



# FLOODPLAIN RESTUDY FOR THE BLACK MESA THREE-DAM OUTLET PROJECT

## **LOMR SUMMARY REPORT**

ALBUQUERQUE, NEW MEXICO

*Project No. IO11.404*

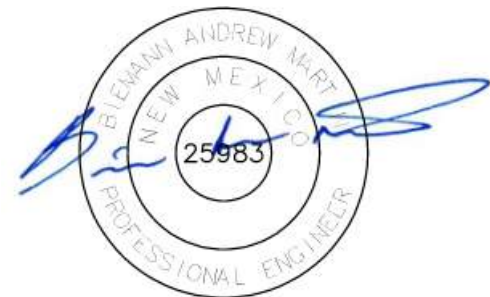
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Hydraulics

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Effective Flood Studies

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- As-Built Information
- Drainage Analysis Report
- Drainage Management Plans
- Floodplain Mapping
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## 1 Introduction

The Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) Black Mesa Three-Dam Outlet Project, a five-phase project to connect the outlets of three dams in the Southwest Valley, has recently been completed. This project connected the outfalls from the Don Felipe, Raymac, and McCoy dams into a single outfall pipe along the Middle Rio Grande Conservancy District's (MRGCD) Gun Club Lateral. The main outlet pipe, constructed by the US Army Corps of Engineers (USACE), is located in Raymac Road and outfalls to the Rio Grande. The entire project was initially designed by USACE, but Wilson & Company was contracted by AMAFCA to produce a final design analysis, and its construction was completed in 2021. USACE has offered a letter of support for this LOMR (provided in Digital Attachments) with an understanding of the importance of this project to the region. The intent of the project was to capture the 100-year flood event at each dam and drain it directly to the Rio Grande floodplain to alleviate flooding issues to the east (downstream) of the dams. This project also eliminated gated releases to existing irrigation facilities which required significant coordination between AMAFCA and the local irrigation district.

The objective of this Letter of Map Revision (LOMR) request is to reanalyze the arroyos and associated floodplains affected by the Three-Dam Outlet project and provide an update to the effective flood maps. Upstream of the dams, approximate A zone floodplains represent most of the arroyos. With a new lidar collection for this area completed in fall of 2021, this LOMR will provide a needed update to the existing floodplains as the use of new topographic data will properly align the flood zones with existing flow paths. Downstream of the dams, existing residential and commercial areas will benefit from an improved understanding of their flood risk following this study.

## 2 Location

The project area represented by this LOMR is located in the Southwest Mesa of Bernalillo County and is bounded by the Rio Puerco escarpment to the west, the Isleta Drain to the East, approximately Interstate 25 to the south, and approximately Gun Club Road to the north. The current effective floodplain mapping for this site is included on FIRM panels 35001C0319H, 35001C0338H, 35001C0507G, 35001C0526H, 35001C0527H, 35001C0528H, and 35001C0529H within the jurisdiction of Bernalillo County (community number 350001). All maps have an effective date of August 16, 2012 except for panel 35001C0507G which has an effective date of September 26, 2008. The effective Bernalillo County FIS report for this location has a revised date of November 4, 2016 and relevant effective maps and tables for this LOMR are included in Appendix A. Figure 1 shows the project area and its relative location on the various FIRM panels. It is noted that panel 35001C0510H will not have any map revisions; therefore, it is not included in the list of panels revised for this project. Also, panel 35001C0339H has mapping revisions due to the extension of the HEC-RAS analysis area.

