United States Department of the Interior
U.S. GEOLOGICAL SURVEY
New Mexico Water Science Center
DUNS 025287520
6700 Edith Blvd. NE Bldg. B
Albuquerque, NM 87113

June 24, 2025

Lynn Crawford, Mayor
Village of Ruidoso
313 Cree Meadows Drive
Ruidoso, New Mexico 88345

Dear Mr. Crawford,

Enclosed is amendment 001 to Joint Funding Agreement (JFA), 24RGJFA35 for a project as described in the attached proposal, "Geomorphic survey of North Fork Eagle Creek, from North Eagle Creek Streamgage to Eagle Creek below South Fork Streamgage." The amendment is to increase the Village of Ruidoso funding by $5,769 for a total agreement amount of $64,000 and to extend the end date to September 30, 2026.

If you concur, please sign and return a copy of the amendment to this office for processing. Work performed with funds from this agreement will be conducted on a fixed price basis. The Village of Ruidoso will be billed for work completed as part of the agreement at the end of each quarter.

If you have any questions concerning the work on this project, please call William Seelig at (915) 534-6307. Administrative questions should be addressed to Esther Torrez at (505) 418-6073.

Sincerely,

ANNE TILLERY

Digitally signed by ANNE TILLERY
Date: 2025.06.24 14:58:55 -06'00'

Anne Tillery
Acting Director

UNITED STATES DEPARTMENT OF THE INTERIOR
U. S. GEOLOGICAL SURVEY
AMENDMENT OF JOINT FUNDING AGREEMENT
FOR
WATER RESOURCES INVESTIGATIONS

Agreement No: 24RGJFA35	Amendment No: 001
Customer No: 6000000329	TIN: 85-6000650
	Fixed Cost: YES

This amendment is for the agreement dated May 15, 2024, between the U.S. GEOLOGICAL SURVEY (USGS), UNITED STATES DEPARTMENT OF THE INTERIOR, party of the first part, and the VILLAGE OF RUIDOSO party of the second part.

1. The parties hereto agree that subject to the availability of appropriations and in accordance with their respective authorities there shall be maintained in cooperation a project for the attached proposal entitled, "Geomorphic survey of North Fork Eagle Creek, from North Eagle Creek Streamgage to Eagle Creek below South Fork Streamgage," hereinafter called the program. The USGS legal authority is 43 USC 36C; 43 USC 50; and 43USC 50b.

2. Paragraph 2a of the agreement is hereby increased by $0.00 to read as follows:

   (a) $0.00 by the party of the first part during the periods

   May 15, 2024 to September 30, 2026

   Paragraph 2b of the agreement is hereby increased by $5,769 to read as follows:

   (b) $64,000 by the party of the second part during the periods

   May 15, 2024 to September 30, 2026

Billing for this agreement will be rendered quarterly. Payments of bills are due within 60 days after billing date. If not paid by the due date, interest will be charged at the current Treasury rate for each 30-day period, or portion thereof, that the payment is delayed beyond the due date. (31 USC 3717; Comptroller General File B-212222, August 23, 1983.)

UNITED STATES
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

by ANNE TILLERY Digitally signed by ANNE TILLERY Date: 2025.06.24 14:56:27 -06'00'
(Signature)
Anne Tillery
(Name)
Acting Director,
New Mexico Water Science Center
Date June 24, 2025

VILLAGE OF RUIDOSO

by _____ **Date:**_____
(Signature)
_____
(Name)
_____

by _____ **Date:**_____
(Signature)
_____
(Name)
_____

PROPOSAL SUBMITTED TO: The Village of Ruidoso

Geomorphic survey of North Fork Eagle Creek, from North Fork Eagle Creek Streamgage to Eagle Creek below South Fork Streamgage

U.S. Geological Survey
New Mexico Water Science Center
USGS Contact: William G. Seelig, Justin R. Nichols
May 6, 2025

Summary

Problem. The U.S. Department of Agriculture Forest Service (USFS) issued a Record of Decision (ROD) for the North Fork Eagle Creek Wells Special Use Authorization on February 18, 2016. A series of nondiscretionary monitoring measures were specified as part of the ROD. Item 6 of these measures asks how the geomorphic characteristics of Eagle Creek are changing over time, to be addressed through repeated geomorphic surveys of the stream reach between the North Fork Eagle Creek (U.S. Geological Survey) (USGS) station identification number 08387550) and the Eagle Creek below South Fork (08387500) streamgages.

