completely on its way down while passing through a layer of air above freezing temperature, then encounters a layer below freezing at lower level to become super cooled, freezing upon impact of any object it then encounters. Because freezing rain hits the ground as a rain droplet, it conforms to the shape of the ground, making one thick layer of ice. Snow is generally formed directly from the freezing of airborne water vapor into ice crystals that often agglomerates into snowflakes. Average annual snowfall in Arizona varies with geographic location and elevation, and can range from trace amounts to hundreds of inches. Severe snow storms can affect transportation, emergency services, utilities, agriculture and basic necessities supply to isolated communities. In extreme cases, snow loads can cause significant structural damage to under-designed buildings.

GENERAL PLAN TERMS

Actions/Projects

Specific actions or projects that help achieve goals and objectives.

Asset

Any natural or human-caused feature that has value, including, but not limited to people; buildings; infrastructure like bridges, roads, and sewer and water systems; lifelines like electricity and communication resources; or environmental, cultural, or recreational features like parks, dunes, wetlands, or landmarks.

Building

A structure that is walled and roofed, principally above ground and permanently affixed to a site. The term includes a manufactured home on a permanent foundation on which the wheels and axles carry no weight.

Critical Facilities and Infrastructure

Systems or facilities whose incapacity or destruction would have a debilitating impact on the defense or economic security of the nation. The Critical Infrastructure Assurance Office (CIAO) defines eight categories of critical infrastructure, as follows:

Telecommunications infrastructure: Telephone, data services, and Internet communications, which have become essential to continuity of business, industry, government, and military operations.

Electrical power systems: Generation stations and transmission and distribution networks that create and supply electricity to end-users.

Gas and oil facilities: Production and holding facilities for natural gas, crude and refined petroleum, and petroleum-derived fuels, as well as the refining and processing facilities for these fuels.

Banking and finance institutions: Banks, financial service companies, payment systems, investment companies, and securities/commodities exchanges.

Transportation networks: Highways, railroads, ports and inland waterways, pipelines, and airports and airways that facilitate the efficient movement of goods and people.

Water supply systems: Sources of water; reservoirs and holding facilities; aqueducts and other transport systems; filtration, cleaning, and treatment systems; pipelines; cooling systems; and other delivery mechanisms that provide for domestic and industrial applications, including systems for dealing with water runoff, wastewater, and firefighting.

Government services: Capabilities at the federal, state, and local levels of government required to meet the needs for essential services to the public.

Emergency services: Medical, police, fire, and rescue systems.

Disaster Mitigation Act of 2000 (DMA2K)

A law signed by the President on October 30, 2000 that encourages and rewards local and state pre-disaster planning, promotes sustainability as a strategy for disaster resistance, and is intended to integrate state and local planning with the aim of strengthening statewide mitigation planning.

Emergency Preparedness and Response (EPR) Directorate

One of five major Department of Homeland Security Directorates which builds upon the formerly independent Federal Emergency Management Agency (FEMA). EPR is responsible for preparing for natural and human-caused disasters through a comprehensive, risk-based emergency management program of preparedness, prevention, response, and recovery. This work incorporates the concept of disaster-resistant communities, including providing federal support for local governments that promote structures and communities that reduce the chances of being hit by disasters.

Emergency Response Plan

A document that contains information on the actions that may be taken by a governmental jurisdiction to protect people and property before, during, and after a disaster.

Federal Emergency Management Agency (FEMA)

Formerly independent agency created in 1978 to provide a single point of accountability for all Federal activities related to disaster mitigation and emergency preparedness, response and recovery. As of March 2003, FEMA is a part of the Department of Homeland Security’s Emergency Preparedness and Response (EPR) Directorate.

Flood Insurance Rate Map (FIRM)

Map of a community, prepared by FEMA that shows the special flood hazard areas and the risk premium zones applicable to the community.

Frequency

A measure of how often events of a particular magnitude are expected to occur. Frequency describes how often a hazard of a specific magnitude, duration, and/or extent typically occurs, on average. Statistically, a hazard with a 100-year recurrence interval is expected to occur once every 100 years on average, and would have a 1% chance – its probability – of happening in any given year. The reliability of this information varies depending on the kind of hazard being considered.

Geographic Information Systems (GIS)

A computer software application that relates physical features on the earth to a database to be used for mapping and analysis.

Goals

General guidelines that explain what you want to achieve. Goals are usually broad statements with long-term perspective.