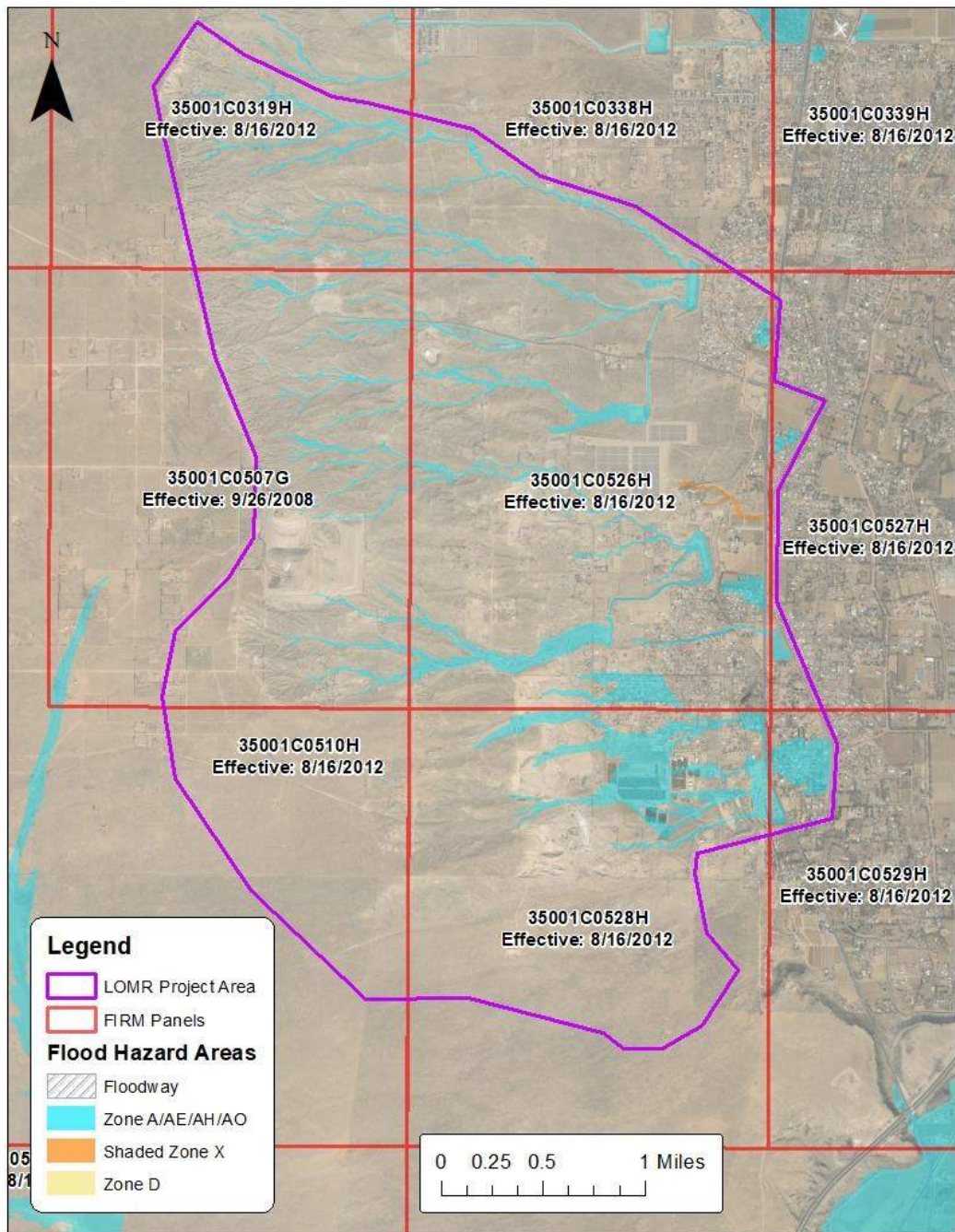


Figure 1: LOMR Project Area

### 3 Effective Flood Studies

Over the years, as expected for a project area covering several panels, there have been a number of LOMRs and LOMAs approved by FEMA. 10-06-1078P primarily covered areas east of the three-dam outfall pipe and was already incorporated into the FIRM panels during the 2012 restudy; therefore, any revision from this LOMR request will reflect 10-06-1078P information on the effective map panels. There are two



unincorporated LOMRs on panel 35001C0526H: 14-06-0097P and 14-06-4098P dated December 26, 2014 and January 9, 2015, respectively. The available data for these LOMRs has been obtained from FEMA. While this is a new study that uses different methodologies, the proposed revision will attempt to incorporate the intent and assumptions of these existing LOMRs. There are many existing LOMAs associated with affected panels but falling outside of the project area. When only a portion of a panel is revised (all panels except 35001C0526H), the existing LOMAs will still be valid for areas on the panels outside of the study area. 13-06-1965A does not appear to have removed any structures from a flood zone, and this flooding area is expected to be superseded by this study.

The floodplain revision that resulted from the 14-06-4098P LOMR was mapped as a shaded X, 0.2% annual chance flood hazard area. From a review of the supporting LOMR data, 14-06-4098P modeled 1% annual chance discharges, so the 0.2% annual chance flood hazard designation is incorrect. Additionally, the supporting hydraulic model calculated flood depths greater than 1-foot throughout the modeled reach, so a shaded X flood zone is also incorrect. Because of this assumption (that the 14-06-4098P LOMR has a mapping error), and since all other flood hazard areas within the Black Mesa LOMR area are represented by a 1% annual chance floodplain, this LOMR only includes an analysis of the 1% annual chance event. Effective flood study information has been provided as a digital attachment to this report.

