Discovery Report

Upper Rio Grande Watershed, HUC – *13020101*

Los Alamos, Mora, Rio Arriba, Sandoval, Santa Fe, Taos Counties, NM

September 30, 2021

FEMA

Project Area Community List

Community Name*	CID
Upper Rio Grande Watershed Communities	
Española, City of	350052
Los Alamos County	350035
Mora County, Unincorporated Areas	350043
Questa, Village of	350116
Red River, Town of	350079
Rio Arriba County, Unincorporated Areas	350049
Sandoval County, Unincorporated Areas	350055
Santa Clara Indian Reservation	350151
Santa Fe County, Unincorporated Areas	350069
Santa Fe, City of	350070
Taos County, Unincorporated Areas	350078
Taos, Town of	350080

*Communities without CIDs are not included.

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The basis and format of this document is derived from FEMA Guidance and Specification, Procedure Memorandums, Operational Guidance, Regional Standard Operating Procedures, and current draft revisions and proposed guidance to include, but not limited to;

Guidance and Specifications: Appendix I - Discovery

Guidance and Specifications: Appendix M – Data Capture Standards

PM 56: Guidelines for Implementation of Coordinated Needs Management Strategy (CNMS)

PM 59: Guidance for Implementation of Watershed-Based Studies

PM 60: Guidance for Flood Risk Assessment Data Development and Analysis

Operational Guidance No. 1-11: Risk MAP Guidance for Incorporating Mitigation Planning Technical Assistance and Training into Flood Risk Projects

Operational Guidance No. 4-11: Risk MAP Meeting Guidance

FEMA Region 6 Discovery & Project Pre-Planning SOP

Any revisions or changes to this document will require FEMA Region 6 Authorization prior to implementation.

Acronyms and Abbreviations

BFE	base (1-percent-annual-chance) flood elevation
BLE	Base Level Engineering
BLM	Bureau of Land Management
CFR	Code of Federal Regulations
cfs	cubic feet per second
CID	Community Identification number
CLOMR	Conditional Letter of Map Revision
CNMS	Coordinated Needs Management Strategy
CRS	Community Rating System
DFIRM	Digital Flood Insurance Rate Map
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FPA	Floodplain Administrator
GIS	geographic information system
HEC-1	Hydrologic Engineering Center – Hydrologic Model Program
HEC-2	Hydrologic Engineering Center – Hydraulic Model Program
HEC-HMS	Hydrologic Engineering Center – Hydrologic Modeling System
H&H	hydrologic and hydraulic
HMP	Hazard Mitigation Plan
HUC	Hydrologic Unit Code
LiDAR	Light Detection and Ranging System
LOMA	Letter of Map Amendment
LOMC	Letter of Map Change
LOMR	Letter of Map Revision
MXD	Map Exchange Document
NFIP	National Flood Insurance Program
NHD	National Hydrologic Dataset
NMDHSEM	New Mexico Department of Homeland Security and Emergency Management

NM RGIS	New Mexico Resource Geographic Information System
NRCS	Natural Resources Conservation Service
NVUE	New Validated or Updated Engineering
Risk MAP	Risk Mapping, Assessment, and Planning
RL	Repetitive Loss
PMR	Physical Map Revision
RSC	Regional Service Center
SFHA	Special Flood Hazard Area
SHMO	State Hazard Mitigation Officer
SHP	ESRI Shape File
SRL	Severe Repetitive Loss
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
USFS	U.S. Forest Service
USFWS	U.S. Fish & Wildlife Service

I. Discovery Overview

The Federal Emergency Management Agency (FEMA) is currently implementing the Risk Mapping, Assessment, and Planning (Risk MAP) Program across the Nation. The purpose of Risk MAP is continued improvement of flood hazard information for the National Flood Insurance Program (NFIP), the promotion of increased national awareness and understanding of flood risk and the support of Federal, State, and local mitigation actions to reduce risk.

The vision and intent of the Risk MAP program is to, through collaboration with the State of New Mexico, local and tribal entities, deliver quality data that increases public awareness and leads to mitigation actions that reduce risk to life and property. To achieve this vision, FEMA has transformed its traditional flood identification and mapping efforts into a more integrated process of more accurately identifying, assessing, communicating, planning and mitigating flood risks. Risk MAP attempts to address gaps in flood hazard data and form a solid foundation for risk assessment, floodplain management, and provide with the State of New Mexico, local and tribal entities with information needed to mitigate flood related risks.

The FEMA Region 6 office, in partnership with the Earth Data Analysis Center, University of New Mexico began the Discovery process in the Upper Rio Grande watershed in October 2019 to gather local information and readily available data to determine project viability and the need for Risk MAP products to assist in the movement of communities towards resilience. The watershed location can be seen in Figure 1.

Through the Discovery process, FEMA can determine which areas of the HUC8 Discovery watersheds may/will be funded for further flood risk identification and assessment in a collaborative manner, taking into consideration the information collected from local communities during this process. Discovery initiates open lines of communication and relies on local involvement for productive discussions about flood risk. The process provides a forum for a watershed-wide effort to understand how the included watershed community's flood risks are related to flood risk throughout the watershed. In Risk MAP, projects are analyzed on a watershed basis, so Discovery Meetings target numerous stakeholders from throughout the watershed on local, regional, State, and Federal levels.

In September 2021 FEMA and the State will hold a Discovery Meetings in this watershed area. During Discovery, FEMA and the State reached out to local communities to:

- Gather information about local or Tribal flood risk and flood hazards
- Reviewed current and historic mitigation plans to understand local or Tribal mitigation capabilities, hazard risk assessments, and current or future mitigation activities.
- Include multi-disciplinary staff from within their community to participate and assist in the development of a watershed vision.

The results of the Discovery process are presented in a Discovery Report, a watershed scale Discovery Map and the digital data that were gathered or developed during the process under fiscal year 2019 CTP Agreement, EMT-2019-CA-00040, Mapping Activity Statement (MAS) 16, between FEMA and EDAC.

This document contains the Discovery Report. The digital data submitted with this report contain correspondence, exhibits used at the Discovery meetings, geographic information system (GIS) data, mapping documents (PDF, shapefiles, personal geodatabases and ESRI ArcGIS 10.8.1 Map Exchange Documents [MXDs]), or other supplemental digital information. Graphics in this

Discovery Report are available as larger format graphics files for printing and as GIS data that may be printed and used at any map scale.

i. Watershed Selection

The Upper Rio Grande Watershed (HUC 13020101) encompasses an area of approximately 3,252 square miles and extends across six counties in the north central part of New Mexico. Major communities include the towns of Española, Los Alamos, and Taos. Tribal Lands belonging to the Nambe Pueblo, Okay Owingeh, Picuris Pueblo, Pojoaque Pueblo, Santa Clara Pueblo, San Ildefonso Pueblo, Tesuque Pueblo, and Taos Pueblo are located in the watershed. There are no levees in the watershed that are shown to provide protection from the base flood on the DFIRMs.

The population in this watershed totals 88,477 people, based on the 2010 census. Los Alamos is one of the watershed's highest population centers (population: 12,213). There are in total 8 incorporated populated areas inside this watershed, in addition there are 8 Pueblo Nations. Sandoval County has the highest population 131,561 in the watershed however the portion of the County that falls within the watershed is unpopulated.

Table 1 provides a status update for each community's NFIP participation, CRS rating, and current FIRMs. Six of the counties and four of the communities are participating in the NFIP. Figure 1 shows the locations of all communities in the watershed. None of the NFIP communities in the watershed participate in the CRS program.

Table 1: NFIP Status of Project Area Communities[1]

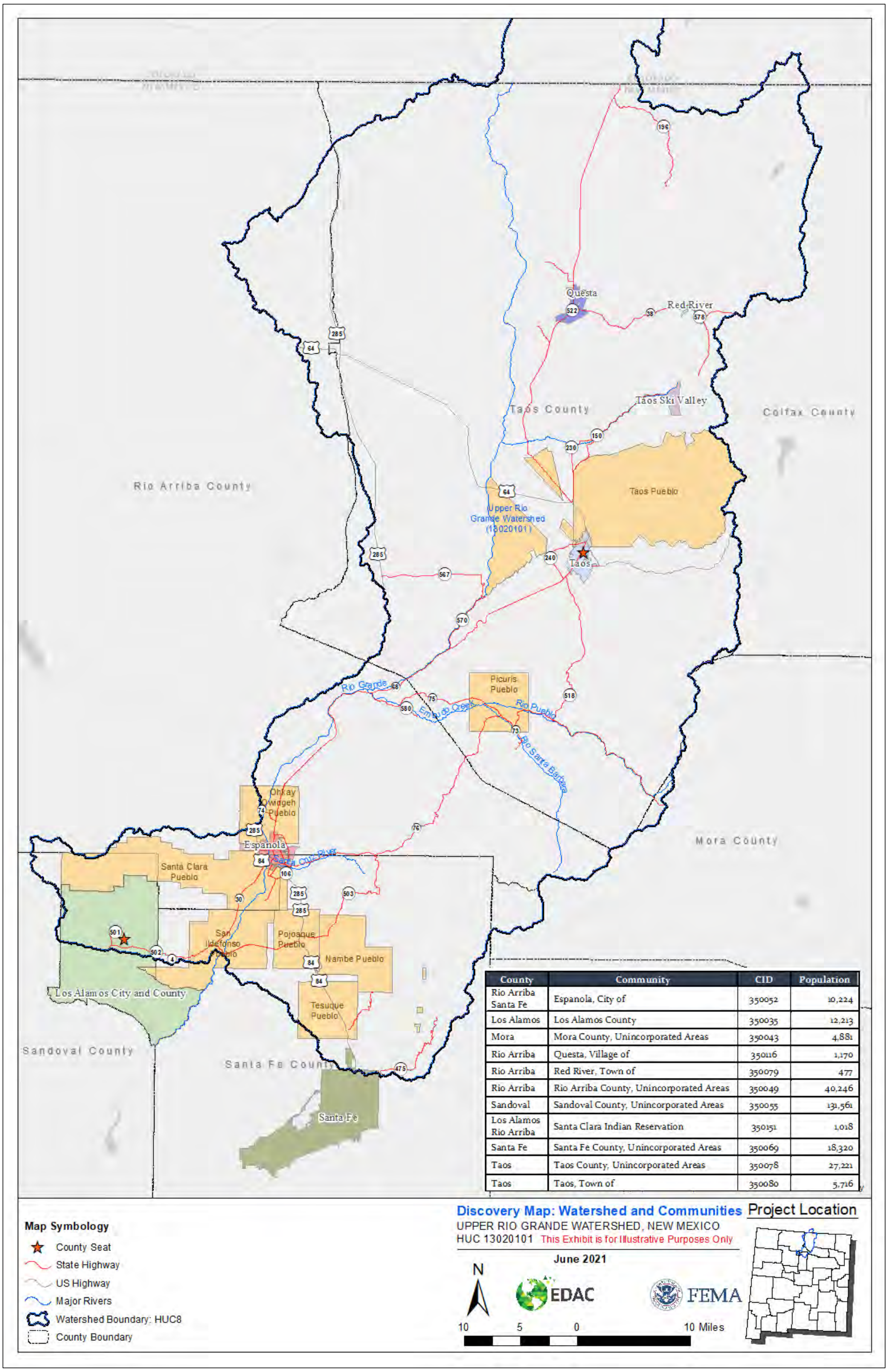
County	Community Name	Community Identification Number (CID)	Participating Community?	CRS Rating	FIRM Date	FIRM Status	Population (2010 Census)
Rio Arriba Santa Fe	Española, City of	350052	Yes	NR	12/04/12	Revised	10,224
Los Alamos	Los Alamos County	350035	Yes	NR	07/18/11	Revised	12,213
Mora	Mora County, Unincorporated Areas	350043	Yes	NR	8/1/1987		4,881
Rio Arriba	Questa, Village of	350116	Yes	NR	10/06/10	Revised	1,170
Rio Arriba	Red River, Town of	350079	Yes	NR	10/06/10	Revised	477
Rio Arriba	Rio Arriba County, Unincorporated Areas	350049	Yes	NR	03/15/12	Revised	40,246
Sandoval	Sandoval County, Unincorporated Areas	350055	Yes	NR	03/18/08	Revised	131,561
Los Alamos Rio Arriba	Santa Clara Indian Reservation	350151	No	NR			1,018

Santa Fe	Santa Fe County, Unincorporated Areas	350069	Yes	NR	12/04/12	Revised	18,320
Taos	Taos County, Unincorporated Areas	350078	Yes	NR	10/06/10	Revised	27,221
Taos	Taos, Town of	350080	Yes	NR	10/06/10	Revised	5,716

[1] Population represents total population for the community and not necessarily population in the watershed.

The primary river in the watershed is the Rio Grande, which flows south into Texas, eventually flowing into the Gulf of Mexico. Upper Rio Grande tributaries include the Red River, Rio Hondo, Pueblo de Taos, Embudo Creek and the largest tributary, the Rio Chama. While the annual flow of the Rio Grande river is quite variable, of the approximate 1.1 million acre-feet (long-term average) of native Rio Grande surface water that leaves the Upper Rio Grande and is measured at the Otowi stream flow gage, about one-third comes from Colorado, one-third comes from the Sangre de Cristo Mountains, and another third comes from the Rio Chama watershed.

Figure 1: Watershed and Communities



The State of New Mexico owns 115 square miles of the watershed. In addition, the New Mexico Game and Fish Department manages an additional 24 square miles, which includes the Red River State Fish Hatcher. There is one New Mexico State Park, the Hyde Memorial State Park, within the Upper Rio Grande Watershed. The Bureau of Land Management (BLM) owns 535 square miles of the watershed. The BLM land includes the Rio Grande del Norte National Monument along with the Orilla Verde Recreation Area and the Wild Rivers Recreation Area. The rivers that run through the Wild Rivers Recreation Area, the Rio Grande and Red River, are designated as National Wild and Scenic Rivers. The United States Forest Service (USFS) Carson National Forest owns 1158 square miles of the watershed. The United States Department of Energy, Los Alamos National Laboratories owns 5 square miles in the watershed. And the National Park Service manages a small area of 0.86 square miles. Nambe Pueblo, Okay Owingeh Pueblo, Picuris Pueblo, Pojoaque Pueblo, Santa Clara Pueblo, San Ildefonso Pueblo, Tesuque Pueblo, and Taos Pueblo own a combined 420 square miles within the Upper Rio Grande Watershed. These areas contribute to the overall square mileage of the watershed, but are not places where communities are able to plan for population growth or development.

There are two EPA Superfund Sites in the watershed (EPA Registry ID: 110022746670 and 110007031602). The North Railroad Avenue Plume site (110022746670) in Española is a contaminated groundwater plume from the operation of the Norge Town laundromat and dry cleaning operation. The Chevron Questa Mine site (110007031602) in Questa is a former molybdenum mine and milling facility on 3 square miles of land and tailing impoundments on about 1.5 square miles of land.

There is critical habitat for three endangered species within the Upper Rio Grande Watershed – the Jemez Mountains Salamander, the Southwestern Willow Flycatcher and the Yellow-billed Cuckoo.

There are 15 non-accredited levees in the USACE National Levee Database (NLD) for the Upper Rio Grande Watershed, none of which provide protection from the base flood. The levee sponsors are the City of Española and Rio Arriba County. Table 2 lists the levees, waterway, and sponsor.

Table 2: Upper Rio Grande Watershed Levees

Levee Name	Waterway	Sponsor
Arroyo de Chinguagues Levee	Arroyo de Chinguagues	Rio Arriba County
Arroyo de Ranchitos Levee	Arroyo de Ranchitos	Rio Arriba County
Arroyo Seco Northside Levee	Arroyo Seco	Rio Arriba County
Arroyo Seco Southside Levee	Arroyo Seco	Rio Arriba County
Española -Rio Grande East System 1	Rio Grande	City of Española
Española -Rio Grande East System 2	Rio Grande	City of Española
Española -Rio Grande West System	Rio Grande	City of Española
Rio Grande in Rio Arriba Levee System	Rio Grande	Rio Arriba County
Rio Grande near La Mesilla Levee	Rio Grande	Rio Arriba County
Rio Grande near Los Luceros Levee 1	Rio Grande	Rio Arriba County
Rio Grande near Los Luceros Levee 2	Rio Grande	Rio Arriba County
San Juan Pueblo Southeast Levee	Rio Grande	Rio Arriba County
Santa Clara Creek Levee 1	Santa Clara Creek	Rio Arriba County

Levee Name	Waterway	Sponsor
Santa Clara Creek Levee 2	Santa Clara Creek	Rio Arriba County
Santa Clara Creek Levee 3	Santa Clara Creek	Rio Arriba County

Table 3 lists the 37 dams within the Upper Rio Grande Watershed. This data is provided through the U.S. Army Corps of Engineers (USACE) National Inventory of Dams and the New Mexico Office of the State Engineer, Dam Safety Bureau.