Hazard

A source of potential danger or adverse condition. Hazards include both natural and human-caused events. A natural event is a hazard when it has the potential to harm people or property and may include events such as floods, earthquakes, tornadoes, tsunamis, coastal storms, landslides, and wildfires that strike populated areas. Human-caused hazard events originate from human activity and may include technological hazards and terrorism. Technological hazards arise from human activities and are assumed to be accidental and/or have unintended consequences (e.g., manufacture, storage and use of hazardous materials). While no single definition of terrorism exists, the Code of Federal Regulations defines terrorism as “...unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives.”

Hazard Event

A specific occurrence of a particular type of hazard.

Hazard Identification

The process of identifying hazards that threaten an area.

Hazard Mitigation

Cost effective measures taken to reduce or eliminate long-term risk associated with hazards and their effects.

Hazard Profile

A description of the physical characteristics of hazards and a determination of various descriptors including magnitude, duration, frequency, probability, and extent.

HAZUS

A GIS-based nationally standardized earthquake, flood and high wind event loss estimation tool developed by FEMA.

Implementation Strategy

A comprehensive strategy that describes how the mitigation actions will be implemented.

Mitigate

To cause to become less harsh or hostile; to make less severe or painful. Mitigation activities are actions taken to eliminate or reduce the probability of the event, or reduce its severity of consequences, either prior to or following a disaster/emergency.

Mitigation Plan

A systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards typically present in a defined geographic area, including a description of actions to minimize future vulnerability to hazards.

Objectives

Defined strategies or implementation steps intended to attain the identified goals. Objectives are specific, measurable, and have a defined time horizon.

100-Hundred Year Floodplain

Also referred to as the Base Flood Elevation (BFE) and Special Flood Hazard Area (SFHA). An area within a floodplain having a 1% or greater chance of flood occurrence in any given year.

Planning

The act or process of making or carrying out plans; the establishment of goals, policies, and procedures for a social or economic unit.

Probability

A statistical measure of the likelihood that a hazard event will occur.

Promulgation

To make public and put into action the Hazard Mitigation Plan via formal adoption and/or approval by the governing body of the respective community or jurisdiction (i.e. – town or city council, county board of directors, etc.).

Q3 Data

The Q3 Flood Data product is a digital representation of certain features of FEMA's Flood Insurance Rate Map (FIRM) product, intended for use with desktop mapping and Geographic Information Systems technology. The digital Q3 Flood Data are created by scanning the effective FIRM paper maps and digitizing selected features and lines. The digital Q3 Flood Data are designed to serve FEMA's needs for disaster response activities, National Flood Insurance Program activities, risk assessment, and floodplain management.

Repetitive Loss Property

A property that is currently insured for which two or more National Flood Insurance Program losses (occurring more than ten days apart) of at least \$1,000 each have been paid within any 10 year period since 1978.

Risk

The estimated impact that a hazard would have on people, services, facilities, and structures in a community; the likelihood of a hazard event resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate, or low likelihood of sustaining damage beyond a particular threshold due to a specific type of hazard event. It also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Substantial Damage

Damage of any origin sustained by a structure in a Special Flood Hazard Area whereby the cost of restoring the structure to its before-damaged condition would equal or exceeds 50% of the market value of the structure before the damage.

Vulnerability

Describes how exposed or susceptible to damage an asset is. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. Like indirect damages, the vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power—if an electric substation is flooded, it will affect not only the substation itself, but a number of businesses as well. Often, indirect effects can be much more widespread and damaging than direct effects.

Vulnerability Analysis

The extent of injury and damage that may result from a hazard event of a given intensity in a given area. The vulnerability analysis should address impacts of hazard events on the existing and future built environment.

Vulnerable Populations

Any segment of the population that is more vulnerable to the effects of hazards because of things such as lack of mobility, sensitivity to environmental factors, or physical abilities. These populations can include, but are not limited to, senior citizens and school children.

GENERAL HAZARD TERMS

Fujita Scale of Tornado Intensity

Rates tornadoes with numeric values from F0 to F5 based on tornado winds speed and damage sustained. An F0 indicates minimal damage such as broken tree limbs or signs, while an F5 indicates severe damage sustained.

Liquefaction

The phenomenon that occurs when ground shaking (earthquake) causes loose soils to lose strength and act like viscous fluid. Liquefaction causes two types of ground failure: lateral spread and loss of bearing strength.