Objectives. The objective of this project is to use techniques established from previous geomorphic surveys to define the geomorphic characteristics of North Fork Eagle Creek over the stream reach between the North Fork and Eagle Creek streamgages, as part of the monitoring requirements stipulated in the draft ROD for the North Fork Eagle Creek Wells Special Use Authorization.

Approach. Geomorphic characteristics of North Fork Eagle Creek between the North Fork and Eagle Creek streamgages will be established and compared to previous geomorphic surveys conducted between 2017 to 2021. Specifically, this study will:

1. Conduct a topographic survey using a RTK GNSS at 14 pre-defined cross sections.
2. Geolocate and catalog woody debris accumulations and pools within the stream channel.
3. Process survey data into a publicly available data release.
4. Based on the results of the survey and field observations, provide a USGS Scientific Investigation Report (SIR) to the Village of Ruidoso (VOR) summarizing the current geomorphic state of the surveyed reach, and changes noted from previous geomorphic surveys.

Data from the survey, along with field observations, will be published as an online data release and the results and interpretations from the geomorphic survey will be presented as a USGS SIR. Total cost of the proposed project is $64,000 over 3 years.

Relevance and Benefits. This study will provide information that could be used in future studies to assess the response of North Fork Eagle Creek watershed to groundwater removal through municipal pumping and will assist the VOR in fulfilling monitoring and mitigation requirements laid out in the ROD Special Use Authorization. This study will also provide an assessment of the long-term response of the North Fork Eagle Creek watershed following disturbances like the 2012 Little Bear Fire. Monitoring information will inform discussions between the VOR and the FS in the development of monitoring plans and in future management decisions under this authorization. This study also contributes to the USGS strategic scientific focus to "monitor and assess availability and quality of the Nation's freshwater supply," and the strategic partnership focus to "enhance partnerships with Federal agencies, academia, and others in the Earth system modeling community" (U.S. Geological Survey, 2021).

Contents

Introduction

The Village of Ruidoso (VOR), in south-central New Mexico, currently has three active supply wells located along North Fork Eagle Creek in the Lincoln National Forest (Figure 1). These wells began production in 1988, and supply 24-29 percent of the VOR water supply (U.S. Department of Agriculture Forest Service [USFS], 2015). The permit for operation of these wells expired in 1995, and discussions began at that time regarding permit renewal. A concern by some parties in

these discussions was the potential effect of well operations on streamflow in Eagle Creek. As a result of these discussions, the U.S. Geological Survey (USGS), in cooperation with the VOR, conducted a study of North Fork Eagle Creek from 2007 to 2009, to characterize the hydrology of the basin and the effects of groundwater pumping on streamflow (Matherne and others, 2010). The U.S. Department of Agriculture Forest Service, Lincoln National Forest (FS) issued the North Fork Eagle Creek Wells Special Use Authorization Project Draft Environmental Impact Statement in May 2012, shortly before the start of the Little Bear Fire, which burned substantial portions of the watershed. Changes in some aspects of the hydrology of North Fork Eagle Creek were expected following the Little Bear Fire, including increased overland runoff and reduced infiltration, temporary increases in 'flashy' responses to rainfall and snowmelt, increased sediment and debris yields, and changes to vegetation as a result of flooding. Based on the altered post-wildfire watershed conditions, a Supplemental Draft Environmental Impact Statement was released by the FS in 2015 (U.S. Department of Agriculture Forest Service, 2015). The Record of Decision North Fork Eagle Creek Wells Special Use Permit (ROD) regarding the VOR permit for operation of the production wells was released in February 2016 (U.S. Department of Agriculture Forest Service, 2015).