Table 2: Upper Rio Grande Watershed Dams

Name	Owner	Hazard Rating	EAP
Beaver Park Dam No 1	Two Lakes Association	High	No
Beaver Park Dam No 2	Two Lakes Association	High	No
Cabresto Dam	Cabresto Lake Irrig.Co; Llano Community Ditch	High	Yes
Carson Dam	Ismael & Nora Aguirre; Ted & Lorenzo Mondragon	High	No
Cerro Dam	Acequia Madre de Cerro de Guadalupe	High	No
Costilla Dam	Rio Costilla Cooperative Livestock Association	High	Yes
Egolf Trout Pond	William Egolf	Low	NR
El Mirador Dam No. 2	Klauer Manufacturing	Low	NR
La Mesilla Site 1 Dam	La Mesilla Community Ditch	High	No
Los Alamos Canyon Dam	Los Alamos County	High	Yes
Nambe Falls Dam	DOI Bureau of Reclamation	Significant	No
Nanaka	Bureau of Indian Affairs	High	Yes
Pin Dee	Bureau of Indian Affairs	High	Yes
Questa Tailings Dam 1	Chevron Mining Inc.	High	Yes
Questa Tailings Dam 4	Chevron Mining Inc.	High	Yes
RC&D Project Measure 83 Dam	Town of Taos	High	No
Santa Cruz Dam	Santa Cruz Irrigation District	High	Yes
Santa Cruz Site 1 Dam	Santa Fe-Pojoaque Soil & Water Conservation Dist.	High	Yes
Santa Cruz Site 2G Dam	Santa Fe-Pojoaque Soil & Water Conservation Dist.	High	Yes
Santa Cruz Site 3 Dam	Santa Fe-Pojoaque Soil & Water Conservation Dist.	High	Yes

Name	Owner	Hazard Rating	EAP
Santa Cruz Site 3A Dam	Santa Fe-Pojoaque Soil & Water Conservation Dist.	High	Yes
Santa Cruz Site 4 Dam	Santa Fe-Pojoaque Soil & Water Conservation Dist.	High	Yes
Santa Cruz Site 5 Dam	Santa Fe-Pojoaque Soil & Water Conservation Dist.	High	Yes
Santa Cruz Site 6 Dam	Santa Fe-Pojoaque Soil & Water Conservation Dist.	High	Yes
Sebastian Martin BM 1 Dam	Upper Rio Grande Watershed District	High	Yes
Sebastian Martin Site 2 Dam	Upper Rio Grande Watershed District	High	Yes
Sebastian Martin Site 18 Dam	Upper Rio Grande Watershed District	High	Yes
Sebastian Martin Site 3 Dam	Upper Rio Grande Watershed District	High	Yes
Sebastian Martin Site 4 Dam	Upper Rio Grande Watershed District	High	Yes
Sebastian Martin Site 5 Dam	Upper Rio Grande Watershed District	High	No
Sebastian Martin Site 6 Dam	Upper Rio Grande Watershed District	High	No
Talpa Irrigation Dam	Talpa Water Users Association	High	No
Tesuque	Bureau of Indian Affairs	High	Yes
Tschicoma	Bureau of Indian Affairs	High	Yes
Upper Fawn Lake Dam	USDA FS	Significant	NR
Upper Trout Lake Dam	USDA FS	Significant	NR
Weinpovi	Bureau of Indian Affairs	Unk	Unk

Population

The population in this watershed totals 88,477 people, based on the 2010 census. Los Alamos is one of the watershed's highest population centers (population: 12,213). There are in total 8 incorporated populated areas inside this watershed, in addition there are 8 Pueblo Nations. Sandoval County has the highest population 131,561 in the watershed however the portion of the County that falls within the watershed is unpopulated. Figure 2 shows the population densities within the Upper Rio Grande Watershed based on U.S. Census Data 2010.

Land Use

The land use of the Upper Rio Grande Watershed is predominantly rural with forest and herbaceous cover being the dominate vegetation types. Figure 3 identifies the relative percent urban cover for areas within the watershed. Figure 4 shows the changes in the percent urban coverage that have occurred in the watershed between 2001 and 2016. There has been minimal increase in urban area in the watershed during that time period.

Figure 2: Population Density in the Watershed

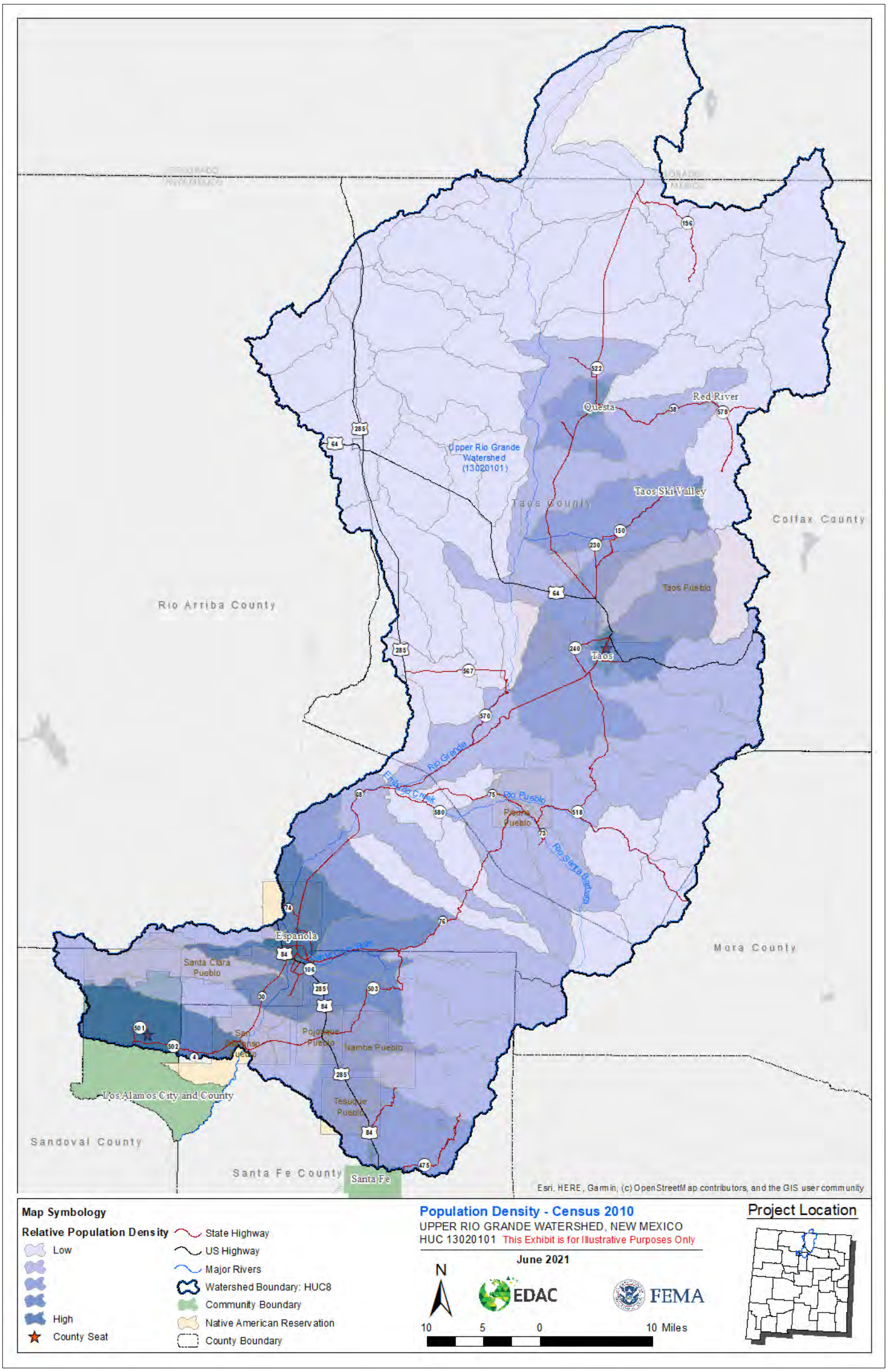


Figure 3: Current Percent Urban Coverage

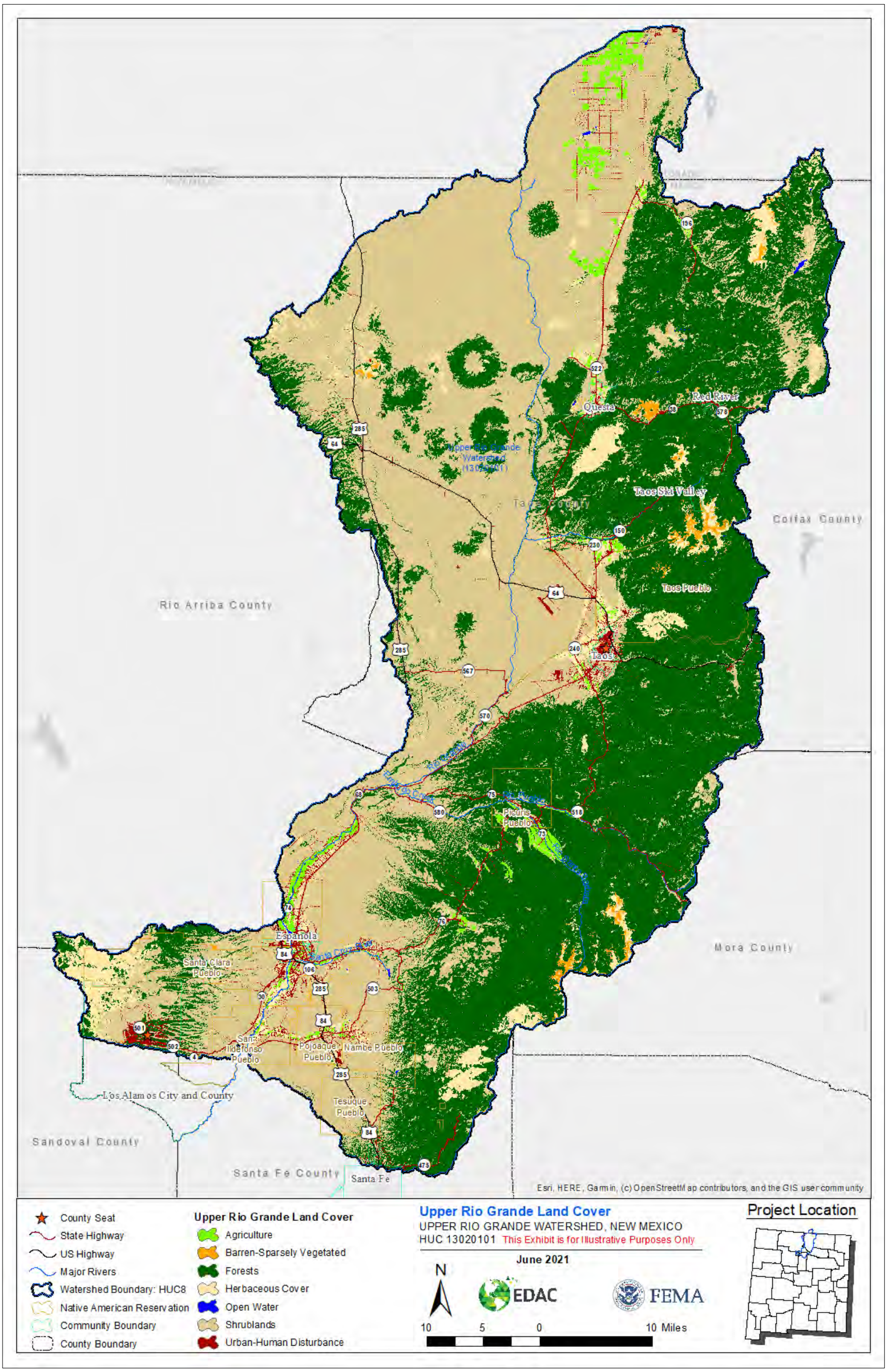


Figure 4: Urban Changes Last Five Years

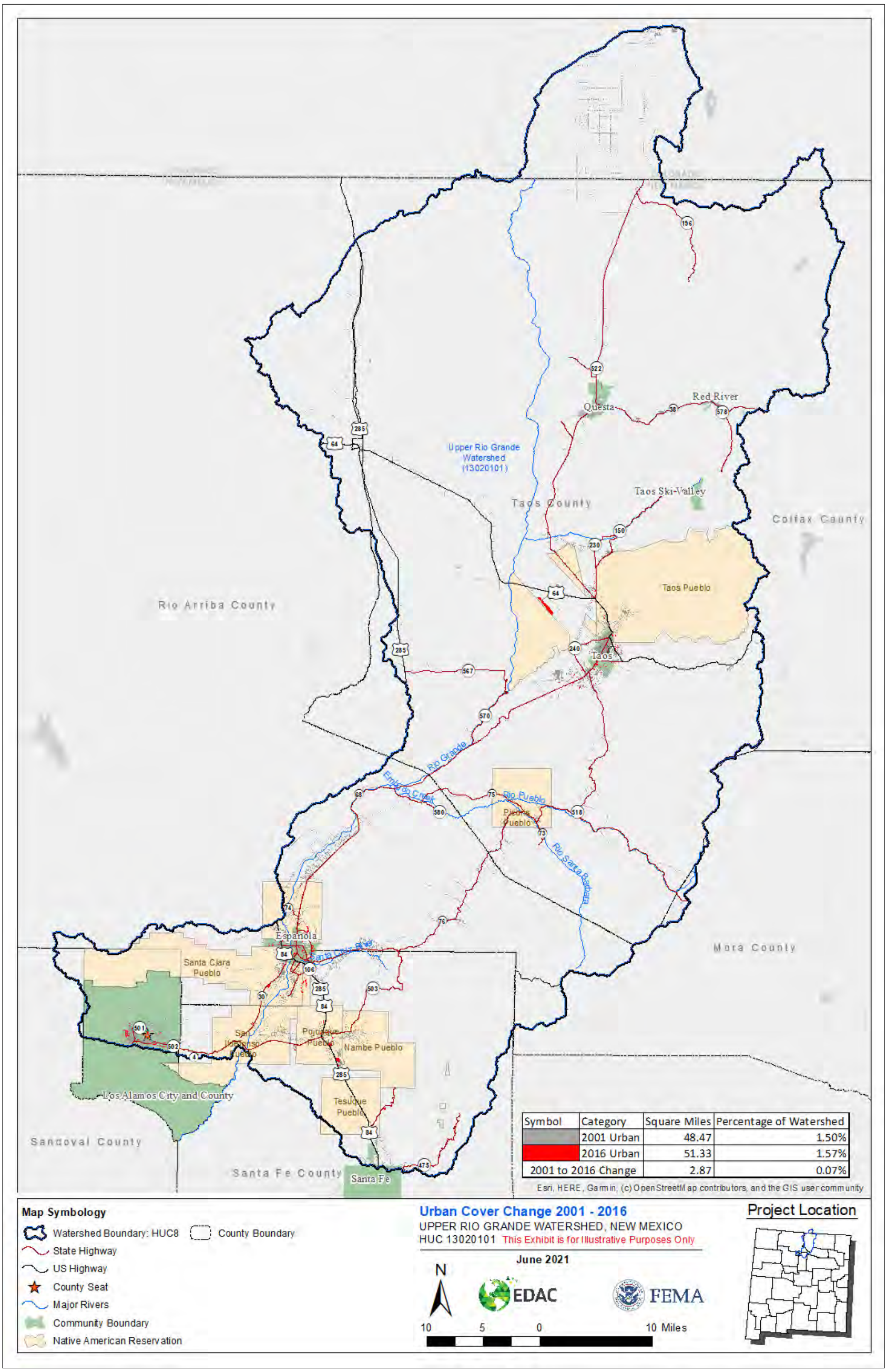


Table 2 lists the number of NFIP insurance claims for the portions of the communities within the Watershed. Figure 5 depicts the distribution of NFIP insurance claims within the Upper Rio Grande Watershed.

Table 2: Total NFIP Insurance Claims

Total NFIP Insurance Claims by Community	
Community	**Claims**
Española, City of	1
Red River, Town of	3
Rio Arriba County	10
Santa Fe County	7
Taos County	13

In addition to NFIP claims, there are no locations of Repetitive Loss (RL) or Severe Repetitive Loss (SRL) properties within the Upper Rio Grande Watershed, see Table 3.

Table 3: Repetitive or Severe Repetitive Loss within the Watershed

Repetitive Losses/Severe Repetitive Losses By Community			
Community	**Number of Properties**	**Total Claims**	**Average Claim Per Property**
N/A	None	None	None

The Upper Rio Grande Watershed has had a history of flooding as demonstrated by numerous presidential disaster declarations with five issued in the past 15 years. The 2018 Taos County Hazard Mitigation Plan notes that the Village of Questa has had some issues with flooding on the Red River. Costilla has also had multiple areas of concern. The committee explained that arroyo erosion and mitigation has caused issues, particularly when there is development nearby or pressure to develop adjacent to the arroyos. Table 4 lists recent disaster declarations for multiple hazards within the watershed.