Modified Mercalli Intensity Scale

The Modified Mercalli Intensity Scale is commonly used in the United States by seismologists seeking information on the severity of earthquake effects. Intensity ratings are expressed as Roman numerals between I at the low end and XII at the high end. The Intensity Scale differs from the Richter Magnitude Scale in that the effects of any one earthquake vary greatly from place to place, so there may be many Intensity values (e.g.: IV, VII) measured from one earthquake. Each earthquake, on the other hand, should have just one Magnitude, although the several methods of estimating it will yield slightly different values (e.g.: 6.1, 6.3).

Monsoon

A monsoon is any wind that reverses its direction seasonally. In the Southwestern U.S., for most of the year the winds blow from the west/northwest. Arizona is located on the fringe of the Mexican Monsoon which during the summer months turns the winds to a more south/southeast direction and brings moisture from the Pacific Ocean, Gulf of California, and Gulf of Mexico. This moisture often leads to thunderstorms in the higher mountains and Mogollon Rim, with air cooled from these storms often moving from the high country to the deserts, leading to further thunderstorm activity in the desert. A common misuse of the term monsoon is to refer to individual thunderstorms as monsoons.

Richter Magnitude Scale

A logarithmic scale devised by seismologist C.F. Richter in 1935 to express the total amount of energy released by an earthquake. While the scale has no upper limit, values are typically between 1 and 9, and each increase of 1 represents a 32-fold increase in released energy.

APPENDIX A

**Table 6-6-1
Greenlee County assessment of previous plan cycle mitigation actions/projects**

| ID | Description | <ul style="list-style-type: none"> • Lead Agency • Proposed Cost • Proposed Comp Date | Status | Disposition | Explanation |
|-----------|--|--|-------------------------|--------------------|--|
| 1 | Flood Alert System for Town of Duncan. Maintain a flood alert system for the Gila River through the Town of Duncan. | <ul style="list-style-type: none"> • Emergency Mgmt/ Emergency Manager • \$35K per year • Annual | In Progress/ Ongoing | Revise | \$52K per year now Redo Glenwood Station/Add 2 new stations in the Glenwood area within 2 years (30K total) |
| 2 | Duncan West Drainage Project. Design and install a backflow gate and pertinent drainage improvements to prevent drainage from the Gila River from backing up into Duncan. The County has some right of way and ADOT holds other portions of the right of way for drainage purposes. Work on Blackfield Wash is included in this project to provide positive drainage. An off-line detention basin may also be incorporated into the project, subject to the design | <ul style="list-style-type: none"> • Engineering/ County Engineer • \$500K • Within 3-years of receipt of grant funding | No Progress | Keep | |
| 3 | Ward Canyon Watercourse Master Plan. Develop a floodplain management and land-use plan for Ward Canyon, for the reach extending one-mile upstream of the San Francisco River confluence. The management plan will consider socio-economic factors as well as standard floodplain and erosion hazard management elements. | <ul style="list-style-type: none"> • Engineering/ County Engineer • \$400K • Within 3-years of receipt of grant | No Progress | Keep | Funding limitations have impeded progress on this action. |
| 4 | Public Drought and Wildfire Outreach and Education. Perform public outreach activities, including fliers, town hall meetings, safety fairs, and others to educate the public on drought related conservation measures and wildfire protection activities and best management practices. | <ul style="list-style-type: none"> • Emergency Mgmt/ Emergency Manager • Staff Time plus \$10K for materials • Seasonal | In Progress/ Ongoing | Keep | Continue to distribute Drought and Wildfire Mitigation Materials provided by DEMA on an annual basis before fire season. |