The ROD established the alternative, among several considered in the Final Environmental Impact Statement, that would be implemented and stipulated the terms and conditions of a new special use permit. Included in the decision were monitoring measures designed to address direct or indirect effects of pumping or to help calibrate effects attributable to pumping. The VOR has requested the USGS to assist in one of these monitoring efforts by establishing geomorphic characteristics within the North Fork Eagle Creek. The collaboration between the VOR and USGS involved five annual geomorphic surveys of the North Fork Eagle Creek to include the reach between the USGS North Fork Eagle Creek and the Eagle Creek below South Fork streamgages. The results from the five annual surveys were published in three Open File Reports (OFRs; Graziano, 2019; Graziano, 2020; and Graziano and Chavarria, 2022), and one Scientific Investigations Report (SIR; Nichols and others, 2023) that also summarized the geomorphic change through the five-year study period, which, combined with data collected in previous surveys (Matherne and others, 2010), can be used to establish a geomorphic baseline for future studies. The SIR concluded that there was minimal overall topographic change through the study reach, but that there was an overall increase in woody debris accumulations and stream pools over the 5-year period. The VOR has requested the USGS to continue with geomorphic surveys at a three-year interval to meet ROD requirements and provide long-term monitoring efforts.

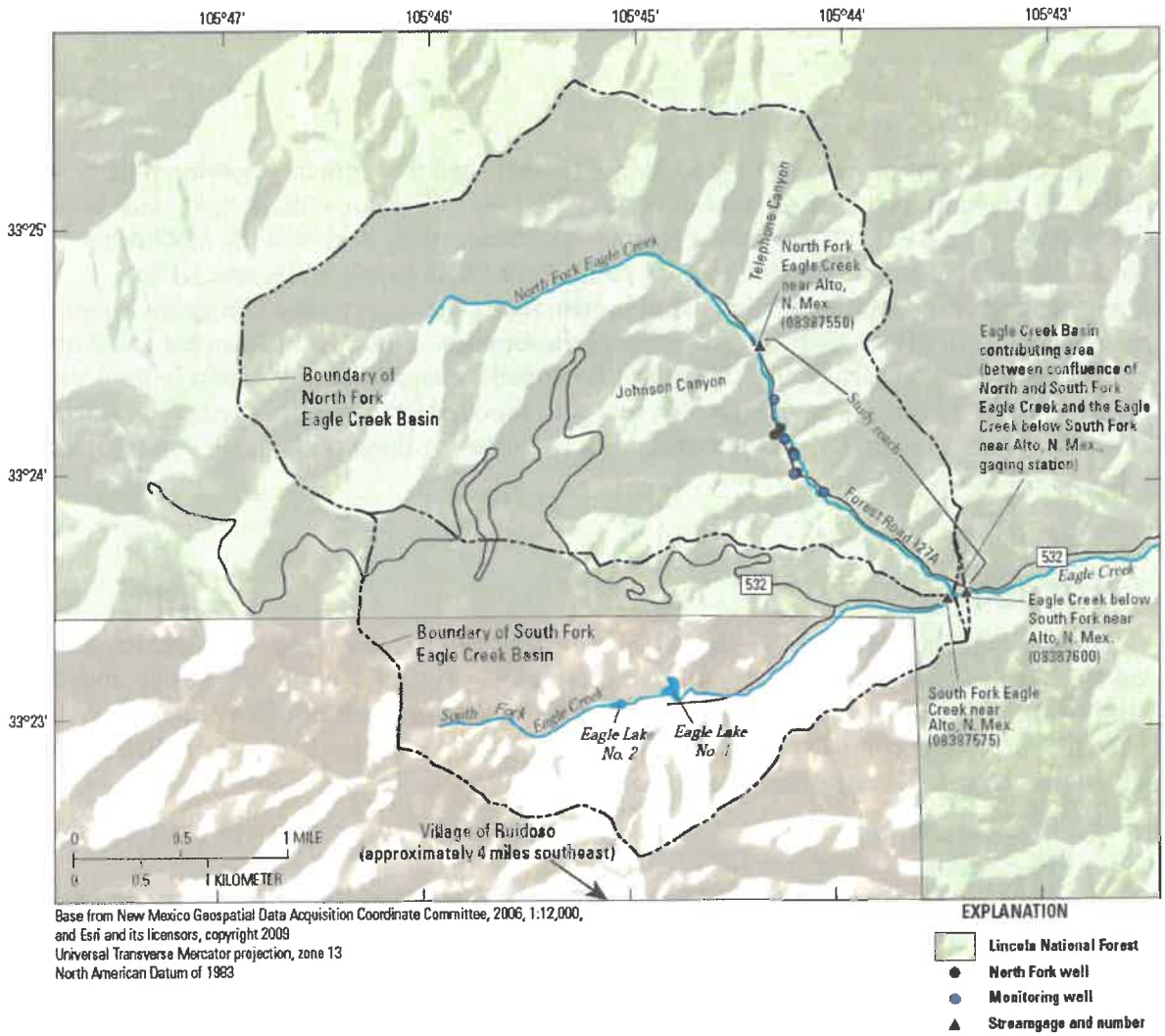

Figure 1: Location of the study reach, Eagle Creek Basin contributing area, Lincoln National Forest boundaries, streamgages, and wells in the study area in the Eagle Creek Basin, south-central New Mexico (modified from Matherne and others, 2010).

Problem

A series of nondiscretionary monitoring measures were specified as part of the ROD for the North Fork Eagle Creek Wells Special Use Authorization. Item 6 of these measures asks how the geomorphic characteristics of Eagle Creek are changing over time and need to be addressed through a geomorphic survey of the stream reach between the North Fork Eagle Creek (USGS station identification number 08387550) and the Eagle Creek below South Fork (08387500) streamgages. Woody debris accumulations and pools can alter the hydrologic conditions of a stream reach causing localized geomorphic change; therefore, these features need to be documented in addition to topographic surveys to inform the geomorphic assessment. While the previous surveys in the stream reach were able to establish a geomorphic baseline, they were unable to quantify long-term trends in geomorphic change due to their short-term observation period of 5 years (Nichols and others, 2023).