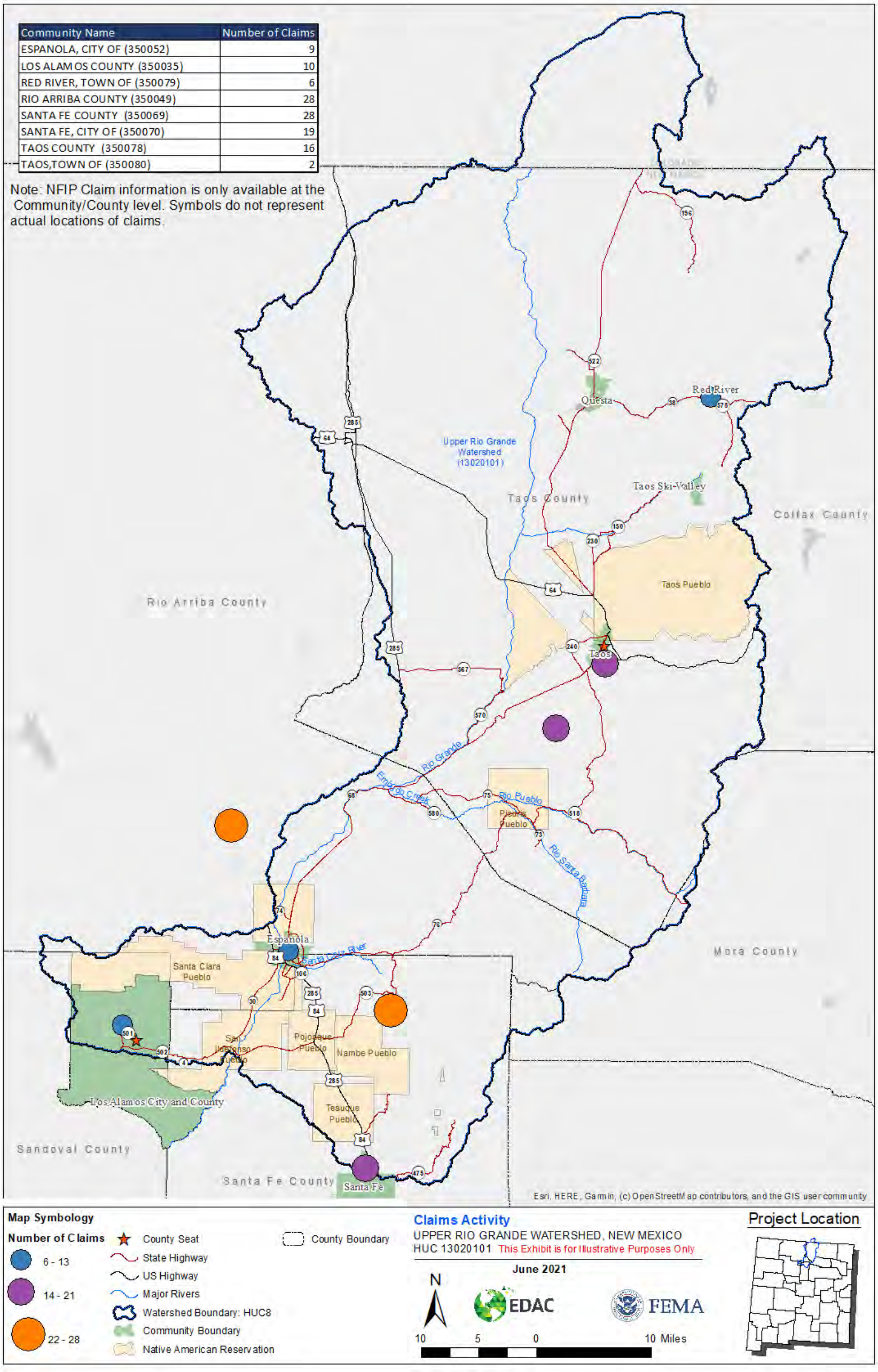
Table 4: Disaster Declarations in the Watershed

Date of Declaration	Watershed Counties Declared	For Hazard
2006	Rio Arriba, Taos	Severe Storms and Flooding
2011	Santa Clara Pueblo, Los Alamos	Flooding
2012	Santa Clara Pueblo, Los Alamos	Flooding
2013	Santa Clara Pueblo, Los Alamos, Rio Arriba, Santa Fe, Taos	Severe Storms, Flooding, and Mudslides
2014	Rio Arriba, Santa Clara Pueblo, Santa Fe, Taos	Severe Storms and Flooding

Figure 5: Single Claims in the Watershed

Community Name	Number of Claims
ESPANOLA, CITY OF (350052)	9
LOS ALAMOS COUNTY (350035)	10
RED RIVER, TOWN OF (350079)	6
RIO ARRIBA COUNTY (350049)	28
SANTA FE COUNTY (350069)	28
SANTA FE, CITY OF (350070)	19
TAOS COUNTY (350078)	16
TAOS,TOWN OF (350080)	2

Note: NFIP Claim information is only available at the Community/County level. Symbols do not represent actual locations of claims.



Topographic Data

Recent acquisitions of topographic data via LiDAR have been made for the entire watershed. Topographic coverage totals are at about 100 percent for the entire watershed. Figure 6 provides a snapshot of CNMS factors for each stream segment, the HUC 12 risk decile, and the availability of topographic data.

Congressional Involvement

Senator Ben Ray Luján serves on the Committee on Commerce, Science, and Transportation; the Committee on Health, Education, Labor, and Pensions (HELP); the Committee on Agriculture, Nutrition, and Forestry; the Committee on Indian Affairs; and the Committee on the Budget. Senator Luján grew up in Nambé, a small community within the Upper Rio Grande Watershed. Senator Luján is a long-time advocate for New Mexico's acequias and traditional lands. Senator Martin Heinrich serves on the Committee on Energy and Natural Resources; the Committee on Appropriations and serves as chairman of the Military Construction (MILCON), Veterans Affairs, and Related Agencies Subcommittee; and the Select Committee on Intelligence, and serves as the Vice Chair of the Joint Economic Committee. Representative Teresa Leger Fernández serves on the House Committee on Natural Resources, and is Chair of the Subcommittee for Indigenous Peoples of the United States and is a Member of the Subcommittee on National Parks Forests and Public Lands; the House Committee on Education and Labor, is a Member of the Higher Education and Workforce Investment Subcommittee and is a Member of the Civil Rights and Human Services Subcommittee; and she serves on the Committee on House Administration, and is a Member of the Elections Subcommittee.

Streams and Waterways

Significant streams in this watershed include the Rio Grande. The USGS provides a National Hydrologic Dataset (NHD) that can be used to identify stream miles that reflect drainage areas of one square mile from available topographic data. The NHD stream mileage may be used to gain a sense of the total potential stream miles for a watershed. Using the NHD, there are approximately 3,259 miles of streams in the Upper Rio Grande Watershed.

The Coordinated Needs Management Strategy (CNMS) Inventory provides a snapshot of the status and attributes of currently studied streams existing within FEMA's floodplain study inventory. In general, the stream mileage shown in CNMS reflects streams with an approximately one-mile drainage area and that currently have effective Special Flood Hazard Areas (SFHA) designated for them. CNMS does not reflect the total potential of stream miles to be studied within a watershed.

In addition to listing the miles of studied stream within a watershed, CNMS documents certain physiological, climatological, or engineering methodological factors that may have changed since the date of the effective study. The stream miles shown in CNMS are attributed with an evaluation of a Validation Status and Status Type that allows an examination of the condition of a given study or group of studies. Studies which are considered Valid in CNMS are the only studies which contribute to the New Validated or Updated Engineering (NVUE) metric.

The NVUE metric is used as an indicator the status of studies for FEMA's mapped SFHA Inventory. Those studies which are categorized as 'unverified', typically indicate that there are some factor of change since the SFHA became effective or may have a deficiency warranting restudy. CNMS

stream mileage categorized as 'Requires Assessment' require further input to determine their validity – often because they represent paper inventory or non-modernized studies. CNMS aids in identifying areas to consider for study during the Discovery process by highlighting needs on a map, quantifying them (mileage), and providing further categorization of these needs in order to differentiate factors that identify the needs.

Table 5 compares the NHD data to the CNMS data and summarizes the Validated NVUE stream mileage from CNMS for the watershed.

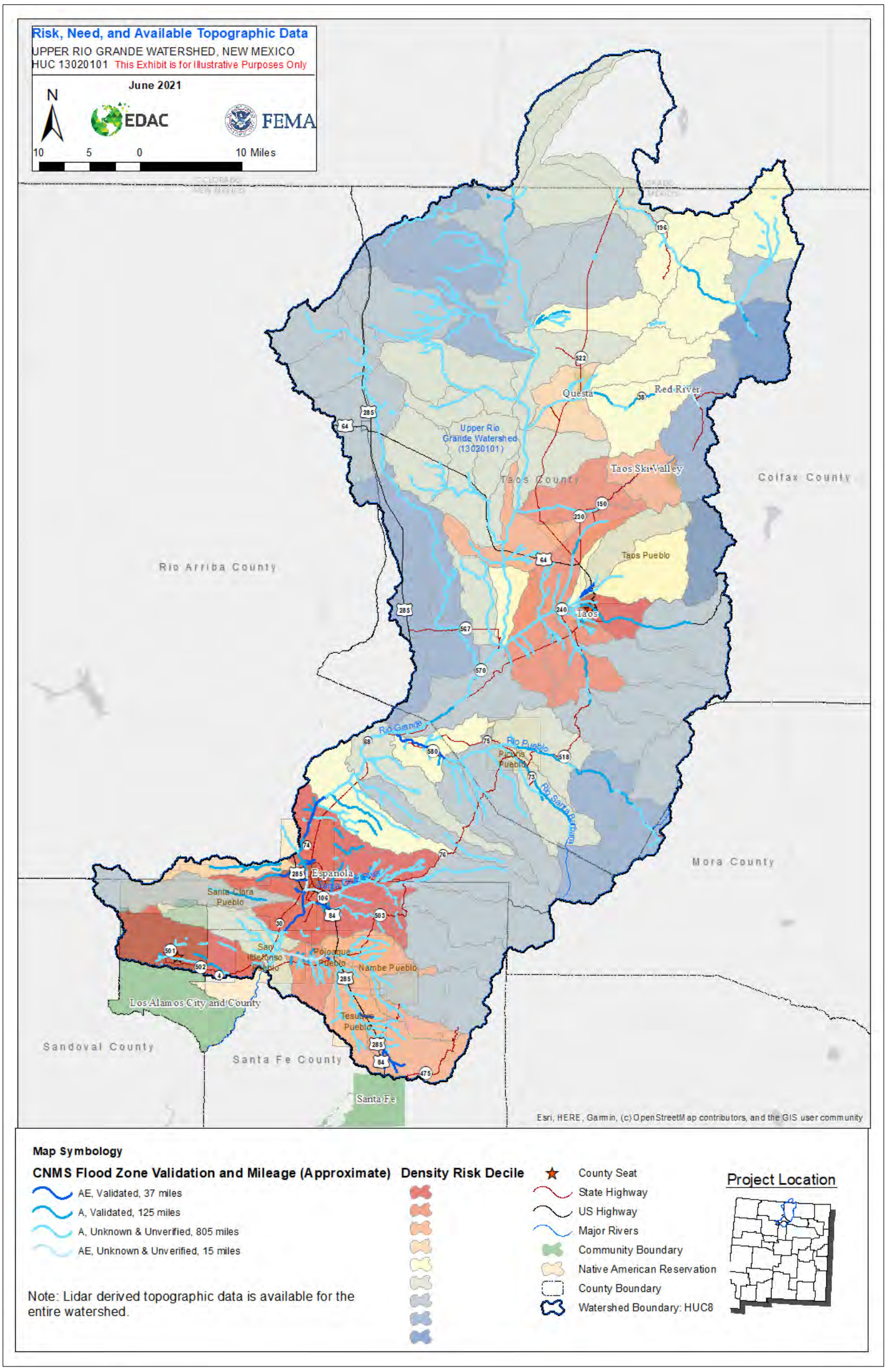
Table 5: NVUE Approximate Stream Mileage in the Watershed

NVUE Validation	Stream Miles
NHD Streams (streams with a drainage area of greater than one square mile)	**2,109.22**
CNMS Streams (streams with effective SFHA)	**1,154.3**
Stream Miles not accounted for in CNMS	**2,111.23**
CNMS Valid Zone AE / AH	37.26
CNMS Valid Zone A	124.64
CNMS Unverified Zone AE / AH	14.52
CNMS Unverified Zone A	800.85
CNMS Zone AE / AH Requiring Further Assessment or in the process of being studied	19.17
CNMS Zone A Requiring Further Assessment	0
All Stream Miles not accounted for in CNMS as there are no effective SFHAs (sum of the below)	2,111.23
Stream Miles not accounted for in CNMS that would fall in land that *could be* developed	565.83
Stream Miles not accounted for in CNMS that would fall in land that *could not be* developed	1,545.4

Within the Upper Rio Grande Watershed and using these criteria from CNMS, approximately 800.85 miles of Zone A and 14.52 miles of Zone AE areas were identified as being unverified. Streams included in the unverified grouping include the Pojoaque River, Red River, Rio Grande, Santa Cruz River, and an Unnamed Tributary to Rio Tesuque, ***with*** approximately 19.17 miles of Zone AE flagged as requiring further assessment or are in the current process of being studied with on-going projects. Additionally, approximately 14.52 miles of Zone AE in the watershed were characterized as being Valid under the NVUE metrics.

Figure 6 provides a snapshot of CNMS factors for each stream segment, the HUC 12 risk decile, and the availability of topographic data. The combination of these three factors resulted in the selection of the Upper Rio Grande Watershed for a Discovery Project.

Figure 6: Risk, Need and Available Topographic Data



II. Discovery Efforts

i. Engagement Plan

Pre-Discovery Community Engagement

Table 7 provides the members of the Regional Project Team was made up of the following staff.

Table 6: Regional Project Team

Organization	Name/E-Mail	Project Role
FEMA R6	Brittany Brush	Project Monitor
FEMA R6	Shanene Thomas	Tribal Liaison and Mitigation Planning
FEMA R6	Trey Rozelle	Flooplain Management & Insurance
State of New Mexico	Loretta Hatch	State Floodplain Coordinator
State of New Mexico	Chelsea Morganti	State Hazard Mitigation Officer
Earth Data Analysis Center	Shawn L. Penman	CTP Coordinator

FEMA and the Regional Project Team were in contact with all Watershed stakeholders via letters, email, and phone calls before this Discovery meeting to request local participation. In addition to assisting scheduling the meeting, locals were asked to help identify additional key people who should be included in the Discovery process and acquire any data that will assist in the risk identification and assessment for the Upper Rio Grande. A detailed list of Communities, local officials, federal, state and regional agencies that were invited to participate in the Discovery Process is included with the supplemental digital data accompanying this report.

In preparation for the Discovery meeting, the Regional Project Team:

- Gathered information about local flood risk and flood hazards
- Reviewed mitigation plans to understand local mitigation capabilities, hazard risk assessments, current or future mitigation activities, and areas of mitigation interest
- Mapped known and available Grant Activity in the Watershed
- Mapped known and available Claims Activity in the Watershed
- Mapped Percent Urban Cover in the Watershed
- Mapped Urban Change from 2001 – 2014
- Mapped Population Density in the Watershed

The information gathered before, during, and after the Discovery meeting will be used to determine which areas of the watershed may require further study through a Risk MAP project. Discovery will also include discussions with other state and federal agencies about potential partnership opportunities, as well as enlisting their help in identifying flood risk throughout the watershed.

The Regional Project Team began outreach efforts to the local governments within the Watershed, Congressional and public officials, to inform them of the Discovery process and to invite them to participate and contribute information about the Watershed about water resource concerns. The following are key steps that were taken before the Discovery workshops:

Discussions are being held with these agencies about potential partnership opportunities, as well as their help in identifying flood risk throughout the watershed.