**Table 6-6-1
Greenlee County assessment of previous plan cycle mitigation actions/projects**

| ID | Description | <ul style="list-style-type: none"> • Lead Agency • Proposed Cost • Proposed Comp Date | Status | Disposition | Explanation |
|-----------|--|--|--------------------------|--------------------|---|
| 5 | Claridge Repetitive Loss Structure Mitigation. Work with homeowner to mitigate this RL structure, by raising home 7 to 10 feet to avoid flooding. The structure has had 4 flood claims. | <ul style="list-style-type: none"> • Engineering/ County Engineer • \$70K • Within 2-years of receipt of grant funds | No Progress | Keep | Funding Limitations |
| 6 | Duncan Flood Protection Plan. Develop a working plan to provide flood protection for the Town of Duncan and the local landowners. The plan will also address the sewer siphon and lift station at the old treatment plant. | <ul style="list-style-type: none"> • Engineering/ County Engineer • \$200K • Within 2-years of receipt of grant | In Progress | Keep | Improvements to the Waste Water Treatment Plant have occurred (ask John B.) |
| 7 | Educate public on proper fuels thinning, setbacks, and water storage for wildfire mitigation. | <ul style="list-style-type: none"> • Emergency Mgmt/ Emergency Manager • Staff Time plus \$10K for materials • Seasonal | In Progress/ On going | Keep | Continue this action on an annual basis just before fire season. |
| 8 | Remove non-native vegetation from watercourses within the County to improve conveyance capacity and reduce fuels for wildfire potential. Replace with native species to sustain erosion and sediment control. | <ul style="list-style-type: none"> • Engineering/ County Engineer • \$300K • Within 1-Year of receipt of grant funds | No Progress | Keep | Funding Limitations |
| 9 | Research and adopt current building codes for use in the unincorporated areas of the County. | <ul style="list-style-type: none"> • Engineering/ County Engineer • Staff Time plus \$5K • 2018 | No Progress | Keep | County is actively working to hire a Building Official to champion this action. |

**Table 6-6-2
Clifton assessment of previous plan cycle mitigation actions/projects**

| ID | Description | Lead Agency Proposed Cost Proposed Comp Date | Status | Disposition | Explanation |
|-----------|---|---|--------------------------|--------------------|---|
| 1 | Enforcement of Zoning and Building Code Ordinances. Continue to enforce zoning and building codes through current site plan, subdivision, and building permit review processes to reduce the effects of drought, flood, severe wind, and other hazards on new buildings and infrastructure. | <ul style="list-style-type: none"> • Codes Enforcement/Code Enforcement Officer • \$80,000 Annually • Ongoing | In Progress/ Ongoing | Keep | |
| 2 | Flood Alert System for Town of Clifton. Continue to update and maintain the flood alert system for the San Francisco River through the Town of Clifton. | <ul style="list-style-type: none"> • Town Manager/Public Works Director/Police Chief • \$10,000 Annually • Ongoing (Monthly Testing with Annual Maintenance) | In Progress / Ongoing | Keep | System is tested monthly |
| 3 | San Francisco River Salt Cedar Removal. Remove salt cedar from floodplain areas upstream and downstream of the bridges through town to mitigate debris accumulation and improve the hydraulic conveyance. | <ul style="list-style-type: none"> • Public Works/Director • \$15,000 annually • Annually | In Progress/ Ongoing | Keep | Salt Cedar was remove by the Zorilla Bridge approx. 1 year ago. |
| 4 | Coronado/5 th Street Drainage Project. Coordinate with ADOT to construct drainage facilities to augment existing drainage system passing flows under the railroad and Coronado Blvd westerly to the San Francisco River. | <ul style="list-style-type: none"> • Town Admin/ Town Manager • Staff Time • Spring 2017 | Complete | Remove | |
| 5 | The Town will continue to enforce floodplain standards that are NFIP compliant per the current floodplain ordinance. | <ul style="list-style-type: none"> • Town Admin/Town Manager • \$5,000 plus Staff Time • Ongoing as needed | In Progress/ Ongoing | Keep | |

**Table 6-6-2
Clifton assessment of previous plan cycle mitigation actions/projects**

| ID | Description | <ul style="list-style-type: none"> • Lead Agency • Proposed Cost • Proposed Comp Date | Status | Disposition | Explanation |
|-----------|--|--|-------------------------|--------------------|---|
| 6 | Perform regular inspection and maintenance of existing levee facilities on at least an annual basis. | <ul style="list-style-type: none"> • Town Manager; Public Works/Director • \$30,000 Annually • Monthly | In Progress/ Ongoing | Keep | Levee is inspected on a monthly basis, and flap gates are activated when the river experiences high flows. |
| 7 | Perform public outreach to citizens located within the levee failure flood risk areas to provide awareness of potential exposure during a levee failure event. Methods could be social media, website, and possibly brochures. | <ul style="list-style-type: none"> • Town Admin/ Town Manager • \$5,000 for brochures plus Staff Time • Fall 2016 | In Progress/ Ongoing | Revise | The Town continues to provide levee hazard and mitigation information to residents via the town website and social media. Will no longer provide brochures. |
| 8 | Coordinate with local public utilities to perform public education of water conservation best practices through social media, newsletters, flyers, and website notices. | <ul style="list-style-type: none"> • Town Admin/ Town Manager • Staff Time • Bi-annually | No Action | Revise | The Town will provide drought and mitigation information via the Town website, social media, newsletter, sewer bills, and the Marquee board. |
| 9 | Research developing an ordinance requiring strategic watering times and volumes during times of drought. | <ul style="list-style-type: none"> • Town Admin/ Town Manager • Staff Time • Bi-annually | No Action | Remove | This action lacks political support. |