Objectives and Scope

The objective of this project is to use techniques established from previous geomorphic surveys to define the geomorphic characteristics of North Fork Eagle Creek over the stream reach between the North Fork and Eagle Creek below South Fork streamgages, as part of the monitoring requirements stipulated in the ROD for the North Fork Eagle Creek Wells Special Use Authorization. The specific question asked in item (6) of Monitoring and Mitigation Measures of the Draft ROD is: "How are the geomorphic characteristics of the stream changing and what effect does it have on surface and subsurface flows and water availability within rooting zones?" It should be noted that repeat topographic surveys cannot address questions regarding subsurface flows and water availability within rooting zones; addressing these portions of item (6) is outside the scope of this proposal.

Approach

Geomorphic characteristics of North Fork Eagle Creek between the North Fork and Eagle Creek streamgages will be established based on a geomorphic survey. Results of the survey, together with field observations, will be summarized in an SIR. The final report will synthesize results from the survey and compare survey results to previous 2017-2021 surveys performed in the stream reach. Specific tasks for this study are as follows:

1. Conduct a topographic survey consisting of channel cross sections using a RTK GNSS at 14 pre-defined cross sections.
2. Geolocate and catalog woody debris accumulations and pools within the stream channel.
3. Process survey data into a publicly available data release.
4. Provide a USGS Scientific Investigation Report (SIR) to the VOR summarizing the current geomorphic state of the surveyed reach, and changes noted from previous geomorphic surveys.

Task 1: Topographic Survey

The reach between the North Fork and Eagle Creek below South Fork streamgages, a length of about 1.6 miles, will be surveyed in mid to late-June, 2025. Channel cross-sections will be surveyed using standard USGS protocols (Benson and Dalrymple, 1984) at the two streamgage sites, and at 14 cross-sections previously established in past geomorphic surveys performed in the study reach (Nichols and others, 2023; Figure 2). Cross-sections will extend into the riparian zone to better characterize potential overbank flooding. Benchmarks have been established at each cross-section, for repeat measurements. The channel will be surveyed using RTK GNSS, with an accuracy of +/- 0.1 ft.