#### 4 Summary of Available Data

The entire Three-Dam Outlet Project has spanned over 20 years. The USACE started the Black Mesa project in the 1990s (cost-shared with Bernalillo County and AMAFCA) and installed the primary outfall pipe that runs along Raymac Road. The USACE did not have funding to finish the rest of the project, so AMAFCA took over responsibility for the project and finished the entire system in early 2021. Due to the length of the project, there is an abundance of data supporting this revision request.

The main data sources used to support this LOMR request are historical Drainage Management Plans, a Drainage Analysis Report, supporting Arid Lands Hydrologic Model (AHYMO) and WaterCAD files, record drawings and other as-built information, and existing topographic data. All of this data is digital and has been attached to this submittal as appropriate. The Drainage Management Plans for the Don Felipe, Raymac, and McCoy Dams were accompanied by an AHYMO analysis which was referenced in developing the existing conditions HEC-RAS model. The record drawings and as-built information were referenced to ensure structures and other features within the model reflect existing conditions. Orientation of dams within the project is shown in Figure 2.

Design plans for the outfall pipe project included a WaterCAD model of the system which was reviewed to ensure adequate capacity within the design for capturing and conveying the 1% annual chance event. It should be noted that the Maplewood



Figure 2: Orientation of Dams Within Project

Pond was not considered in the outflow pressure pipe computations since this is a smaller pond and is operated separate from the larger dams. Any future attempt to introduce a low-level outflow structure for this pond in combination with the larger dams would require an updated evaluation of the pressure pipe system.

The 2018 Mid-Region Council of Governments (MRCOG) lidar collection for Middle Rio Grande Valley was made available to ESP for review. ESP reviewed this existing lidar collection within the Black Mesa area of interest to determine whether the lidar met the needs of the project as well as FEMA Guidelines and Specifications which references the USGS 3DEP Lidar Base Specification for QL2 lidar data. The 2018 MRCOG lidar data within the project area failed the minimum accuracy threshold for QL2 lidar data as established by previous and current FEMA and USGS specifications. A summary of this review is provided in Appendix B and any additional supporting data can be provided as needed. Due to the failure of existing topographic data to meet required quality standards, a new lidar collection was obtained. A summary of these efforts is described in the following section.

## 5 Lidar Collection

Following the review of existing 2018 MRCOG lidar data within the project area, ESP was tasked with conducting ground survey and aerial lidar acquisition and processing to support the modeling needs of this project. The summary report of this lidar collection effort is provided in Appendix C. For this LOMR study, only the Digital Elevation Model (DEM) mosaic is provided in support of the hydrologic and hydraulic modeling.

## 6 Hydraulic Analysis

### 6.1 Approach

It was determined that a two-dimensional (2D) hydraulic analysis would be used to analyze existing conditions floodplains due to the complex drainage patterns within the study area and the mix of riverine, ponding, and shallow concentrated flow areas. A combined, hydrologic and hydraulic analysis was performed in HEC-RAS, version 6.3, that incorporates rain-on-grid infiltration and 2D hydraulic modeling for the 1% annual chance event. The following sections describe data development for hydrologic and hydraulic parameters used in the model.

### 6.2 HEC-RAS 2D Development

There is no existing model for most floodplains within the LOMR project area (see Section 3), and almost all floodplains are approximate Zone A flood hazards; therefore, the hydraulic analysis only includes a single plan for existing conditions to establish model-backed flood hazard areas. The latest versions of HEC-RAS can simultaneously model precipitation and infiltration and perform 2D hydraulic modeling over a 2D flow area. This functionality was used to model the 1% annual chance rainfall event for the LOMR area. The 2D model is based on terrain data described in Section 5 of this report. The SCS CN method was used to model rainfall infiltration. The CN values and rainfall data used in the 2D HEC-RAS model are described in Section 6.2.4 and Section 6.2.3, respectively.

There is a gravel mine west of the South Valley Dairy that has an agreement to replace the areas they excavate. Because of this, the terrain in this area was modified to reflect conditions prior to the mining operations as determined by reviewing 1991 quadrangle topographic map from USGS. This process eliminated any excess storage that may occur within the gravel mine in the 2D model. The modeling also

does not include irrigation gates or other controls that may divert stormwater flows. It should also be noted that the Isleta Drain and Gun Club Lateral are expected to function as a drain for this area and were assumed to be empty for the purposes of this analysis.