Table 7: FEMA History of Engagement

Community Name	Type of Engagement	Date	Agency	Comments
Rio Arriba County	CAV	6/22/2016	FEMA/NMDHSEM	
Santa Fe County	CAV	9/8/2016	FEMA/NMDHSEM	
Santa Fe, City of	CAV	9/8/2016	FEMA/NMDHSEM	
Taos County	CAV	8/11/2016	FEMA/NMDHSEM	
Taos, Town of	CAV	12/19/2016	FEMA/NMDHSEM	
Upper Rio Grande Watershed	Topographic Acquisition / LiDAR	2016	FEMA	

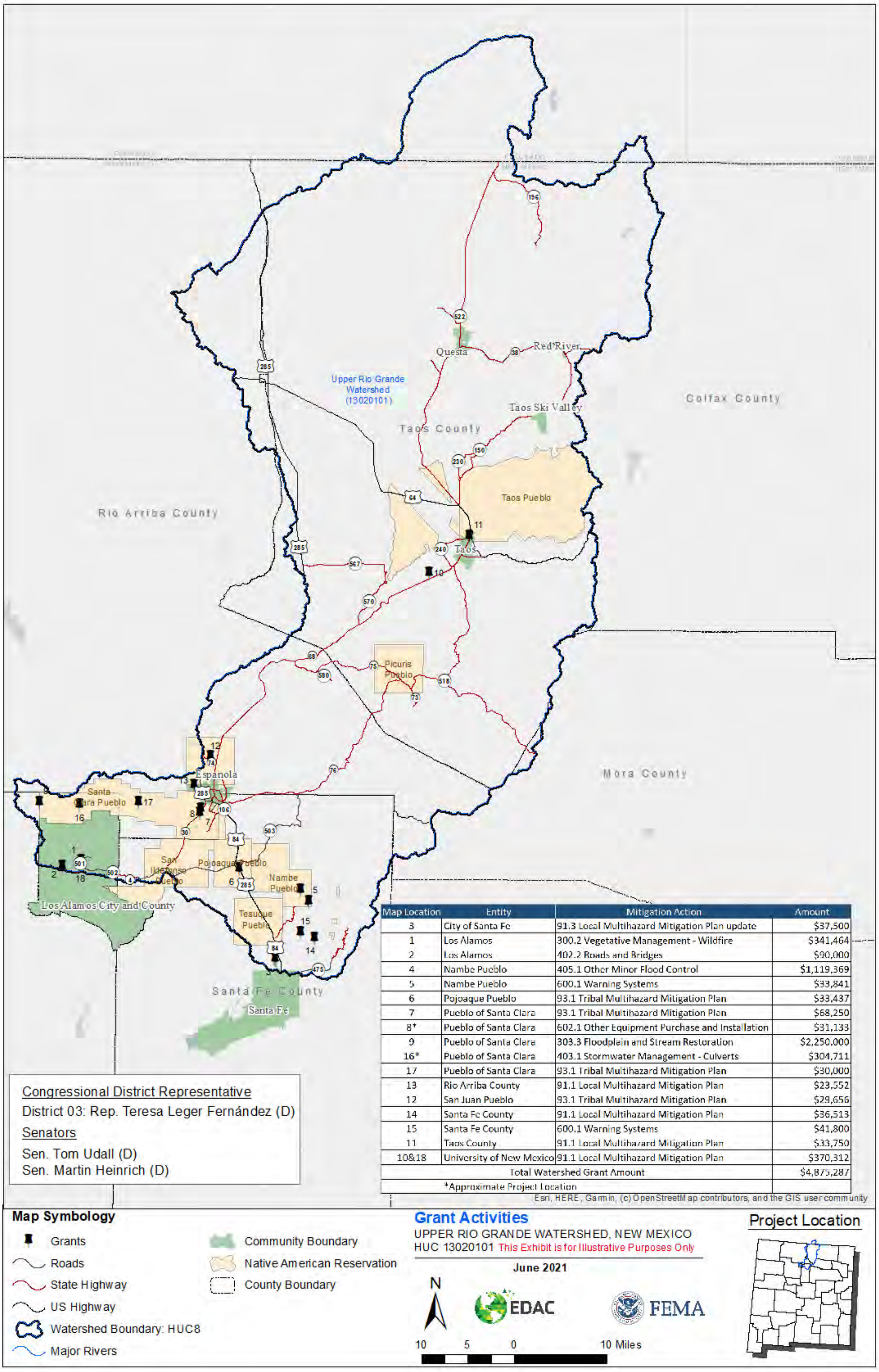
* Meetings or other FEMA engagement activities that have occurred in the watershed in the past 5 years.

Table 8: Mitigation Plan Status

Community Name	Community Mitigation Action:	Hazard Mitigation Plan Name:	Plan Status:	Plan Approved	Plan Expires
Los Alamos County		N/A	Expired		
Ohkay Owingeh (San Juan Pueblo)			Current	7/10/2018	12/3/2022
Rio Arriba County		N/A	Expired		
Santa Clara Pueblo		Santa Clara Pueblo Hazard Mitigation Plan	Current	8/1/2018	7/31/2023
Santa Fe County		Santa Fe County Hazard Mitigation Plan	Current	5/30/2018	5/29/2023
Taos County		Taos County Hazard Mitigation Plan	Current	1/2/2019	1/1/2024
Taos Pueblo			Current	10/16/2018	10/15/2023
University of New Mexico			Current	6/9/2016	6/8/2021

Figure 7 displays the locations and types of mitigation grant activity in the Upper Rio Grande Watershed which have been approved by FEMA. This map only shows approved grant activity. There may be additional grants being pursued at both the state and local level within the watershed.

Figure 7: Grants Activity



Map Location	Entity	Mitigation Action	Amount
3	City of Santa Fe	91.3 Local Multihazard Mitigation Plan update	$37,500
1	Los Alamos	300.2 Vegetative Management - Wildfire	$341,464
2	Los Alamos	402.2 Roads and Bridges	$90,000
4	Nambe Pueblo	405.1 Other Minor Flood Control	$1,119,369
5	Nambe Pueblo	600.1 Warning Systems	$33,841
6	Pojoaque Pueblo	93.1 Tribal Multihazard Mitigation Plan	$33,437
7	Pueblo of Santa Clara	93.1 Tribal Multihazard Mitigation Plan	$68,250
8*	Pueblo of Santa Clara	602.1 Other Equipment Purchase and Installation	$31,133
9	Pueblo of Santa Clara	303.3 Floodplain and Stream Restoration	$2,250,000
16*	Pueblo of Santa Clara	403.1 Stormwater Management - Culverts	$304,711
17	Pueblo of Santa Clara	93.1 Tribal Multihazard Mitigation Plan	$30,000
13	Rio Arriba County	91.1 Local Multihazard Mitigation Plan	$23,552
12	San Juan Pueblo	93.1 Tribal Multihazard Mitigation Plan	$29,656
14	Santa Fe County	91.1 Local Multihazard Mitigation Plan	$36,513
15	Santa Fe County	600.1 Warning Systems	$41,800
11	Taos County	91.1 Local Multihazard Mitigation Plan	$33,750
10&18	University of New Mexico	91.1 Local Multihazard Mitigation Plan	$370,312
	Total Watershed Grant Amount		$4,875,287
	*Approximate Project Location		

Pre-Discovery Congressional and Media Engagement

In order to achieve success with any Region 6 Risk MAP project, members of Congress and their staff members, as well as the media must be aware and understand the study process. Working with FEMA External Affairs to inform both legislators and the media will improve credibility and opens the door to understanding risk in a more holistic, comprehensive manner.

Table 9: Congressional Information

U.S. Senator		Term Expiration	FEMA History of Engagement
Martin Heinrich		2025	
Ben Ray Luján		2027	
U.S. Representative	**District Number**	**Term Expiration**	**FEMA History of Engagement**
Teresa Leger Fernández	3	2023	

State Senators	
District	**Name**
5	Leo Jaramillo
6	Roberto "Bobby" J. Gonzales
8	Pete Campos
22	Benny Shendo, Jr.
25	Peter Wirth

State Representatives	
District	**Name**
40	Roger E. Montoya
41	Susan K. Herrera
42	Kristina Ortiz
43	Christine Chandler
46	Andrea Romero
47	Brian Egolf

Contact information for the community and additional stakeholders can be found with the supplemental digital data.

Tribal Engagement

The FEMA Region 6 tribal liaison contacted the tribes within the Upper Rio Grande Watershed to inform them about the Discovery process.

ii. Pre-Discovery Data Collection

Table 10: Data Collection for the Watershed

Data Types	Deliverable/Product	Source
Average Annualized Loss Data	Discovery Map Geodatabase	FEMA Region VI
Boundaries: Community	Discovery Map Geodatabase	RGIS
Boundaries: County and State	Discovery Map Geodatabase	RGIS
Boundaries: Watersheds	Discovery Map Geodatabase	RGIS
Census Blocks	Discovery Map Geodatabase	RGIS
Contacts	Table	Local Web Sites, State/FEMA Updates
Community Assistance Visits	Discovery Report	New Mexico Department of Homeland Security and Emergency Management, State Floodplain Coordinator
Community Rating System (CRS)	Discovery Report	FEMA's "Community Rating System Communities and Their Classes"
Dams and Levees	Discovery Map Geodatabase	National Inventory of Dams, USACE/New Mexico Office of the State Engineer, Dam Safety Bureau

iii. Discovery Meeting

A two-hour Discovery meeting was held September 2, 2021, this meeting was held virtually due to the impact of the COVID-19 pandemic. Feedback from local communities indicated that they were not having in-person meetings at the time of Discovery and that a virtual Discovery meeting would be preferred. Workshop time and location are shown in Table 11.

Table 11: Project Discovery Workshop Times and Locations

Workshop	Date and Time	Location
1	September 2, 2021 10:00 am –12:00 pm	Virtual Webinar

A series of Story Maps with information was created for the virtual Discovery meeting to provide the information that would be shared in an in-person meeting. The following Story Maps were created:

- Discovery Process – Overview of Discovery process with description of why it is important, who should participate, what kind of information is being sought, and mitigation actions.

- Base Level Engineering (BLE) – Discussion of the BLE process, link to the estimated BFE Viewer, and links to the FEMA BLE publications.
- NFIP Community Actions – Over view of the NFIP program including a video, description of New Mexico flooding along with a FEMA Video on flash flooding, flood insurance facts and links to how to buy flood insurance, and information about flood insurance and post-wildfire flooding.
- Hazard Mitigation – Discussion of hazard mitigation plan and links to the FEMA hazard mitigation plan resource page, links to how to create a hazard mitigation plan, section on the New Mexico Mitigation Funding Resource Guide, information on Hazard Mitigation Assistance Grants, links to mitigation planning resources, including tribal mitigation planning, the FEMA Mitigation Planning Success Stories story map was embedded, and information about the NMDHSEM mitigation program.
- Map of Upper Rio Grande Watershed – interactive web map of the Upper Rio Grande Watershed with community flood information including, NFIP communities, locations of LOMAs, USGS gages, acequias and special flood hazard zones.
- Hazards Data Collection Survey Tool – An on-line survey for stakeholder to provided information about flood locations including description of flooding, location, photos, mitigation activities, and contact information.
- Upper Rio Grande Discovery Maps – maps prepared for Discovery meeting including: Maps of current floodplain-related grants; risk, needs and topographic availability; RL/SRL properties; letters of map change (LOMCs); urban changes over the last 5 years; NFIP claims; risk/need/topographic availability; population density in the watershed; and urban change in the watershed.

iv. Discovery Implementation

The Discovery Workshop was attended by local stakeholders. A full list of attendees is provided in the sign-in sheets included with the supplemental digital data accompanying this report. Some attendees included:

- Los Alamos County: Public Works Engineer
- Taos County: County Commissioner, Planning Directory, Public Works Director,
- Town of Taos, GIS Staff, Local Floodplain Manager, City Councilor
- Rio Arriba County: Emergency Manager, Planning and Zoning Director
- Village of Taos Ski Valley: Public Works Director, GIS Staff

v. Data Gathering Overview

Information about the Upper Rio Grande Watershed was gathered both prior to the Discovery Workshops and interactively during the Workshop. For this watershed, the Town of Taos and Taos County, submitted data prior to the discovery Workshop. Much of data collected in pre-discovery was obtained from FEMA or other national datasets. Additional data was collected from RGIS, USACE, and local communities via their public web sites. Table 12 summarizes the data collected prior to the Discovery Workshop and the primary sources of the data.

During the pre-discovery process phone calls were made to local FPAs, Emergency Managers, and Mitigation planners to collect current and proposed mitigation actions. This data was collected in spreadsheets and will be used by FEMA to track mitigation actions within the region. The final spreadsheets are included in the supplemental digital data.

Table 12: Data Collection Summary – Pre-Discovery Workshop

Data Location	Data Custodian	Data Set Description
Watershed-wide	FEMA	Effective FIRM and FIS and backup information available from FEMA's Map Service Center and FEMA Library
Watershed-wide	FEMA	LOMC locations from FEMA's Map Service Center and FEMA Library
Watershed-wide	FEMA	Locations of RL/SRL properties and Claims
Watershed-wide	FEMA	Location of Grants being funded
Watershed-wide	FEMA	Participation in the NFIP, Community Rating System (CRS) ratings
Watershed-wide	FEMA	Disaster Declarations
Watershed-wide	FEMA	CNMS information
Watershed-wide	FEMA	AAL data
Watershed-wide	NMDHSEM	Approved HMPs
Watershed-wide	FEMA, RGIS	Location of available or planned areas of updated LiDAR or other topographic data
Watershed-wide	RGIS	Transportation features
Watershed-wide	FEMA, RGIS	Populated places and population characteristics
Watershed-wide	USGS	Watershed HUC (8 & 12) boundaries, NHD streams, stream gage information, land use and land cover
Watershed-wide	USDA	NAIP Imagery
Watershed-wide	Local FPAs, Mitigation Planners and Emergency Managers, FEMA	Mitigation Actions identified by local stakeholders and collected by phone call
Watershed-wide	New Mexico Office of the State Engineer, Dam Safety Bureau	Location of dams, hazard rating, and EAP Status
Watershed-wide	EPA	Superfund site locations and details
Watershed-wide	USFWS	Critical habitat locations
Watershed-wide	NRCS	NRCS Project Locations
Watershed-wide	USACE	USACE Project locations, reports

The information from local communities was captured in GIS format (ESRI Personal Geodatabase, point features named "*Community_Data")* and the data from the submitted information was matched with each point location on the watershed maps.

Table 13 summarizes the comments and information collected during the Discovery meeting or through the Discovery Story Map. If multiple attendees made the same comment, the "Information Provided by" column lists more than one attendee. Item numbers tie directly back to the GIS data and the data collection sheets. In addition, data collected in pre-Discovery from Town of Taos and Taos County and from calls with local community officials have also been placed in GIS format and are shown on the watershed collection. Discovery data collection continued after the Discovery Workshop as additional datasets were provided. This data set are also included in Table 13. Some comments collected at the Discovery Workshop reflect on areas outside of the Upper Rio Grande Watershed. This information was collected for future use in future Discovery efforts and is noted below.

Table 13: Data Collection Summary - During and After Discovery Workshop

Flooding Source	Information Provided By	Discovery Workshop Comment Summary
Rito Cieneguilla	Taos County	• There is no SFHA along this water way.
Red River	Taos County	• Area of concentrated population near Red River and no mapped SFHA
Unnamed Arroyo	Town of Taos	• Drainage Channel (along Paseo del Canon E) installed prior to the 2010 FIRM update not incorporated into the update. BLE data shows correct flow path.
Taos County	Town of Taos and Taos County	• Zone in areas outside of Taos Pueblo Reservation, with detailed study in area, why is this Zone D instead of Zone X.
Rio Hondo	Taos County	• Village of Taos Ski Valley no mapped SFHA
Unnamed Arroyo	Taos County	• Grading work in Village of Quest, SFHA does not reflect the change in surface.
Rio Fernando River	Taos County	• The current SFHA does not match the flood hazard zone from the BLE analysis.
Rio Grande del Rancho, Talpa	Taos County	• The current SFHA is shown outside the channel boundaries. The BLE data follows the river channel.
Rio Grande del Rancho	Taos County	• The current SFHA is shown outside the channel boundaries. The BLE data follows the river channel.
Rio Pueblo, Angostura	Taos County	• The current SFHA is shown outside the channel boundaries. The BLE data follows the river channel.
Taos County	Taos County	• BLE data, North of Camino del Medio depth grid seems unrealistic given topography.
Taos County	Taos County	• BLE data, East of Paseo del Pueblo Sur (Couse Pasture) depth grid seems unrealistic given topography.
Taos County	Taos County	• Development in areas designated as being within a floodplain
Taos County	Taos County	• Growth occurring in the Llano Quemado and Los Las Colonias areas. Multiple arroyos running through these areas are a flooding risk that landowners can be complacent about due to their infrequent flow.
Rio Arriba County	Rio Arriba County and Santa Fe-Pojoaque Soil and Water Conservation District	• Santa Cruz flood control earthen dams past designed fifty-year life span and Santa Cruz Site 1 Dam is at near capacity and in need of immediate remediation. The NRCS is conducting a Watershed Rehabilitation Program project at the Santa Cruz Site 1 Dam.

Flooding Source	Information Provided By	Discovery Workshop Comment Summary
Rio Arriba and Santa Fe County	USACE	• USACE Española Valley, Rio Grande and Tributaries, New Mexico, Final Integrated Feasibility Report and Environmental Assessment, August 2017 - The study area is located in southern Rio Arriba County and includes a small portion of northern Santa Fe County. Study area boundaries are the 0.2% chance exceedance event floodplains for the Rio Grande and Rio Chama from the northern border of Ohkay Owingeh Pueblo, downstream through the Santa Clara Pueblo lands and to the southern border of San Ildefonso. The lowest reaches of the tributaries of the Rio Grande (Santa Cruz River, Arroyo Guachupangue, and the Rio Pojoaque), are also included in the study area. Of note: Appendix I discusses flooding impacts and preliminary alternatives developed.
Rio Arriba County	USACE	• Drainage Management Plan for Ohkay Owingeh Pueblo, Rio Arriba County, New Mexico. July 24, 2020

III. Watershed Findings

This watershed contains no levee structures that are managed by the U.S. Army Corps of Engineers (USACE), Albuquerque District, within the National Levee Database (NLD).