**Table 6-6-3
Duncan assessment of previous plan cycle mitigation actions/projects**

| ID | Description | Lead Agency Proposed Cost Proposed Comp Date | Status | Disposition | Explanation |
|-----------|--|--|-------------------------|--------------------|--|
| 1 | Enforcement of Zoning and Building Code Ordinances. Continue to enforce zoning and building codes through current site plan, subdivision, and building permit review processes to reduce the effects of drought, flood, severe wind, and other hazards on new buildings and infrastructure | <ul style="list-style-type: none"> Town Administration/ Town Manager Staff Time Ongoing/ As-Needed | In Progress/ Ongoing | Keep | Hired new attorney, looking at the ordinances. |
| 2 | Review and update as needed, zoning ordinance to provide more stringent floodplain management policy and ordinance. | <ul style="list-style-type: none"> Town Administration/ Town Manager Staff Time Annually | In Progress/ Ongoing | Keep | |
| 3 | Establish written floodplain management procedures and compliance criteria for the NFIP program. | <ul style="list-style-type: none"> Town Administration/ Town Manager Staff Time Aug 2016 | No Action | Keep | Town of Duncan is working to update procedures. Lack of funding/staff has delayed project. |
| 4 | Highway 70 Drainage Evaluation. Work with ADOT to analyze and evaluate the existing Highway 70 drainage system to identify hazard areas and identify alternative drainage solutions. | <ul style="list-style-type: none"> Town Administration/ Town Manager Staff Time Ongoing | In Progress/ Ongoing | Keep | Working with ADOT to clean out drainages along 70. |
| 5 | Roadside Drainage Ditch Maintenance. Perform regular maintenance of roadside drainage ditches and cross culverts with the Town. Cost reported is an annual cost. | <ul style="list-style-type: none"> Town Administration/ Town Manager/ Public Works/ Director Staff Time plus \$40K per year Ongoing | In Progress/ Ongoing | Keep | Received CBBG Grant to install new culverts |

**Table 6-6-3
Duncan assessment of previous plan cycle mitigation actions/projects**

| ID | Description | Lead Agency Proposed Cost Proposed Comp Date | Status | Disposition | Explanation |
|-----------|--|---|--------------------------|--------------------|---|
| 6 | Drainage Master Plan for Duncan. Analyze and evaluate drainage conditions within the Town of Duncan to identify drainage problem areas and develop alternative solutions and mitigation actions. | <ul style="list-style-type: none"> Town Administration/ Town Manager Staff Time plus \$100K Aug 2016 | In Progress/ Ongoing | Keep | Greenlee County and the Town of Duncan are working to evaluate drainage for the community and implement projects to improve drainage. |
| 7 | Flood Alert System for Town of Duncan. Test and maintain flood alert system for the Gila River through the Town of Duncan. | <ul style="list-style-type: none"> Town Administration. Town Manager Staff Time Annually | In Progress/ Ongoing | Keep | Receive Grant from CARES Act to install new flood alert system. |
| 8 | Duncan Floodplain Levee. Design, construct and maintain a 100-year floodplain levee to protect the Town of Duncan. | <ul style="list-style-type: none"> Town Administration/ Town Manager \$1.5 million 2019 | No Action | Keep | Lack of staff and funding. Working to armor existing levee |
| 9 | Gila River Sewer Line. Relocate the existing sewer line under the Gila River to protect it from Gila River flooding and erosion | <ul style="list-style-type: none"> Town Administration/ Town Manager \$300 K Jan 2017 | No Action | Keep | Working to obtain a Grant to fund this project |
| 10 | Gila River Sediment. Remove over growth of weeds and sediment deposits to increase the conveyance capacity of the river through Town limits as well as reduce wildfire potential. | <ul style="list-style-type: none"> Public Works/ Crew \$30K per year Annual Ongoing | In Progress / ongoing | Keep | Continue to clear sediment and brush to reduce flood and fire hazard. |
| 11 | Well Sources. Conduct hydrogeological investigations to identify 3 new well locations that are located outside of the 100-year floodplain | <ul style="list-style-type: none"> Town Administration/ Town Manager Staff Time 2018 | In Progress | Keep | Town of Duncan is working to identify sites for new wells. |

APPENDIX B