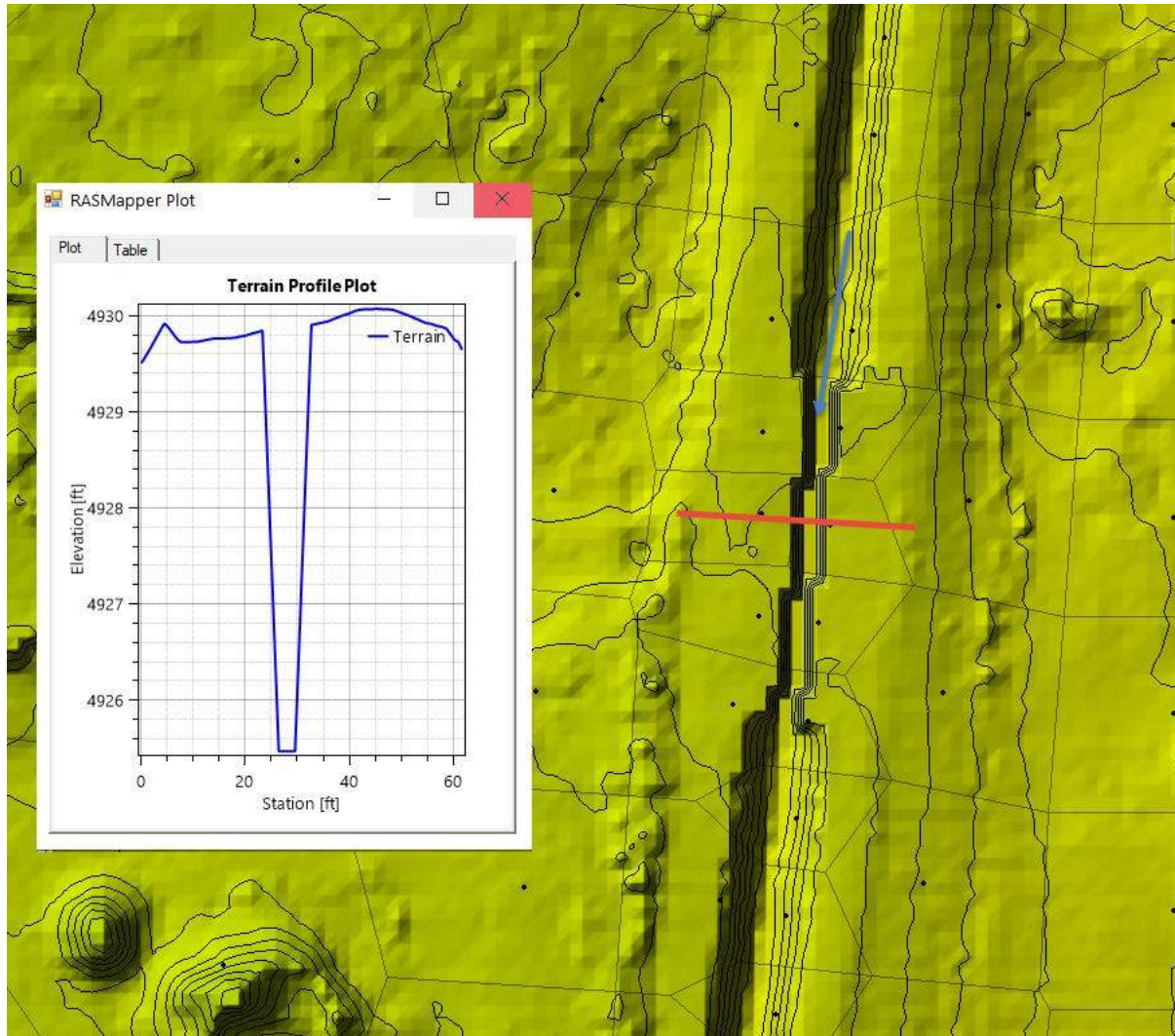
#### **6.2.1 2D Grid Geometry**

A HEC-RAS 2D analysis consists of dividing the study area into a grid of cells with no more than 8 faces and performing cell-by-cell infiltration and 2D hydraulic calculations. The model calculates runoff flows, water surface elevations/depths, and similar parameters for all cells in the grid, which can subsequently be used to develop floodplain boundaries.

Grid cell spacing ranges from 10x10 feet to 200x200 feet for the hydraulic model. Breaklines were used to identify important terrain features such as stream centerlines, tops of dams, and roadway centerlines to force cell alignment along those features and appropriately capture terrain that influences flow direction. Breaklines were also used along identified stream centerlines. Refinement regions were used to create smaller cell sizes in selected areas where multiple break lines were not practical or efficient to adequately capture topographic features.