In addition to NFIP claims, there are no locations of Repetitive Loss or Severe Repetitive Loss with the Upper Rio Grande Watershed. Figure 8 shows the approximate location of these losses.

Letters of Map Amendment and Revisions are also distributed throughout the watershed, but appear to be concentrated in the City of Española and the Town of Taos and around the Arroyo Seco, Pojoaque River, Rio Tesuque, and the Unnamed Tributary No 43. Please refer to Figure 9 for the location of these Letter of Map Change (LOMC).

Acequias and ditches have played an important role in the settlement of New Mexico and today remain an integral part of community life. The words “acequia” and “ditch” can defined in both a physical and political context. As a physical structure, an acequia or ditch is typically man-made earthen channel that conveys water to individual tracts of land. As a political organization, a community ditch or acequia is a public entity that functions to allocate and distribute irrigation water to the landowners who are its members.

The physical characteristics of an acequia or ditch typically include a diversion dam and headgate, a main ditch channel commonly called the acequia madre, lateral ditches leading from the main channel to irrigate individual leading from the main channel to irrigate individual parcels of land, and wasteway channel that returns surplus water from the acequia or ditch system back to the stream. Occasionally, the works include a storage reservoir or transbasin ditch. The diversion structures can be built or readily available materials, such as timber, bush and rocks, or consist of concrete and masonry. The channels are usually unlined, open and operate by gravity flow.

Acequias are vulnerable to flooding, which can damage the acequia itself as well as cause property damage surrounding the acequia. Flood waters can damage culverts and diversion dams, and fill acequias with silt, requiring extensive restoration efforts. The Upper Rio Grande Watershed contains 1028.86 miles of acequias, managed by 9 different Acequia Associations, and there are also 58 acequia recipients of public assistance to support disaster recovery on record with NMDHSEM, and three of which received 406 mitigation funding as part of Public Assistance. Based on known locations in the watershed, 134.57 miles of at risk acequia infrastructure have been identified based on their proximity to the NFHL. Figure 10 show these acequias and Acequia Associations, as well as locations of Acequia disaster damages.

Figure 8: Repetitive and Severe Repetitive Losses

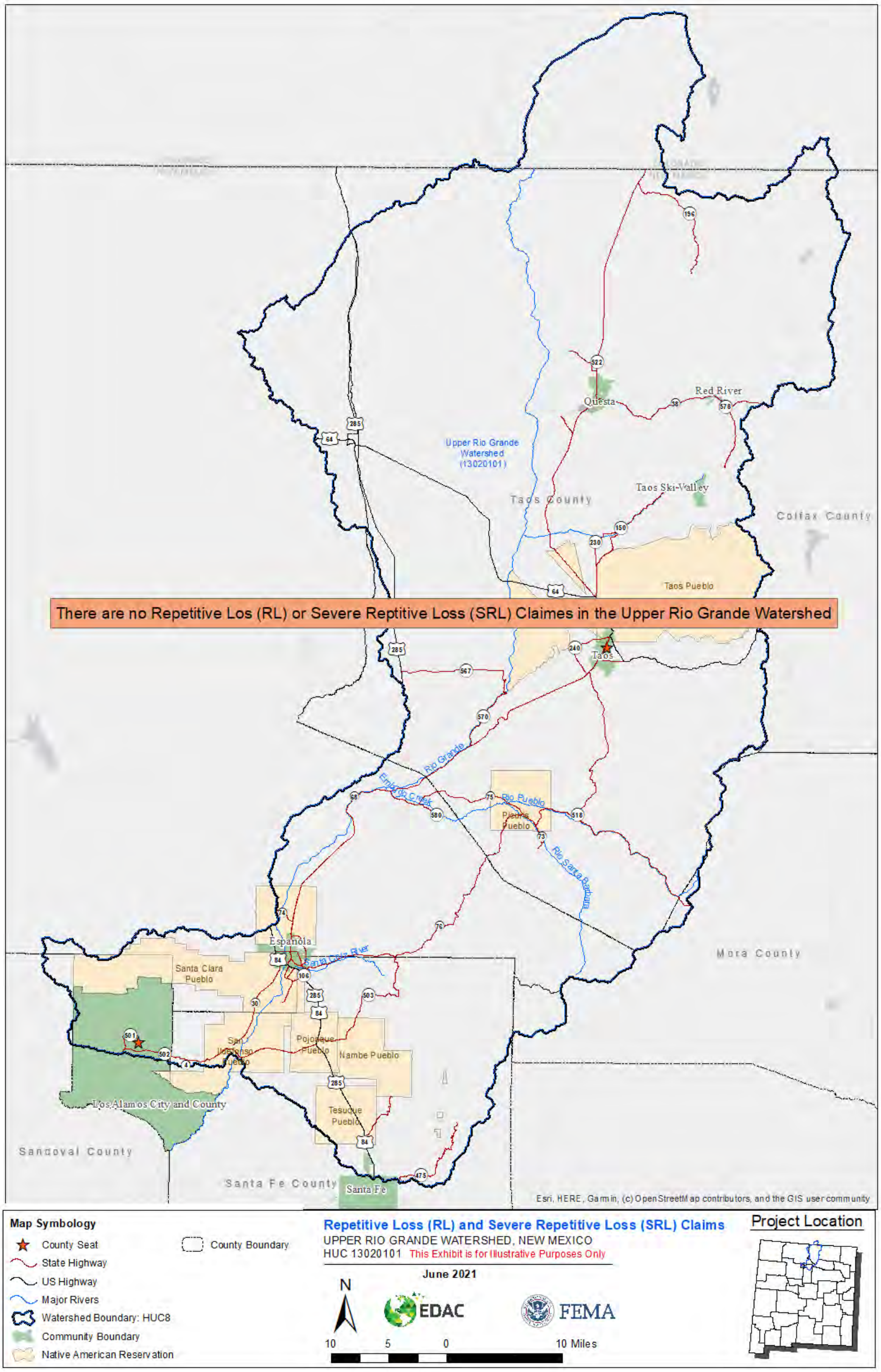


Figure 9: Letter of Map Changes (LOMCs)

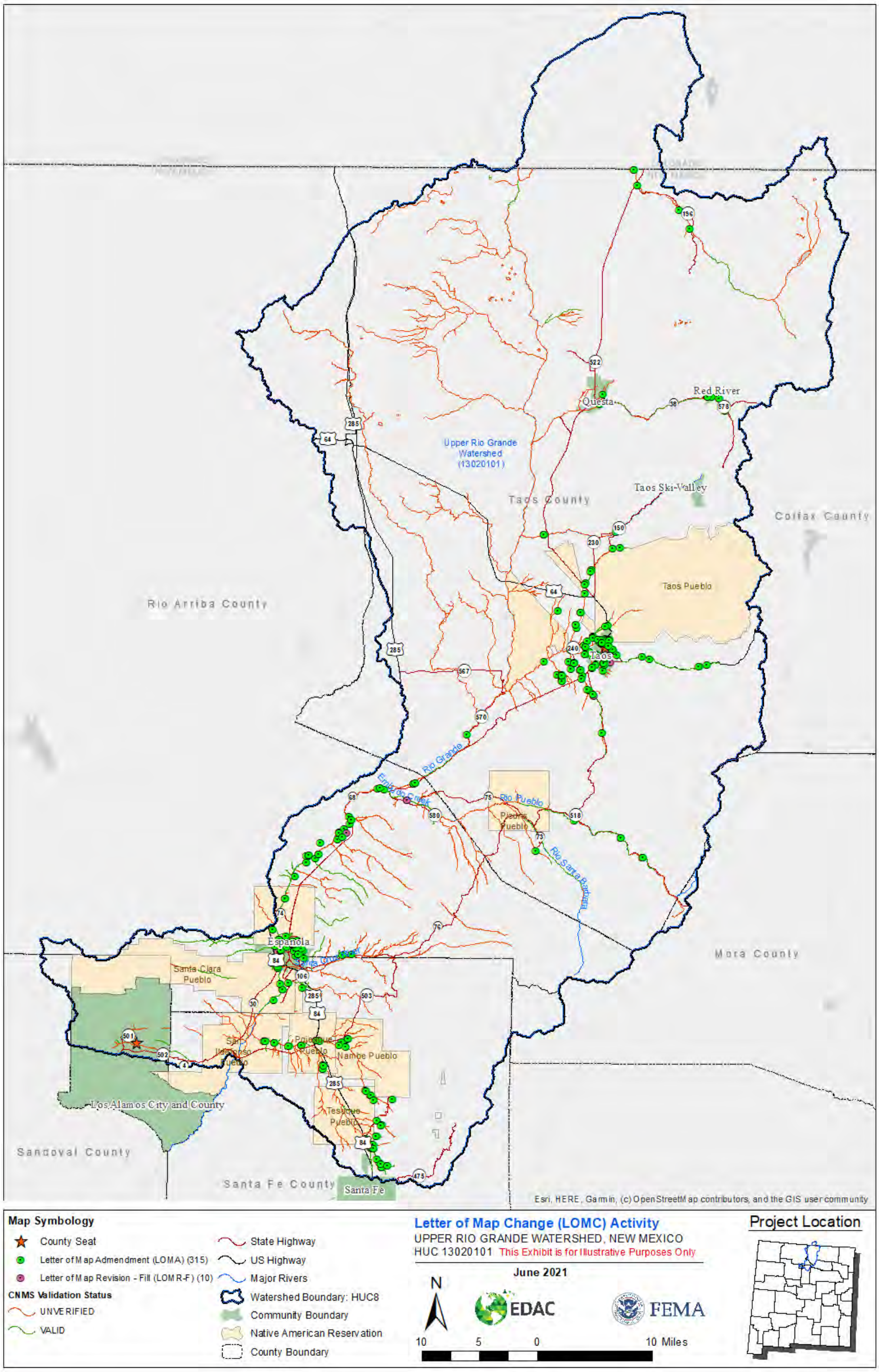
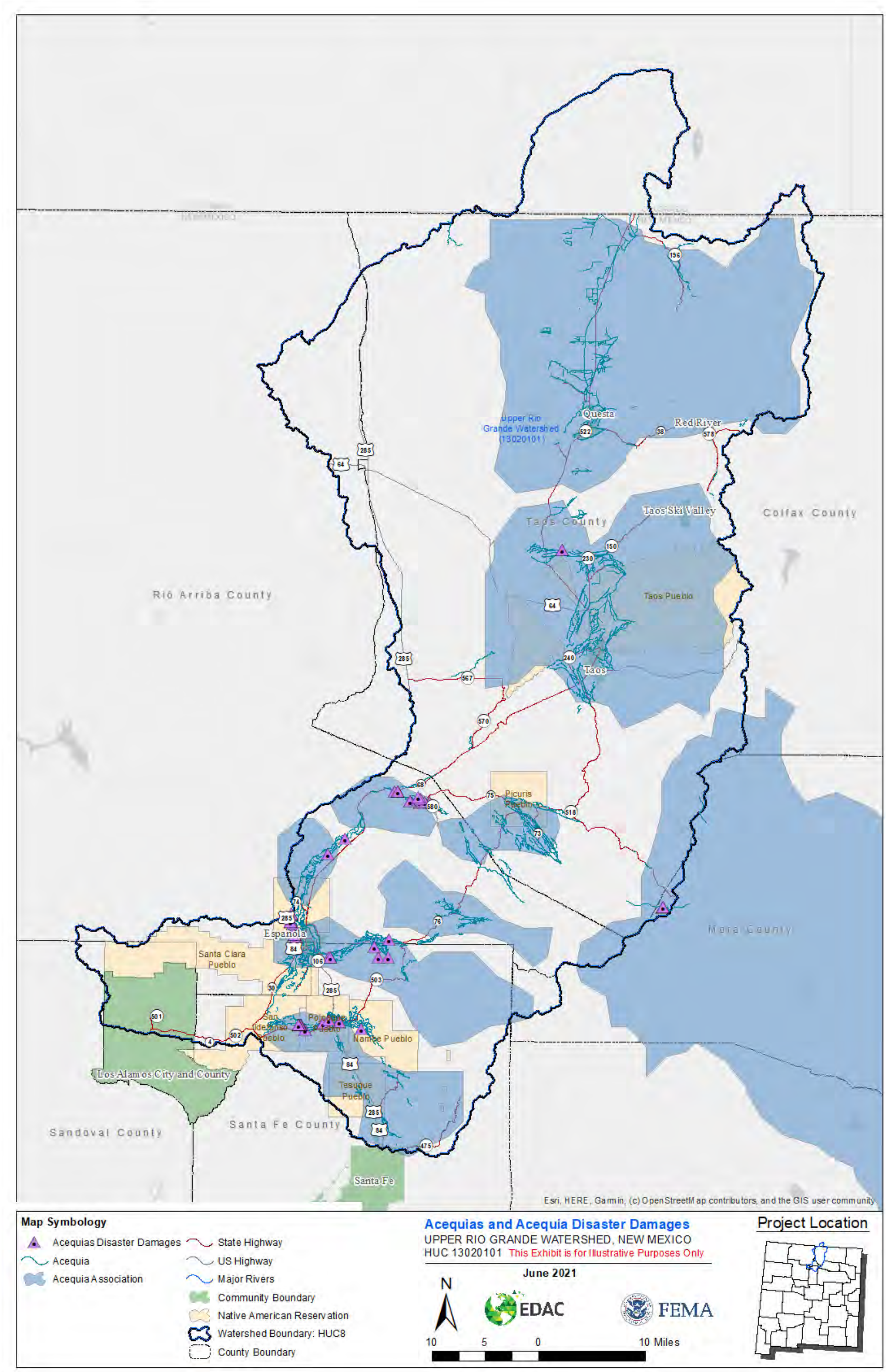


Figure 10 Acequias and Acequia Damages



i. Pre-Discovery Hydrology

Two limited reviews of hydrologic information were performed for Discovery analysis within the Upper Rio Grande Watershed. These reviews were focused on:

- Review of Peak Discharges in the watershed
- Limited Gage analysis for the watershed

For the watershed as a whole, as a part of the 2018 Base Level Engineering a comparison between discharges from the FIS and the BLE hydrologic analysis was done and across community boundaries looking for discharge anomalies, places where LOMRs demonstrate that the effective discharges may be suspect on a more global basis. Any notes were added if these changes can be eliminated as a concern due to hydrologic factors including local flood control structures, detention, flow break outs, sinks or other natural or manmade factors that may significantly alter hydrology flows.

Review of Peak Discharges

Peak discharges were reviewed based on available FIS reports, hydraulics models, flow gages and available LOMRs within the watershed at the crossing of SHFA areas at corporate limits (county, city and town). A comparison of discharges was made for the same streams across county boundaries as shown in Table 14, Discharge Comparison at Community Limits.

Table 14: Discharge Comparison at Community Limits

Stream Name	County/Parish	Effective one-percent annual chance discharge (cfs)	Effective Discharges Source	Notes
SANTA CRUZ RIVER At the confluence with the Rio Grande	Rio Arriba County	4,160	FIS	
	Santa Fe County	4,160		

Table 15 lists any LOMRs for the Upper Rio Grande Watershed that have an impact on hydrology. Each LOMR was reviewed.

Table 15: LOMRs that Revise Hydrology within the Watershed

Stream Name	Case Number	Basis of request	Notes
Unnamed Tributary to Rio Grande del Rancho	14-06-0477P	Hydrologic & Hydraulic Analysis with new topographic information	LOMR that revised a Zone A based on new topographic information, hydrologic and hydraulic analyses. No BFEs were developed.
Unnamed Tributary to Unnamed Tributary to Rio Fernando de Taos	14-06-2951P	Hydrologic & Hydraulic Analysis with updated topographic information	LOMR that revised a Zone A based on updated topographic information, hydrologic and hydraulic analyses. No BFEs were developed.
Unnamed Tributary to Rio Fernando de Taos	16-06-2418P	Hydrologic & Hydraulic Analysis with updated topographic information	LOMR that revised a Zone A based on updated topographic information, hydrologic and hydraulic analyses. No BFEs were developed.
Arroyo Seco	18-06-2137P	Hydrologic & Hydraulic Analysis with updated topographic information	LOMR that revised a Zone A based on updated topographic information, hydrologic and hydraulic analyses. No BFEs were developed.
Unnamed Tributary No. 64	18-06-3973P	Hydrologic & Hydraulic Analysis with updated topographic information	LOMR that revised a Zone A based on updated topographic information, hydrologic and hydraulic analyses. No BFEs were developed.
Unnamed Tributary No. 70 Unnamed Tributary No. 71	18-09-4061P	Hydrologic & Hydraulic Analysis with updated topographic information	LOMR that revised a Zone A based on updated topographic information, hydrologic and hydraulic analyses. No BFEs were developed.
Arroyo Seco	19-06-0621P	Hydrologic & Hydraulic Analysis with updated topographic information	LOMR that revised a Zone A based on updated topographic information, hydrologic and hydraulic analyses. No BFEs were developed.
Unnamed Tributary No. 74	19-09-1165P	Hydrologic & Hydraulic Analysis with updated topographic information	LOMR that revised a Zone A based on updated topographic information, hydrologic and hydraulic analyses. No BFEs were developed.
Unnamed Tributary No. 67 Unnamed Tributary No. 81	19-06-1284P	Hydrologic & Hydraulic Analysis with updated topographic information	LOMR that revised a Zone A and Zone X based on updated topographic information, hydrologic and hydraulic analyses. No BFEs were developed.