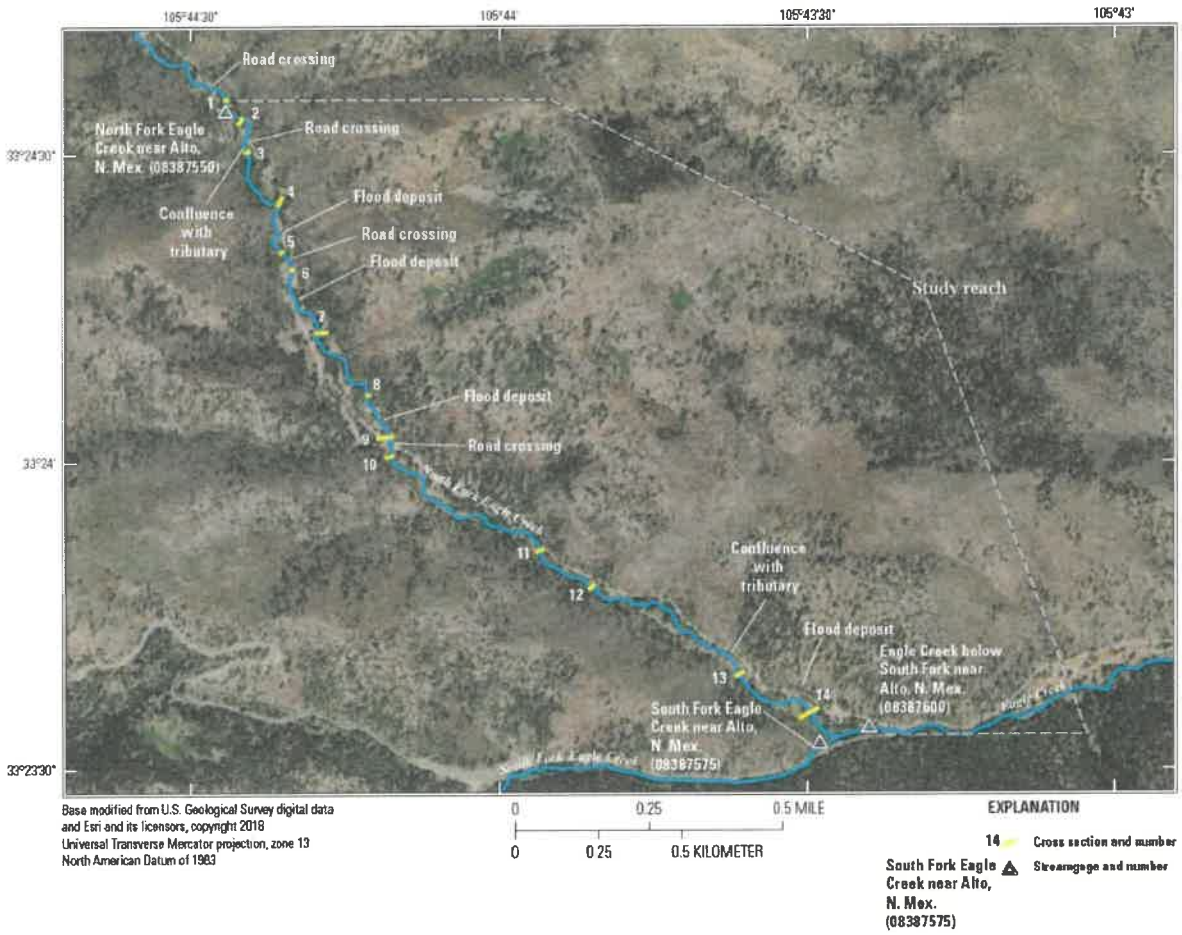

Figure 1: Study reach extent, locations of streamgages, locations and extents of cross sections, and locations of other features in the North Fork Eagle Creek Basin, south-central New Mexico, 2017–21 (Graziano, 2019).