#### **6.2.2 Structure Modeling**

Gun Cub Lateral, Isleta Drain, and the South Valley Solar Field have multiple culvert/roadway crossings that were not practical to model in HEC-RAS. Instead, the terrain was modified to “hydro-correct” the terrain. Hydro-correcting the terrain consists of modifying terrain elevations to allow the model to transfer flow through a roadway embankment similar to a culvert to produce more realistic flow transfer in the model. Hydro-corrections were based on as-built culvert sizes (where available), or approximate channel bottom widths measured from terrain data. A typical hydro-corrected culvert is shown in Figure 3 below.



**Figure 3: Example Hydro-Corrected Culvert and Representation of the Cell Face Profile**

Most existing floodplains within this study area are approximate Zone A areas with no published Base Flood Elevations (BFEs). Therefore, the approximation of crossings within the Gun Club Lateral, Isleta Drain, and South Valley Solar Field is in accordance with FEMA guidance for approximate Zone A studies as provided in Table 1 within FEMA’s “Guidance for Flood Risk Analysis and Mapping, General Hydraulics Considerations” dated December 2020. However, to better understand critical locations within the study area, several structures were surveyed to confirm elevations and structure dimensions. West of Gun Club Lateral, field survey data was collected in 2022 for roadway culvert crossings at Pajarito Road, Niese Road, and the culvert at the Los Indios Sedimentation Pond for use in the model. Survey was also collected at the two weir structures in the Pajarito Diversion Sedimentation Pond. At these locations, HEC-RAS SA/2D connections were used and survey data incorporated into the model. A typical SA/2D connection is shown in Figure 4, and the field survey data is provided with the digital attachments provide with this report.