Stream Name	Case Number	Basis of request	Notes
Unnamed Tributary No. 69	19-09-1193P	Hydrologic & Hydraulic Analysis with updated topographic information	LOMR that revised a Zone A based on updated topographic information, hydrologic and hydraulic analyses. No BFEs were developed.
Unnamed Tributary No. 46	20-06-2426P	Hydrologic & Hydraulic Analysis with updated topographic information	LOMR that revised a Zone A based on updated topographic information, hydrologic and hydraulic analyses. No BFEs were developed.
Rio Pueblo de Taos Tributary 6	21-06-0091P	Hydraulic Analysis with updated topographic information	LOMR that revised a Zone A and Zone X based on updated topographic information and hydraulic analyses. No BFEs were developed.

Frequency Analysis

For the 2018 Base Level Engineering a comparison between discharges from FIS and the BLE hydrologic analysis was done and the results are listed in Table 15. Names in parentheses identify where studied stream names do not match that listed in the effective FIS. Aside from Cañada Ancha, comparison locations represent similar drainage areas. The scope of the BLE study limited any hydrologic analysis to a direct use of the regression equations from USGS SIR 2008-5119. Any discrepancies between effective flooding and the discharges produced during this study are likely related to differing methodologies. No hydrologic analyses for effective studies utilized equations from USGS SIR 2008-5119. Another reason for the differences in final discharges may be the use of newly acquired, high-quality LiDAR data used for determining the drainage area and the average basin elevation for each subbasin.

Table 15: Summary of Hydrologic Analysis

Stream Name	Drainage Area from USGS Gage (square mile)	1% Effective Discharge(cfs)	BLE Discharge Area (sq. miles)	BLE 1% Discharge (cfs)	Discharge Area % Difference	Q % Difference
Arroyo de Guachupangue	3	1,850	3.0	413	-0.7%	-77.7%
Arroyo de Guachupangue	4.6	2,210	4.7	591	1.5%	-73.3%
Arroyo de Guachupangue Tributary	1.5	1,520	1.5	303	2.0%	-80.1%
Arroyo deRanchitos	1.4	1,430	1.5	269	10.0%	-81.2%
Embudo Creek	305	5,410	298.9	3,350	-2.0%	-38.1%
Rio Grande	10,500	19,600	10244.5	20,300	-2.4%	3.6%
Rio Grande	14,300	26,400	14020.1	43,300	-2.0%	64.0%
Rio GrandeTributary 1	0.8	1,190	0.7	192	-16.3%	-83.9%
Santa CruzRiver	173.5	4,160	172.0	2,860	-0.9%	-31.3%
Arroyo Seco (Arroyo Seco 2)	21.7	4,410	20.8	1,380	-4.3%	-68.7%
Cañada Ancha	1.97	1,150	3.2	184	61.9%	-84.0%
Pojoaque River	172	5,800	172.2	3,640	0.1%	-37.2%
Pojoaque River	183	6,340	183.4	3,900	0.2%	-38.5%
Pojoaque River	196	7,020	193.3	4,140	-1.4%	-41.0%
Rio Tesuque	24.5	2,680	24.0	739	-1.9%	-72.4%
Rio Tesuque	25.6	2,730	26.0	809	1.7%	-70.4%
Rio Tesuque	77.8	5,810	77.9	2,450	0.1%	-57.8%

Stream Name	Drainage Area from USGS Gage (square mile)	1% Effective Discharge(cfs)	BLE Discharge Area (sq. miles)	BLE 1% Discharge (cfs)	Discharge Area % Difference	Q % Difference
Santa CruzRiver	86	2,140	92.4	2,300	7.4%	7.5%
Santa CruzRiver	181	3,590	182.3	3,080	0.7%	-14.2%
Unnamed Stream 31 (RioTesuque Trib 13)	1	270	1.0	128	4.0%	-52.6%
Bitter Creek	10.73	345	10.6	279	-0.9%	-19.1%
Mallette Creek	7.1	253	6.9	228	-2.8%	-9.9%
Red River	66.65	1,152	56.8	840	-14.9%	-27.1%
Rio Lucero	20.3	449	20.0	410	-1.7%	-8.7%
Rio Lucero	16.6	412	13.3	312	-19.7%	-24.3%
Rio Pueblo deTaos	199	1,435	187.7	2,180	-5.7%	51.9%
Rio Pueblo deTaos	110	1,294	115.8	1,430	5.3%	10.5%
Rio Pueblo deTaos	66.6	1,270	58.1	944	-12.8%	-25.7%

ii. Pre-Discovery Hydraulics and Floodplain Analysis

Hydraulics, hydrology, floodplains, and floodways were reviewed based on the FIS reports, available hydraulic models, available hydrologic models, and FIRMs. Table 16 shows the hydraulic analyses used for streams studied by enhanced methods.

Table 16: Summary of Hydraulic Analysis

Stream Name	Validation Status	Date of Effective Analysis	Hydrology Model	Hydraulic Model
Admin Arroyo	Valid	11/30/2005	Regression Equations	HEC-RAS 3.1.3
Admin Arroyo	Unverified	10/31/1986	Possibly Regression Equations	Possibly HEC-2
Alamitos Creek	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Arroyo Acequias	Valid	10/31/1986	Possibly Regression Equations	Possibly HEC-2
Arroyo Aguaje de la Petaca	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Arroyo Aguaje de la Petaca Trib 1	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Arroyo Aguaje de la Petaca Trib 2	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Arroyo Alamo	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Arroyo Ancho	Unverified	10/31/1986	Possibly Regression Equations	Possibly HEC-2
Arroyo Ancho Trib 1	Unverified	10/31/1986	Possibly Regression Equations	Possibly HEC-2
Arroyo Ancho Trib 2	Unverified	10/31/1986	Possibly Regression Equations	Possibly HEC-2
Arroyo Barrancos	Unverified	10/31/1986	Possibly Regression Equations	Possibly HEC-2
Arroyo Cuma	Unverified	10/31/1986	Possibly Regression Equations	Possibly HEC-2
Arroyo Cuyamungue	Unverified	10/31/1986	Possibly Regression Equations	Possibly HEC-2

Arroyo de Chinguague	Valid	4/30/1987	Unknown	Unknown
Arroyo de Guachupangue	Valid	2/16/2003	Regression Equations	RMA2
Arroyo de Guachupangue	Valid	4/30/1987	Regression Equations	RMA2
Arroyo de Guachupangue Tributary	Valid	2/16/2003	Regression Equations	RMA2
Arroyo de la Morda	Valid	4/30/1987	Unknown	Unknown
Arroyo de la Plaza Larga	Valid	4/30/1987	Unknown	Unknown
Arroyo de la Plaza Larga Trib 1	Valid	4/30/1987	Unknown	Unknown
Arroyo de la Plaza Larga Trib 2	Valid	4/30/1987	Unknown	Unknown
Arroyo de los Borregos	Valid	4/30/1987	Unknown	Unknown
Arroyo de los Chavez	Valid	4/30/1987	Unknown	Unknown
Arroyo de Ranchitos	Valid	Unknown	Unknown	Unknown
Arroyo de Ranchitos	Valid	2/16/2003	Regression Equations	RMA2
Arroyo del Carrizo	Valid	4/30/1987	Unknown	Unknown
Arroyo del Carrizo Trib 1	Valid	4/30/1987	Unknown	Unknown
Arroyo del Corral de Piedra	Valid	4/30/1987	Unknown	Unknown
Arroyo del Gaucho	Valid	4/30/1987	Unknown	Unknown
Arroyo del Gaucho	Valid	2/16/2003	Regression Equations	RMA2
Arroyo Del Llano	Valid	4/30/1987	Unknown	Unknown
Arroyo Del Llano	Valid	12/31/2010	Regression Equations	HEC-RAS 4.1
Arroyo del Pueblo	Valid	4/30/1987	Unknown	Unknown
Arroyo Manuela	Valid	10/31/1986	Possibly Regression Equations	Possibly HEC-2
Arroyo Miranda	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Arroyo San Antonio	Valid	10/31/1986	Possibly Regression Equations	Possibly HEC-2
Arroyo Seco	Valid	4/12/2019	Regression Equations	HEC-RAS 5.0
Arroyo Seco	Valid	7/20/2018	Regression Equations	HEC-RAS 5.0
Arroyo Seco	Valid	11/30/2005	Regression Equations	HEC-RAS 3.1.3
Arroyo Seco	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Arroyo Seco	Unverified	12/31/2010	Regression Equations	HEC-RAS 4.1

Arroyo Seco 2 Trib 1	Valid	10/31/1986	Possibly Regression Equations	Possibly HEC-2
Arroyo Seco 2 Trib 2	Valid	10/31/1986	Possibly Regression Equations	Possibly HEC-2
Arroyo Seco 2 Trib 3	Valid	10/31/1986	Possibly Regression Equations	Possibly HEC-2
Bayo Canyon Creek	Valid	8/31/2000	Unknown	Unknown
Beaver Lake	Unverified	4/30/1987	Regression Equations	WSPRO
Big Tesuque Creek	Valid	12/1/2010	HEC-HMS	HEC-RAS 4.1
Bitter Creek	Valid	1/31/1998	Regression Equations	HEC-RAS 2.2
Cabresto Creek	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Canada de los Ramones	Valid	4/30/1987	Unknown	Unknown
Canada de Ojo del Agua	Valid	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Canada de Ojo del Agua	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Canada los Pino Reales	Valid	4/30/1987	Unknown	Unknown
Carson Reservoir	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Casias Creek	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Cissell Lake	Unverified	4/30/1987	Regression Equations	WSPRO
Comanche Creek	Valid	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Comanche Creek	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Costilla Creek	Valid	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Costilla Creek	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Embudo Creek	Valid	4/30/1987	Gage Analysis	WSPRO
Embudo Creek	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Jacona Ranch Arroyo	Valid	10/31/1986	Possibly Regression Equations	Possibly HEC-2
La Canada Honda	Valid	4/30/1987	Unknown	Unknown
Lake Number One	Unverified	4/30/1987	Regression Equations	WSPRO
Latir Creek	Valid	4/30/2009	Regression Equations	HEC-RAS 3.1.3

Latir Creek	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Latir Lakes	Unverified	4/30/1987	Regression Equations	WSPRO
Little Tesuque Creek	Valid	12/1/2010	HEC-HMS	HEC-RAS 4.1
Mallette Creek	Valid	1/31/1998	Regression Equations	HEC-RAS 2.2
North Tributary to Pueblo Canyon	Valid	8/31/2000	Unknown	Unknown
NP	Valid	4/30/2009	Regression Equations	HEC-RAS 3.1.3
NP	Unverified	4/30/1987	Regression Equations	WSPRO
NP	Valid	4/30/1987	Regression Equations	WSPRO
NP	Valid	4/30/2009	Regression Equations	HEC-RAS 3.1.3
NP	Valid	4/30/1987	Regression Equations	RMA2
NP	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Pojoaque River	Unverified	11/30/2005	Regression Equations	HEC-RAS 3.1.3
Pojoaque River Trib 1	Valid	10/31/1986	Possibly Regression Equations	Possibly HEC-2
Red River	Valid	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Red River	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Red River	Unverified	1/31/1998	HEC-1	HEC-RAS 2.2
Rio Chiquito	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Rio de las Trampas	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Rio Fernando de Taos	Valid	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Rio Fernando de Taos	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Rio Grande	Valid	4/30/1987	Unknown	Unknown
Rio Grande	Valid	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Rio Grande	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Rio Grande (With Levees)	Unverified	2/16/2003	Gage Analysis	HEC-RAS
Rio Grande Above Rio Chama	Valid	4/30/1987	Gage Analysis	WSPRO

Rio Grande Below Española	Valid	4/30/1987	Regression Equations	WSPRO
Rio Grande del Rancho	Valid	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Rio Grande del Rancho	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Rio Grande Trib 5	Valid	4/30/1987	Unknown	Unknown
Rio Grande Trib 6	Valid	4/30/1987	Unknown	Unknown
Rio Grande Tributary 1	Valid	2/16/2003	Regression Equations	RMA2
Rio Grande Tributary 10c, 10e, 10f	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Rio Hondo	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Rio Lucero	Valid	4/30/1987	Regression Equations	WSPRO
Rio Lucero	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Rio Pueblo	Valid	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Rio Pueblo	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Rio Pueblo de Taos	Valid	4/30/1987	Regression Equations	WSPRO
Rio Pueblo de Taos	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Rio Santa Barbara	Valid	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Rio Santa Barbara	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Rio Tesuque (Downstream)	Valid	11/30/2005	Regression Equations	HEC-RAS 3.1.3
Rio Tesuque (Upstream)	Valid	12/1/2010	HEC-HMS	HEC-RAS 4.1
Rio Tesuque	Unverified	12/1/2010	HEC-HMS	HEC-RAS 4.1
Santa Clara Creek	Valid	4/30/1987	Unknown	Unknown
Santa Cruz River	Valid	10/31/1986	Possibly Regression Equations	Possibly HEC-2
Santa Cruz River	Unverified	2/16/2003	Regression Equations	RMA2
Santa Cruz River	Unverified	12/31/2010	Regression Equations	HEC-RAS 4.1
Seven Lakes	Unverified	4/30/1987	Regression Equations	WSPRO
Unnamed Stream 27	Valid	12/31/2010	Regression Equations	HEC-RAS 4.1
Unnamed Stream 29	Unverified	12/31/2010	Regression Equations	HEC-RAS 4.1

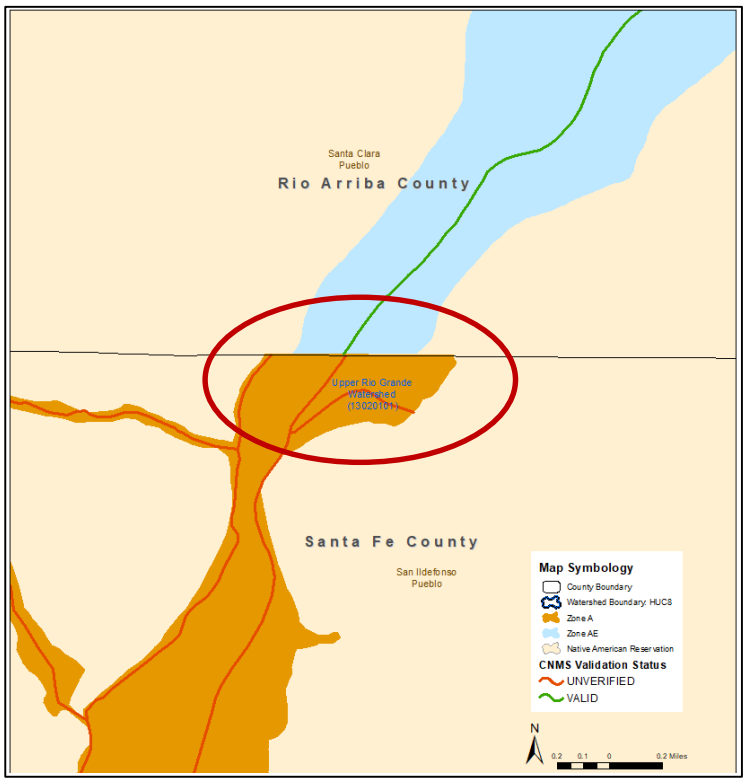
Unnamed Stream 30	Unverified	12/31/2010	Regression Equations	HEC-RAS 4.1
Unnamed Stream 31	Valid	12/1/2010	HEC-HMS	HEC-RAS 4.1
Unnamed Tributary No 43	Valid	2/26/2021	WIN TR-55 1.0.08	HEC-RAS 5.0.4
Unnamed Tributary No 43	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Unnamed Tributary No 46	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Unnamed Tributary to Unnamed Tributary to Rio Fernando de Taos	Unverified	4/30/2009	Regression Equations	HEC-RAS 3.1.3
Unnamed Tributary to Unnamed Tributary to Rio Fernando de Taos	Unverified	11/19/2014	Rational Method	HEC-RAS 4.1
Unnamed Water Feature	Valid	10/31/1986	Possibly Regression Equations	Possibly HEC-2
Wilson Lake	Unverified	4/30/1987	Regression Equations	WSPRO

Rio Grande at the County Boundary between Rio Arriba County and Santa Fe County:

The Rio Grande flows from Rio Arriba County into Santa Fe County as show in Figure 10. The flood hazards for this flooding source are mapped as Zone AE in Rio Arriba County and as Zone A in Santa Fe County.