Task 2: Ancillary Field Observations

In addition to the survey, the channel condition will be further characterized by using photographs and observations of features such as pool locations and aggradation or degradation of sediment and woody debris accumulations. All geomorphic features, to include pools and debris accumulations, will be geolocated, categorized, and cataloged. Streamflow is measured at the two streamgages at either end of the survey reach, and at the South Fork Eagle Creek near Alto, New Mexico (08387575) streamgage. The South Fork is a tributary to Eagle Creek, entering upstream from the Eagle Creek streamgage (Figure 2).

Task 3: Data Processing and Data Release

Cross-sections and channel profiles will be developed based on the survey data. Cross-sections will include channel width and bank height and slope at each location. All data associated with the project will be made publicly available through a data release on the USGS data cataloging and management platform, ScienceBase (https://www.sciencebase.gov/catalog/).

Task 4: Interpretation and SIR Publication

Results of the survey and field observations will be presented to the VOR as an SIR, to include data forms, summary tables, photographs, and figures, and an interpretation of results.

Relevance and Benefits

This study will provide information which can contribute to an assessment of the response of the North Fork Eagle Creek watershed to groundwater withdrawal through municipal well pumping and will assist the VOR in fulfilling monitoring and mitigation requirements laid out in the Draft ROD Special Use Authorization. Monitoring information will inform discussions between the VOR and the FS in the development of annual monitoring plans and in future management decisions under this authorization.

This study contributes to the goals of the USGS strategic scientific focus to "monitor and assess availability and quality of the Nation's freshwater supply," and the strategic partnership focus to "enhance partnerships with Federal agencies, academia, and others in the Earth system modeling community" (U.S. Geological Survey, 2021).

Quality Assurance Plan

Quality assurance (QA) measures will be followed to ensure completeness of the information communicated during the study. The QA objectives for collection and communication of information will:

- Withstand scientific scrutiny,
- Be obtained by methods appropriate for the information and its intended use, and
- Be representative and of known completeness and comparability.

Surveys will be conducted, and data processed according to standard USGS protocols (Benson and Dalrymple, 1967). Project records will be electronically archived at the USGS New Mexico Water Science Center. All data associated with the project will be made publicly available through a data release on the USGS data cataloging and management platform, ScienceBase (https://www.sciencebase.gov/catalog/).

Deliverables

Data collected during the field surveys will be made publicly available through a data release published through ScienceBase. Results of the survey, along with field observations, and interpretations, will be published as a USGS SIR.

Timeline and Budget

The field survey will be completed in June-July 2025. Project tasks 1, 2, and 3 will be completed from Q3 of FY 25 to Q1 of FY 26 and consist of performing the field survey, formatting the survey data, and publishing it as a data release. Task 4 will be completed from Q1 to Q4 of FY 26, and consists of analysis of survey data to quantify geomorphic characteristics, comparisons to previous surveys, and a publication of interpretations through an SIR. Task 1, Task 2, and Task 3

are budgeted for $19,316 and will involve a total of 176 staff hours, while Task 4 is budgeted for $44,683 and will involve a total of 370 staff hours, equaling a total project cost of $64,000.

Timeline: Begins after finalization of Joint Funding Agreement

Task	Year 1				Year 2				Year 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Task 1: Topographic Cross-Section Survey												
Task 2: Ancillary Field Observations Cataloging												
Task 3: Data processing and data release												
Task 4: Data analysis, interpretation, and SIR												

	Year 1	Year 2	Year 3	Total
Village of Ruidoso	**$9,734**	**$9,582**	**$44,683**	**$64,000**
USGS	**$0**	**$0**	**$0**	**$0**
Total	**$9,734**	**$9,582**	**$44,683**	**$64,000**

References

Benson, M.A., and Dalrymple, Tate, 1967, General field and office procedures for indirect measurements: U.S. Geological Survey Techniques of Water-Resources Investigations, book 3, chap. Al, 30 p., http://pubs.er.usgs.gov/publication/twri03A1.

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Matherne, A.M., Myers, N.C., and McCoy, K.J., 2010, Hydrology of Eagle Creek Basin and effects of groundwater pumping on streamflow, 1969–2009: U.S. Geological Survey Scientific Investigations Report 2010–5205, 73 p. (Revised November 2011)

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