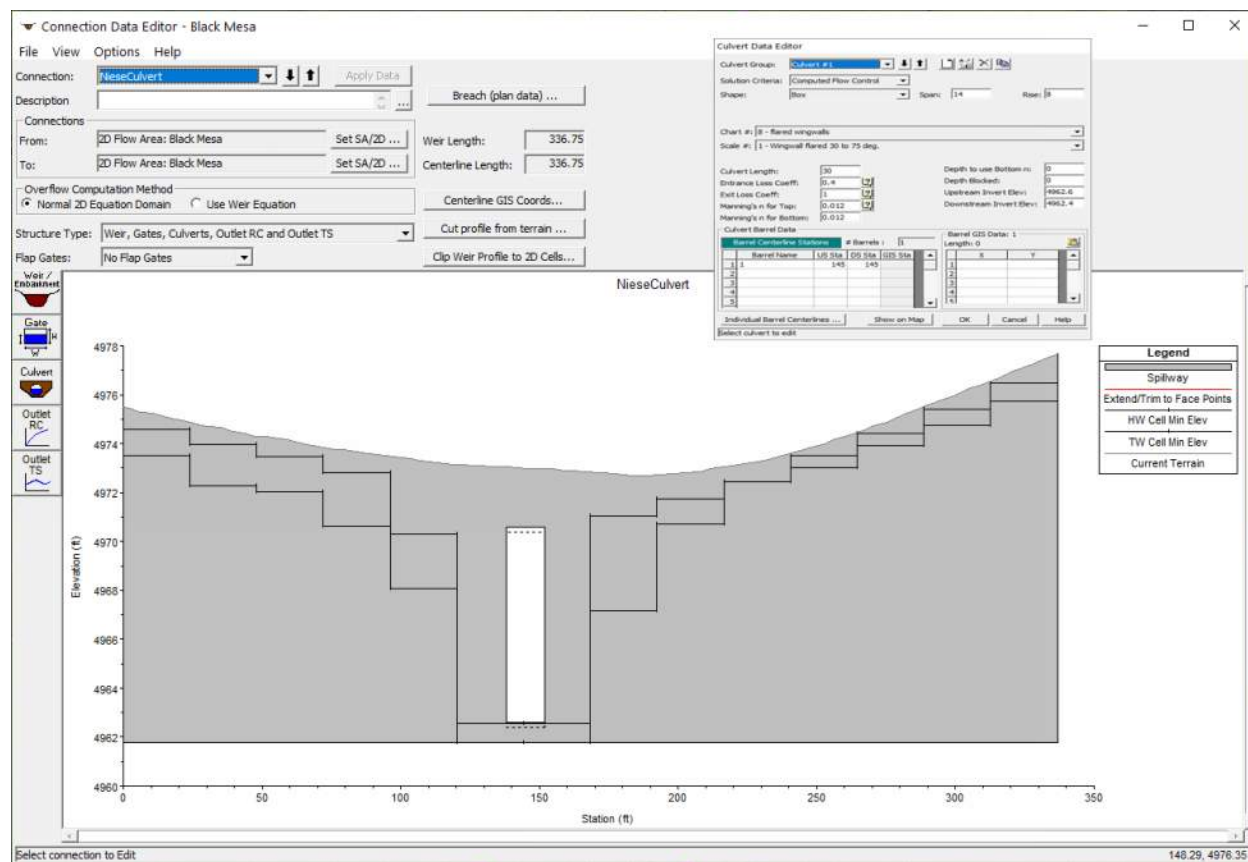


Figure 4: Niese Road SA/2D Connection with Survey Data

There are five ponds/dams that are operated for flood control in the study area. As-built dam plans indicate that discharge from four of the ponds/dams are controlled by gate valves on the outlet pipes. The Los Indios Pond is not gate controlled. However, as stated in the AMAFCA OMI Manual, 2021, Standard Operating Procedures, the gates for the Don Felipe, Raymac, and McCoy dams, as well as Maplewood Pond, are closed until manually operated to release stored flood waters. Releases enter downstream drainage facilities, including the Black Mesa pressure pipe system, which are designed to take full flows from a fully opened gate. Releases from each dam are planned to not overload the Black Mesa pressure pipe system or cause backups into the other dams.

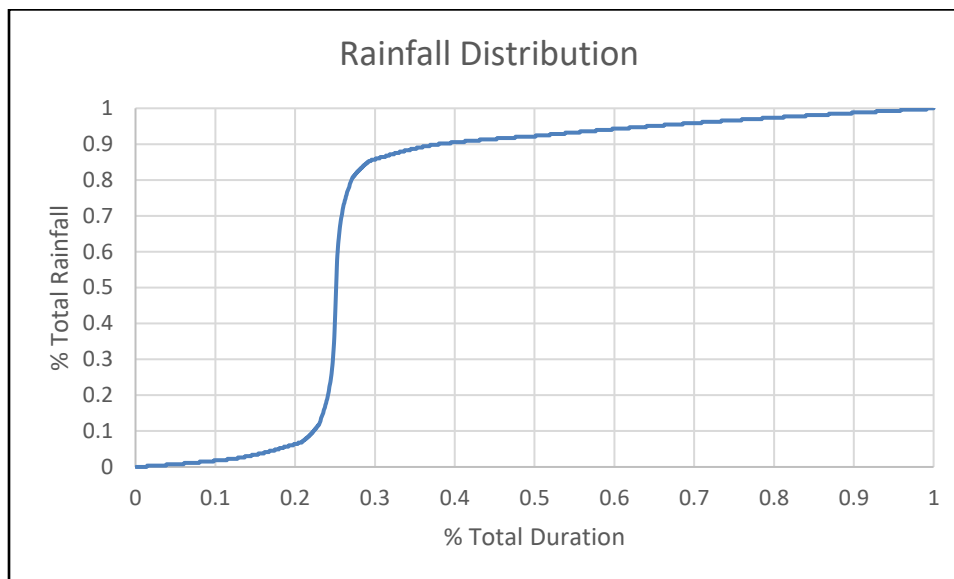
Therefore, the four gated dam outlets were modeled as fully closed to the planned releases and to represent worst-case flooding conditions behind the dams. Emergency spillways were modeled as broad crested weirs based on lidar elevations and widths measured from aerial imagery, however, the modeling confirmed the 100-yr storm runoff is fully contained at each dam without activation of the emergency spillways.

### 6.2.3 Rainfall Determinization

Precipitation depth data for the 1% annual chance event and partial duration based 24-hour point precipitation frequency was obtained from NOAA Atlas 14. The 24-hour, 100-year NOAA Atlas 14 rainfall depth for the project area is 2.65 inches. For sub-shed runoff and hydrograph generation, a hypothetical frequency storm with maximum intensity at the 25% position was used. The rainfall distribution is shown below in Figure 5. A spreadsheet is included in the digital attachments that supports the modeled



hyetograph derived from a HEC-HMS distribution. The referenced HEC-HMS distribution follows the set up recommended in the AMAFCA white paper “Migrating from AHYMO’97 to HEC-HMS (and USEPA SWMM)” prepared by OCCAM Engineers, Inc. (now Stantec) in June 2018 and describing the process to migrate AHYMO models to HEC-HMS.