According to the CNMS analysis the portion of the Rio Grande studied by detailed methods in Rio Arriba County is considered a valid stream. The hydrological Gage analysis and WSPRO hydraulic modeling are dated April 1987. The portion of the Rio Grande in Santa Fe County fails the BLE comparison check. The hydrological model is unknown but it is possibly regression equations and the hydraulic modeling method is unknown but it is possibly HEC-2 are dated October 1986. There is new LiDAR based topography available and new USGS Regression Equations.

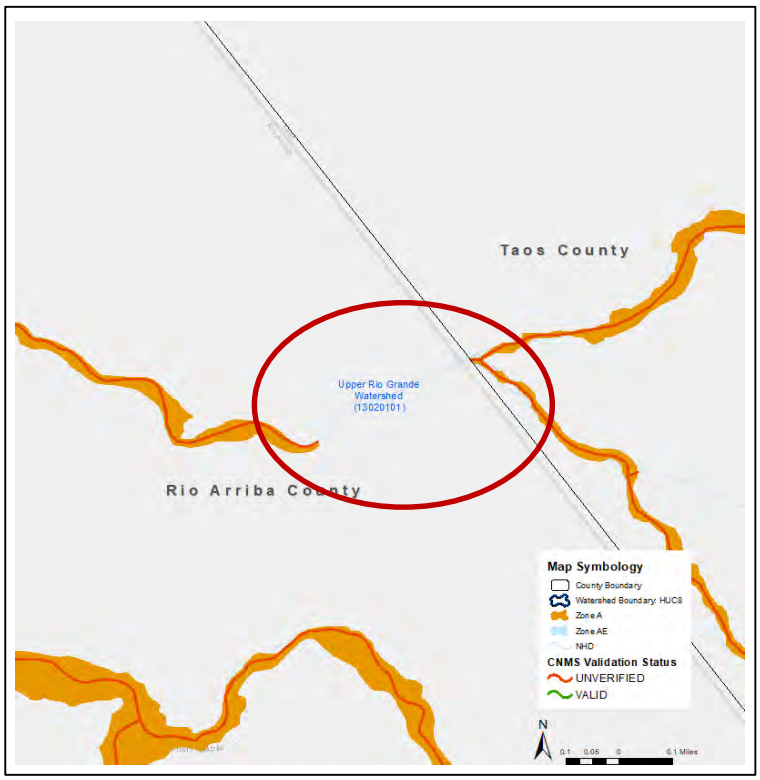
Figure 11 Rio Grande at the County Boundary between Rio Arriba County and Santa Fe County



Embudo Creek at County Boundary between Taos and Rio Arriba Counties

Embudo Creek flows from Taos County into Rio Arriba County. The flood hazard in Taos County is mapped as Zone A and is mapped as Zone A in Rio Arriba county, an approximately 0.34-mile section of Embudo Creek is unmapped and is not included in the CNMS inventory (see Figure 11).

Figure 12 Embudo Creek at the County Boundary between Rio Arriba County and Taos County

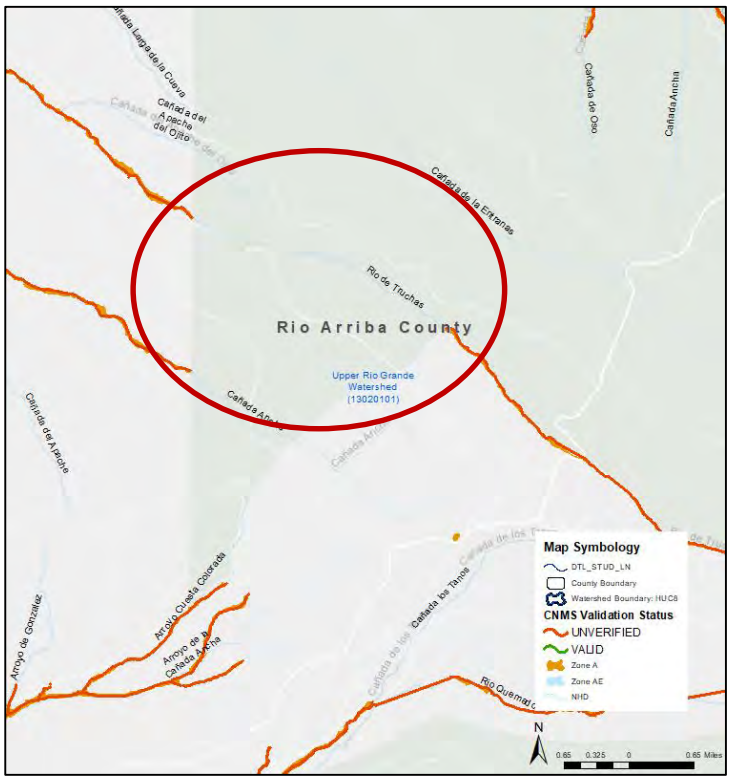


Rio de Truchas, Rio Arriba County:

The Rio de Truchas, in Rio Arriba County, flows northwest into the Rio Grande. The flood hazard for this flooding source is mapped as Zone A, there is a break in the mapped line for this river of approximately 2.9 miles (see Figure 12). This section of the Rio de Truchas is not included in the CNMS.

This section of the Rio de Truchas lies within the Carson National Forest, USFS, and is thus a low risk area. The Base Level Engineering data for this watershed covers this section of the Rio de Truchas.

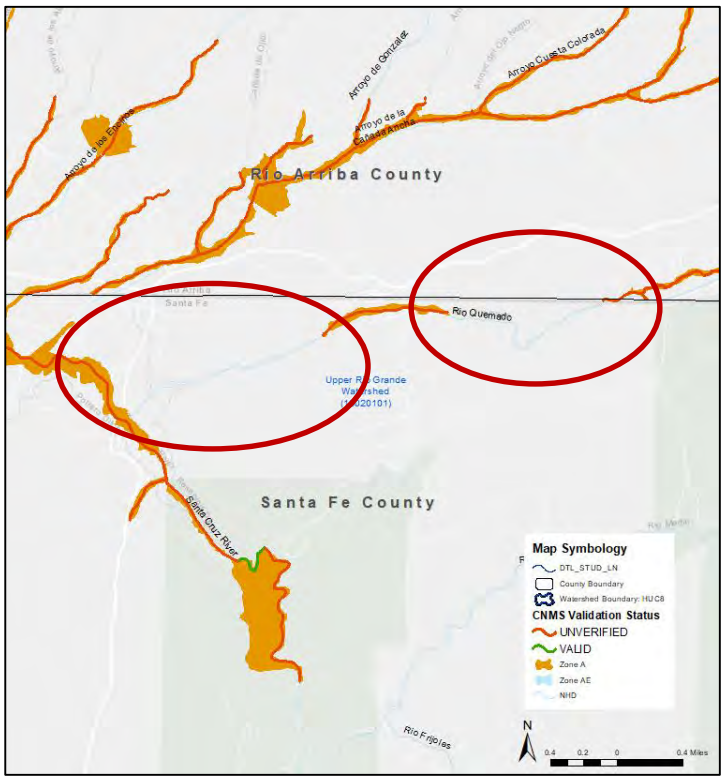
Figure 13 Rio de Truchas in Rio Arriba County



Rio Quemado at County Boundary between Rio Arriba and Santa Fe Counties:

Rio Quemado flows from Rio Arriba County into Santa Fe County. The flood hazard for this flooding source is mapped as Zone A in both bounties, however at the boundary between the two counties the mapped flood zone stops for a distance of approximately 1.2 miles and then the mapped flood zone continues for a distance of 0.8 miles and then stops for a distance of 1.3 miles until the Santa Cruz river is reached (see Figure 13). These portions of the Rio Quemado are not included in the CNMS inventory. Portions of the unmapped river is located on land owned by the Bureau of Land Management but there is also a portion that is privately owned.

Figure 14 Rio de Quemado at the County Boundary between Rio Arriba and Santa Fe Counties

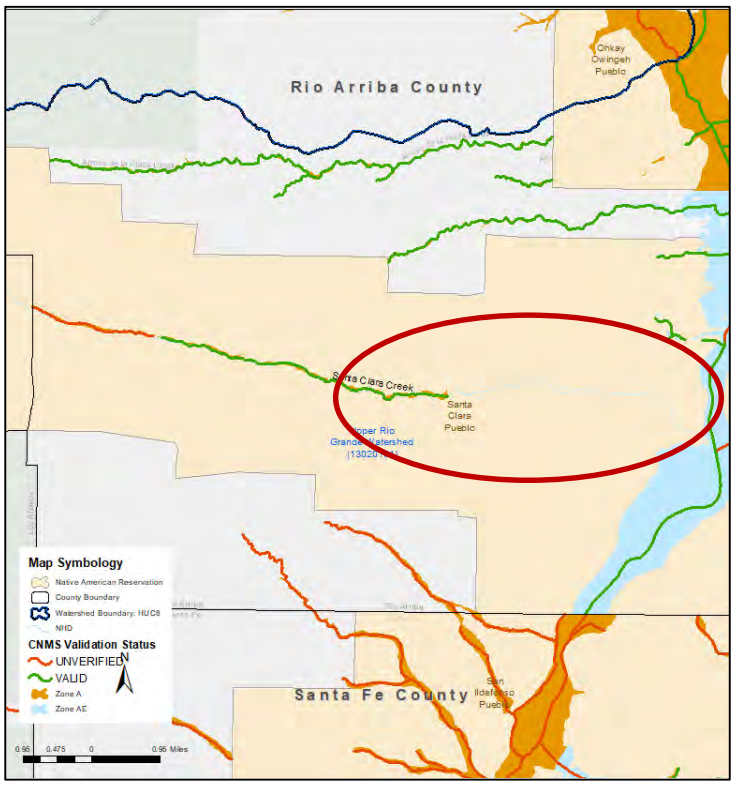


Santa Clara Creek, Rio Arriba County:

Santa Clara Creek flows southeast into the Rio Grande river from the Jemez Mountains. The flood hazard for this flooding source is mapped as Zone A through a portion of Santa Clara Pueblo, the mapped portion of the Creek does not continue to the Rio Grande (see Figure 14).

Santa Clara Creek has experienced catastrophic post-wildfire flooding events.

Figure 15 Santa Clara Creek



iii. Pre-Discovery CNMS Analysis

Table 17 shows the detailed study streams in the Upper Rio Grande Watershed that have failed one or more validation elements during the CNMS stream reach level validation process. The CNMS validation elements attempt to identify changes to the Physical Environment, Climate and Engineering Methodologies since the date of the Effective Analysis (different from the Effective issuance date). Per the CNMS validation process, the study is considered as having a need or assigned an 'Unverified' status, if one of seven critical elements fail, or if four or more of the 10 secondary elements fail during stream reach level validation.

Table 17: CNMS Analysis

Stream Name	Validation Status	Failed CNMS Elements	Date Hydrology & Hydraulics Effective
Admin Arroyo	Valid	S9	11/30/2005
Arroyo de Guachupangue	Valid	S9	2/16/2003
Arroyo de Guachupangue	Valid	S6, S9	4/30/1987
Arroyo de Guachupangue Tributary	Valid	S9	2/16/2003
Arroyo de Ranchitos	Valid	S4, S9	2/16/2003

Stream Name	Validation Status	Failed CNMS Elements	Date Hydrology & Hydraulics Effective
Arroyo del Gaucho	Valid	S9	2/16/2003
Arroyo Seco	Valid	S9	11/30/2005
Big Tesuque Creek	Valid	S4, S6	12/1/2010
Bitter Creek	Valid	S6, S9	1/31/1998
Embudo Creek	Valid	S4, S6	4/30/1987
Little Tesuque Creek	Valid	S4, S6	12/1/2010
Mallette Creek	Valid	S6, S9	1/31/1998
NP	Valid	S4, S6, S9	4/30/1987
Pojoaque River	Unverified	C7, S9	11/30/2005
Pojoaque River	Unverified	C7, S9	11/30/2005
Pojoaque River	Unverified	C7, S9	11/30/2005
Red River	Unverified	C6	
Rio Grande (With Levees)	Unverified	C7, S6	2/16/2003
Rio Grande Above Rio Chama	Valid	S6	4/30/1987
Rio Grande Below Española	Valid	S6	4/30/1987
Rio Grande Tributary 1	Valid	S6, S9	2/16/2003
Rio Lucero	Valid	S6, S9	4/30/1987
Rio Pueblo de Taos	Valid	S4, S6	4/30/1987
Rio Tesuque (Downstream)	Valid	S9	11/30/2005
Rio Tesuque (Upstream)	Valid	S4, S6	12/1/2010
Santa Cruz River	Unverified	C5, S4, S6,	12/1/2010
Santa Cruz River	Unverified	C5, S6, S9	2/16/2003
Unnamed Stream 31	Valid	S4, S6	12/1/2010

Table 18 provides a description of the validation elements that failed as identified in the CNMS database.

Table 18: CNMS Category Descriptions

Element Name	Issue being identified by the Element	Element Description
C5	Current channel reconfiguration outside effective SFHA	Failure of this element indicates the streamline is seen on imagery as outside the SFHA and cannot be explained by a minor mapping error, which could be corrected through base fitting.

Element Name	Issue being identified by the Element	Element Description
C6	Five or more new or removed hydraulic structures bridge/culvert) that impact BFEs	Failure of this element indicates that five new or removed hydraulic structures that impacts BFEs have been observed since the effective analysis was completed.
C7	Significant channel fill or scour	Failure of this element indicates a significant channel or scour has been identified.
S4	More than one and less than five new or removed hydraulic structures (bridge/culvert) impacting BFEs	This element identifies addition or removal of more than one, but less than five hydraulic structures along the studied streams since the date of the Effective Study.
S6	Better topographic or bathymetric data available	Failure of this element indicates better topographic or bathymetric data has been made available since the Effective Study date.
S9	Significant storms with high water marks	Failure of this element indicates that recent storm surge high waters marks were not identified.

Summary of CNMS Concerns

1. Los Alamos County

Los Alamos County contains a total of 11.38 miles of streams within the Upper Rio Grande Watershed, all are Zone A, 2.01 miles of which are Valid, the rest are unverified. 9.37 miles of Zone A Unverified streams failed the BLE comparison check. Main streams include Los Alamos Canyon, Pueblo Canyon Creek, and Rendija Canyon Creek.

2. Mora County

Mora County contains a total of 2.49 miles of streams within the Upper Rio Grande Watershed, all are Unverified Zone A. All of these streams failed the BLE comparison check. The main stream is Alamitos Creek.

3. Rio Arriba County

Rio Arriba County contains a total of 276.17 miles of streams within the Upper Rio Grande Watershed. The county contains 199.05 miles of Zone A, of which 46.75 miles are Valid and 152.3 miles are Unverified and failed the BLE comparison check. The county contains 25.89 miles of Zone AE, of which 22.55 miles are Valid. The County contains 51.22 miles of Zone X all of which have been assessed. Main streams include Arroyo de Guachupangue, Arroyo de Ranchitos, Arroyo del Gaucho, Rio Grande, Santa Clara Creek, and Santa Cruz River.

The following Valid Stream failed Critical Element C7, indicating that a significant channel or scour has been identified:

- Rio Grande (With Levees)

4. Taos County

Taos county contains a total of 659.44 miles of streams within the Upper Rio Grande Watershed. The county contains 562.06 miles of Zone A, of which 45.92 are Valid. 476.35 miles of the Unverified Zone A streams failed the BLE comparison check. The county contains 7.45 miles of Zone AE, of which 4.13 are Valid. The county contains 89.92 miles of Zone X all of which have been assessed. Main streams include Arroyo Aguaje de la Petaca, Arroyo Seco, Costilla Creek, Red River, Rio Fernando de Taos, and the Rio Grande.

The following Valid Stream failed Critical Element C6, indicating that five new or removed hydraulic structures that impacts BFEs have been observed since the effective analysis was completed:

- Red River

5. Sandoval County

Sandoval County does not contain any streams in the current CNMS data.

6. Santa Fe County

Santa Fe County contains a total of 192.58 miles of streams within the Upper Rio Grande Watershed. The county contains 154.31 miles of Zone A, of which 9.89 miles are Valid. The county contains 18.66 miles of Zone AE, of which 10.59 miles are Valid. The county contains 19.4 miles of Zone X. Main streams include Arroyo Seco, Pojoaque River, Rio Grande, Rio Tesuque, and the Santa Cruz River.

The following Valid Stream failed Critical Element C5, indicating that the streamline is shown outside the SFHA:

- Santa Cruz River

The following Valid Stream failed Critical Element C7, indicating that a significant channel or scour has been identified:

- Pojoaque River

IV. Base Level Engineering

Base Level Engineering (BLE) was completed for the Upper Rio Grande Watershed in November 2018. BLE is a watershed wide engineering modeling method that uses high resolution ground elevation, automated model building techniques, and manual model review to prepare broad and accurate flood risk information for FEMA to assess its current flood hazard inventory.

The following BLE datasets are available for the Upper Rio Grande Watershed:

- Hydrologic Analysis - Based on regression equations that are reviewed against stream gages throughout the study area. Each stream has expected flood volume for seven storm events (10%, 4%, 2%, 1%, 0.2% and the 1% plus/minus events).
- Hydraulic Modeling – HEC_RAS version 5.0.4 was used to create stream models for the 10%, 4%, 2%, 1%, 0.2% and the 1% plus/minus events.
- Flood Risk Flood Extents – Seamless floodplains are prepared and available for the 10%, 1% and 0.2% annual chance storm events.
- Estimated Water Surface Elevation Grids – Estimated water surface elevation grids for the 1% and the 0.2% annual chance events are prepared during a Base Level Engineering assessment. A grid coverage is a regularly sized lattice (10 ft. x 10 ft.) where each grid cell has a value, in this case the elevation of the estimated flood event water surface (the top of the water). The Estimated Water Surface Elevation grid allows users to more efficiently interact with hydraulic model results, providing interpolated water surface elevations at any location within the floodplain.
- Estimated Flood Depth Grids – Estimated flood depth grids are prepared for the 1% and the 0.2% annual chance events are prepared. A grid coverage is a regularly sized lattice (10 ft. x 10 ft.) where each grid cell has a value, in this case the estimated flood depth will be contained. The Estimated Flood Depth grid allows users to better understand the possibility of flooding by providing an estimated flood depth at any location within the floodplain.
- HAZUS – A Hazus analysis was prepared using the 1- and 0.2-percent-annual-chance depth grids.

FEMA has also made available the Estimated Base Flood Elevation Viewer (https://webapps.usgs.gov/infrm/estbfe/) which allows communities, residents and the development community to interact with Base Level Engineering information. The Estimated BFE Viewer provides an indication of flood risk (high/moderate/low) and returns Estimated Base Flood Elevations and Estimated Flood Depths at any location within the 1% annual chance floodplain. The BLE data and reports may also be downloaded from the viewer.

V. Watershed Options

In conjunction with the assessment of risk, need, and the availability of topographic data, as well as the input of stakeholders within in this Watershed, future projects within the Upper Rio Grande Watershed are recommended. FEMA looks to promote mitigation action within the watershed. After internal and partner review of the communities within the watershed, the following are overarching opportunities identified to promote community action within the watershed.

Table 19 lists some potential needs in the Watershed and actions that could be taken under each of the four areas discussed during the Discovery meetings, including:

- Risk Identification and Communication – traditional flood studies and data updates
- NFIP Community Actions – insurance-related mitigation or information
- Mitigation Planning and Mitigation Actions – items related to planning updates
- Community Benefits and Grant Opportunities – outreach and disaster activities as well as non-flooding hazards like safe room information

Table 19: Potential Watershed Activities

Risk Identification and Communication
• Utilize Base Level Engineering products to communicate risk • There are 12 LOMRs in Taos County that are not incorporated into the current FIRMs dated from 2008 to 2012. • Update FIS and FIRMs for Taos County. • Outreach and education about natural hazards in the watershed
NFIP Community Actions
• Discuss the CRS program with interested communities. • Outreach and education about NFIP requirements
Mitigation Planning and Mitigation Actions
• Assist communities in the preparation, update and adoption of HMPs. Los Alamos and Rio Arriba County lack a current plan. • Assist communities with preparation of Emergency Action Plan for small communities and private dam owners. Review availability of grants for small communities and private dam owners for repair and breach inundation mapping.
Community Benefits and Grant Opportunities
• Apply for grants to assist in the mitigation of flooding concerns in the county • Assist communities with preparation of Emergency Action Plan for small communities and private dam owners. • Review availability of grants for small communities and private dam owners for repair and breach inundation mapping.

BFE = Base Flood Elevation
CAV = Community Assistance Visit
CFM = Certified Floodplain Manager
CLOMR = Conditional Letter of Map Revision
CNMS = Coordinated Needs Management Strategy
CRS = Community Rating System
DEM = Digital Elevation Model
FIRM = Flood Rate Insurance Map
FPA = Floodplain Administrator
G&S = FEMA's *Guidelines and Standards for Flood Hazard Mapping Partners*
H&H = hydrologic and hydraulic
Hazus = Hazards U.S.
HMP = Hazard Mitigation Plan
LiDAR = Light Detection and Ranging System
LOMR = Letter of Map Revision
LSU = Louisiana State University
NFIP = National Flood Insurance Program
NVUE = New, Validated, or Updated Engineering
PMRS = Physical Map Revision
Risk MAP = Risk Mapping, Assessment, and Planning
RGIS = Resource Geographic Information System
RL/SRL = Repetitive Loss/Severe Repetitive Loss
SFHA = Special Flood Hazard Area
USGS = U.S. Geological Survey

Table 20 provides specific evaluation guidelines for streams or areas that could benefit from additional study. Any FEMA-based metrics that would be met if the need or issue was addressed are noted, as well as any current FEMA map actions that would affect the activity. Any comments or concerns raised by a stakeholder during the Discovery process that could be tied to one of the needs or actions for the Watershed are also noted. Some needs/actions are listed that were not raised by any specific community but were identified as general improvements that could be made in the Upper Rio Grande Watershed to meet general FEMA regional goals.

Needs are identified as being on the critical path as high, medium, or low priority or as a task that could be assigned to a State or local community to complete. These definitions are also included in Table 20.

- **High** – The local community would immediately benefit from the action and FEMA's metrics would also be met.
- **Medium** – The local community would benefit over the longer term from the action and a portion of FEMA's metrics may be met.
- **Low** – The local community activities can continue without this revision and FEMA's metrics are not affected.
- **Community Action** – The activity would be more appropriate as a community-led action rather than a FEMA-led action.

Table 20 Metrics and Rankings of Needs

Item	Description of Need Evaluation Guide **High** – Local community would immediately benefit from the action, and FEMA's metrics would also be met **Medium** – Local community would benefit over the longer term from the action, and a portion of FEMA's metrics may be met **Low** – Local community activities can continue without this revision, and FEMA's metrics are not impacted **Community Action** – Activity would be more appropriate as a community-led action rather than a FEMA-led action		Impacts From Any Current Map Actions	FEMA Metric or Community Benefit	Evaluation	Relates to Community Comment Number
	Location of Need/Project	**Details**				
A	Mitigation/HMP	• Los Alamos County does not have a HMP	• None	• Impacts all of Los Alamos County • Community's eligibility for • Federal/State grants • Facilitate the application for HMP Grants • Expedite the Grant approval process	High Community Action	No specific comment
B	Mitigation/HMP	• Rio Arriba County does not have a HMP	• None	• Impacts all communities in Rio Arriba County • Community's eligibility for Federal/State grants • Facilitate the application for HMP Grants • Expedite the Grant approval process	High Community Action	No specific comment
C	Outreach / Coordination to enter CRS Program	• FEMA to continue to promote benefits of participation	• None	• Potential decrease in flood insurance premiums • Community outreach improved	Community Action	No specific comment
D	Outreach / Coordination for Grant Opportunities	• NMDHSEM to provide information on hazard mitigation grants	• None	• Community outreach improved	Community Action	No specific comment
E	Outreach / Community Hazard Awareness and Education	• Per mitigation plan educate communities about Multi-hazards: Dam Failure, Drought, Earthquake, Flood, High Wind, Landslide, Severe Winter Storm, Thunderstorm, Wildfire, Hazardous Materials	• None	• Risk reduction	Community Action	No specific comment

Item	Description of Need Evaluation Guide **High** – Local community would immediately benefit from the action, and FEMA's metrics would also be met **Medium** – Local community would benefit over the longer term from the action, and a portion of FEMA's metrics may be met **Low** – Local community activities can continue without this revision, and FEMA's metrics are not impacted **Community Action** – Activity would be more appropriate as a community-led action rather than a FEMA-led action		Impacts From Any Current Map Actions	FEMA Metric or Community Benefit	Evaluation	Relates to Community Comment Number
	Location of Need/Project	Details				
F	HAZUS Outreach / Coordination	• Provide information from HAZUS results derived from Base Level Engineering.	• None	• Communities become more familiar with the HAZUS program and are prepared to use Risk MAP products when they are issued. • HAZUS can be used for HMP updates.	Medium	No specific comment
G	Rio Arriba, Santa Fe, and Taos County Dam Emergency Action Plan	• Create Emergency Action Plans for all dams	• None	• Community outreach improved	Medium	No specific comment
H	Rio Arriba, Santa Fe, and Taos County Dam Inundation Mapping	• Create inundation mapping for high hazard dams	• None	• Community's ability to mitigate risk • FEMA increase public Awareness of risk management • FEMA increase public Action toward managing flood risk	Medium	No specific comment
I	Los Alamos County Stormwater Management Plan	• Per mitigation plan develop a countywide Stormwater Management Plan	• None	• Risk reduction • Improved Stormwater Management	Community Action	No specific comment
J	Los Alamos County Landslide/Debris Flow Risk Reduction	• Per mitigation plan mitigate areas of slope instability as a result of increase post wildfire runoff.	• None	• Risk reduction	Community Action	No specific comment
K	Los Alamos Rose St Drainage	• Undersized culvert on Rose St in Los Alamos	• None	• Risk reduction	Community Action	1
L	Rio Arriba County	• Per mitigation plan improve warning system	• None	• Community's ability to mitigate risk • FEMA increase public Awareness of risk management • FEMA increase public Action toward managing flood risk	Community Action	No specific comment
M	Rio Arriba County	• Per mitigation plan create defensible spaces and buffer zones	• None	• Community's ability to mitigate risk • FEMA increase public Awareness of risk management	Community Action	No specific comment

Item	Description of Need Evaluation Guide **High** – Local community would immediately benefit from the action, and FEMA's metrics would also be met **Medium** – Local community would benefit over the longer term from the action, and a portion of FEMA's metrics may be met **Low** – Local community activities can continue without this revision, and FEMA's metrics are not impacted **Community Action** – Activity would be more appropriate as a community-led action rather than a FEMA-led action		Impacts From Any Current Map Actions	FEMA Metric or Community Benefit	Evaluation	Relates to Community Comment Number
	Location of Need/Project	Details				
N	Rio Arriba County	• Per mitigation plan create public awareness and education campaign to inform and educate the public on high risk dam failure events	• None	• Community's ability to mitigate risk • FEMA increase public Awareness of risk management	Community Action	No specific comment
O	Rio Arriba County	• Per mitigation plan retrofitting structures with structural components to withstand wildfire	• None	• Community's ability to mitigate risk	Community Action	No specific comment
P	Rio Arriba County Stormwater Management Plan	• Per comprehensive and mitigation plan develop a county-wide stormwater management plan that addresses flood protection and erosion control.	• None	• Risk identification and reduction	Community Action	No specific comment
Q	Rio Arriba County Santa Cruz Dam No. 1 Rehabilitation Project	• Santa Cruz Dam Site No. 1, owned by the Santa Fe – Pojoaque Soil & Water Conservation District has exceeded its design life and is filled with sediment.	• None	• Risk reduction	Community Action	No specific comment
R	Santa Fe County Dam Monitoring and Public Warning System	• Per mitigation plan enhance high hazard dam monitoring and public warning capabilities	• None	• Risk reduction • Communication	Community Action	No specific comment
S	Santa Fe County Stream Bank Stabilization	• Per mitigation plan mitigate effects of high flow events on arroyo erosion/channel migration.	• None	• Risk reduction	Community Action	No specific comment
T	Santa Fe County Low Water Crossings • CR84 River Crossing	• Per mitigation plan mitigate hazards associated • with specific low water crossings as part of ongoing county road improvements or areas of planned development.	• None	• Risk reduction	Community Action	No specific comment
U	Santa Fe County Reduce Flood and Debris Flow Potential Associated with Wildfire Burn Scars	• Per mitigation plan implement best management practices to reduce flood and debris flow potential following wildfires.	• None	• Risk reduction	Community Action	No specific comment
V	Taos County Dam Failure Risk Assessments	• Per mitigation plan perform enhanced dam failure risk assessments	• None	• Risk identification	Community Action	No specific comment
W	Taos County CRS	• Per mitigation plan join CRS	• None	• Potential decrease in flood insurance premiums • Community outreach improved	Community Action	No specific comment

Item	Description of Need Evaluation Guide **High** – Local community would immediately benefit from the action, and FEMA's metrics would also be met **Medium** – Local community would benefit over the longer term from the action, and a portion of FEMA's metrics may be met **Low** – Local community activities can continue without this revision, and FEMA's metrics are not impacted **Community Action** – Activity would be more appropriate as a community-led action rather than a FEMA-led action		Impacts From Any Current Map Actions	FEMA Metric or Community Benefit	Evaluation	Relates to Community Comment Number
	Location of Need/Project	Details				
X	Taos County FIRM and FIS update	• Per mitigation plan promote the need for better mapping and initially for non-regulatory projects related to better floodplain data to be followed at a later date by a regulatory remapping of Taos County.	• None	• FIRMs updated to reflect existing conditions • Risk identification and reduction	High	No specific comment
Y	Taos County Stormwater Management Plan	• Per comprehensive plan work with Taos Soil and Water Conservation District to develop a County-wide Stormwater Management Plan that addresses flood protection and erosion control.	• None	• Risk identification • Risk reduction	Community Action	No specific comment
Z	Taos County, Pilar no SFHA	• Pilar, Rito Cieneguella has no mapped SFHA with a concentration of population.	• None	• Risk identification • Risk reduction	High	2
AA	Taos County, Paseo del Canon E Drainage Channel and Taos Charter School	• Drainage channel improvements not reflected in SFHA mapping	• None	• Risk identification • Risk reduction	Medium	3,5
BB	Taos County, Angostura, SFHA outside of stream channel	• SFHA outside of river channel, BLE data shows correct location	• None	• Risk identification • Risk reduction	High	3
CC	Taos County, SMU in Taos, SFHA outside of stream channel	• SFHA outside of river channel, BLE data shows correct location	• None	• Risk identification • Risk reduction	High	3
DD	Taos County, Talpa, SFHA outside of stream channel	• SFHA outside of river channel, BLE data shows correct location	• None	• Risk identification • Risk reduction	High	3
EE	Taos County, Taos Canyon, SFHA outside of stream channel	• SFHA outside of river channel, BLE data shows correct location	• None	• Risk identification • Risk reduction	High	3
FF	Taos County, Village of Taos Ski Valley no mapped floodplain	• Taos Ski Valley has no SFHA mapped	• None	• Risk identification • Risk reduction	High	3
GG	Taos County, Village of Questa, grading work not reflected in SFHA	• Current SFHA does not reflect grading work in village.	• None	• Risk identification • Risk reduction	High	3
HH	Taos County, Town of Taos, Taos Pueblo Zone D	• Area of Zone D and AE from FIRM updates, may reflect inaccuracies in political boundary files used in FIRM production.	• None	• Risk identification • Risk reduction	High	4

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	Location of Need/Project	Details				
II	Taos County, near Town of Red River, unmapped populated area	• Populated area not mapped in 2010 FIRMs	• None	• Risk identification • Risk reduction	High	6, 7
JJ	Rio Fernando de Taos Revitalization Project, Taos County	• Per mitigation plan project includes green infrastructure, forest restoration, acequia maintenance and infrastructure improvement, improved grazing management, planning, and public education and outreach.	• None	• Risk reduction • Community outreach improved	Community Action	No specific comment
KK	Red River, Taos County Landslide/Mudslide Mitigation	• Per mitigation plan landslide/mudslide mitigation on NM Highway 38	• None	• Risk reduction	Community Action	No specific comment

i. Project Prioritization

Flood risk projects are intended to be initiated and cataloged at a HUC-8 unit. This means that when a project is initiated, all flood hazards within the HUC-8 will be evaluated to determine the project scope within that HUC-8 boundary. Evaluation means that risk, need, available data, and desired output products are assessed for the entire HUC-8. Evaluation does not mean the actual development of new or updated flood risk products, only the assessment of what products would be required to fulfill the identified needs in light of the level of risk. Unmet needs must be cataloged in the Coordinated Needs Management Strategy Database (CNMS).

Once the entire HUC-8 has been evaluated, the Region will select the project tasks necessary to respond to the identified levels of risk and need. The Region is expected to maximize the amount and usefulness of project work to be performed in any HUC-8, but is not expected to perform every project task and meet all needs in every watershed. All scope with the HUC-8 boundary must be tasked/ordered at one time.
As a result of the Discovery process future projects were identified as show in Table 20.

Table 21 Project Prioritization

Project	Ranking	Need
Los Alamos County Hazard Mitigation Plan	High	Meets FEMA metrics for HMP adoption.
Rio Arriba County Hazard Mitigation Plan	High	Meets FEMA metrics for HMP adoption.
Taos County FIRM Update	High	Updated topography and BLE data, community interest in better mapping.