**Figure 5: Rainfall Distribution**

#### 6.2.4 Infiltration

The runoff curve numbers (CN) were determined using the Natural Resources Conservation Service (NRCS) system of combining soils and land use data to generate a value that represents the existing runoff production potential of each basin. Land use information was determined using ArcGIS 2018 Aerial Imagery from Atlantic and soil information was collected from the NRCS Web Soil Survey site. CN values were generally appointed based on designations included in Table 9-1 “Runoff curve numbers for agricultural lands” or Table 9-5 “Runoff curve numbers for urban areas” from Chapter 9 of Part 360 in the National Engineering Handbook (which are also Tables 2.2a, 2.2b & 2.2c from USDA Urban Hydrology for Small Watersheds, TR-55). All CN values were assigned in accordance with Table 1.

**Table 1: CN Lookup Table**

Land Use Description	CN Assignment per Hydrologic Soil Group			
	A	B	C	D
Residential, 1 acre lots	51	68	79	84
Residential, 1/2 acre lots	54	70	80	85
Residential, 1/3 acre lots	57	72	81	86
Residential, 1/4 acre lots	61	75	83	87
Residential, 1/8 acre lots	77	85	90	92

Land Use Description	CN Assignment per Hydrologic Soil Group			
	A	B	C	D
Residential, 2 acre lots	46	65	77	82
Industrial	81	88	91	93
Open Space	68	79	86	89
Roadways	98	98	98	98

HEC-RAS, version 6.3, includes a tool to develop a spatial infiltration layer based on combined soils and land use GIS data. The tool was used to develop an infiltration layer with assigned SCS CN values that are applied on an individual 2D grid cell basis. The SCS default Initial Abstraction Ratio (0.2) was used corresponding to the SCS CN value used for the study. HEC-RAS does not require a minimum infiltration rate. Since minimum infiltration rate is not a standard feature of the SCS CN Method, it was not used in this study.

#### 6.2.5 Boundary Conditions

A normal depth outflow boundary condition was placed at the outlet of the model (located at the Isleta Drain outfall). The normal depth slope was determined as the ground slope along the Isleta Drain in vicinity of the model outlet. It should also be noted that the Isleta Drain is expected to function as a drain for this area and was assumed to be empty at the start of the simulation for the purposes of this analysis.

To limit water ponding along the 2D boundary, the 2D limits were generally set on high terrain that forms a natural drainage divide. The 2D boundary does not include any areas east of Isleta Drain, since the drain is assumed to be empty and capable of handling local drainage within this area. At the upper end of Gun Club Lateral and Isleta Drain, normal depth boundary conditions were added to allow water to move freely within the drainage laterals without ponding against the model boundary. Peak outflows at these locations are relatively small (Gun Club Lateral peak outflow of 24.72 cfs and Isleta Drain peak outflow of 1.03 cfs while the overall peak outflow for the model is 154.27 cfs). These outflows are considered appropriate for this model given that Gun Club Lateral and Isleta Drain function as drains for the study area.

As previously presented, this study uses rain-on-grid hydrology requiring a precipitation boundary in the model. The precipitation boundary consists of the 24-hr incremental precipitation for the 1% annual chance storm event. Rainfall values and the rainfall distribution used for this study were described in Section 6.2.3 of this report. This model assumes dry initial conditions and that the storm event occurs over the entire model area.

Sediment bulking was not included in the hydraulic analysis since FEMA does not map BFEs based on bulked flows. However, a separate analysis was performed to determine the storage capacity of each of the three major dams to evaluate the potential for sediment bulked flows to activate each dam's emergency spillway for the 1% annual chance event. Generally, based on local guidance, 17% is an upper limit of bulking used to account for sediment suspension in this area, so a 17% increase to the modeled volume was reviewed within each dam/pond. Results of this analysis are summarized in Table 2 below. While sediment bulking would likely affect BFEs within the project area, Table 2 shows that it will not

affect the ability of the dams to capture and store the 1% annual chance flows. Additionally, these dams have been in place for over 30 years without any evidence of sediment transport issues along the previously studied streams.

**Table 2: Sediment Bulk Flow Impact on Dam Storage During 1% Annual Chance Event**

Dam	2D Model Flood Elevation (ft, NAVD88)	Dam Storage (ac-ft)	Dam Storage +17% for Bulk Flow (ac-ft)	Expected Bulk Flow Elevation* (ft, NAVD88)	Emergency Spillway Elevation (ft, NAVD88)	Freeboard (ft)
Don Felipe	4968.8	108.8	127.3	4970.3	4970.7	0.4
Raymac	4959.8	42.3	49.5	4962.1	4964.8	2.7
McCoy	4940.8	30.3	35.4	4941.3	4956.2	14.9
Maplewood Pond	4936.8	2.6	3.0	4937.7	4946.9**	9.2
Los Indios	5030.4	0.7	0.8	5030.2	5035.0	4.8

\*Interpolated from Elevation/Storage Curves

\*\*Top of Dam Elevation

#### 6.2.6 2D Manning's n

Manning's n values used for this study were developed from published references generally accepted by the engineering community. Manning's n values were assigned relative to the land use types as shown in Table 3. Building footprints provided by the Mid-Region Council of Governments (MRCOG) were incorporated into the land use layer and high manning's n values were assigned to represent the obstruction to overland flow caused by buildings. Based on as-built plans, the Los Indios Diversion Channel is rip lined so it was assigned a manning's n value of 0.055 representing rip rap in the channel.

**Table 3: 2D Manning's n value Assignments**

Land Use Description	Manning's n values
Buildings	10
Residential, 1 acre lots	0.04
Residential, 1/2 acre lots	0.05
Residential, 1/3 acre lots	0.06
Residential, 1/4 acre lots	0.08
Residential, 2 acre lots	0.03
Industrial	0.08
Open Space	0.02
Roadways	0.02

#### 6.2.7 Calculation Options

All 2D simulations were run using the Diffusion Wave calculation methodology with a variable timestep based on monitoring Courant numbers to improve model stability. Table 4 summarizes each event and the time steps used for each analysis.

**Table 4: Time Steps for Each Analysis**

Annual Chance Event	Starting Time Step (s)	Ending Time Step (s)	Minimum Time Step Used (s)
1%	1	1	0.5

### 6.2.8 Initial Results Review

Once the model was developed using the described procedures and data, the model was run and results were viewed in the HEC-RAS RAS Mapper tool. Several initial checks were completed including review of the outflow boundary discharge hydrograph to ensure the model ran long enough to fully capture the peak discharge throughout the study area. Additionally, breaklines and refinement areas were adjusted to help refine the 2D grid, and model velocities were reviewed to ensure stability and surging was not present. The overall volume accounting error for the 1% annual chance event is 0.1483%.

Water surface elevation convergence errors that occurred during the simulation run were evaluated to identify cells with large convergence errors. Cells with convergence errors were modified such that all remaining convergence errors are minimal (less than 0.1 feet). For this analysis, there were no reported convergence errors, so all computed water surface elevations were within the 0.02 feet model tolerance.

Due to a lack of historic flood flow/elevation data or highwater marks within the study area, the 2D model parameters have not been calibrated.

## 6.3 HEC-RAS Results and Mapping

Maximum water surface elevations associated with the computation point of each 2D grid cell were exported from RAS Mapper for the 1% annual chance event. The HEC-RAS Horizontal Water Surface Rendering Mode was applied to associate the water surface elevations, as computed in the 2D simulations, to each computation point. The points were then used to generate mapping products using the project terrain DEM.

For this project, depth thresholds between 0.0 – 1.0 foot were tested to determine the optimal balance to maintain hydraulic connectivity through fluvial reaches and remove disconnected, shallow flooding areas from the final mapping. The full depth results were applied to the depth raster. Final mapping boundaries are based on a flood depth raster with a cell value greater than the chosen threshold. Mapping limits were manually evaluated and selected based on several factors indicated as follows:

- Mapping represents areas that will be designated Zone A, Zone AE (dam reservoirs with known spillway elevations), AH (1'-3' ponding), and AO (1'-3' shallow flow).
- Rather than simply cut-off mapping of Zone A or AO at 1 sq mi upstream of the three dams mapping extends upstream to a point where discontinuous mapping dominates. Note that this approach differs from FEMA's guidance to regulate areas with a drainage area of 1 square mile or greater.
- East of Gun Club Lateral, areas of flooding with larger, continuous mapping with depths of 1-3 feet were mapped to represent Zones A, AH and AO in these areas.
- Mapping areas were reviewed by AMAFCA and Bernalillo County prior to delivery to FEMA.

Stillwater elevations at the water impounding structures were compared to effective FEMA elevations as shown in Table 5 below. Since the McCoy Dam and Maplewood Pond are not listed in Table 13 of the effective FIS report, a comparison cannot be made, but the modeled stillwater elevations at these structures were included for reference since these will be mapped as Zone AE for the LOMR. Annotated FIRMs and FIS tables are provided in Appendix D.

**Table 5: Modeled Elevations Compared to FEMA Stillwater Elevations**

Location	Modeled 1% Flood Elevation (ft, NAVD88)	FEMA Stillwater Elevation (ft, NAVD88)
Don Felipe Dam	4968.8	4969.0
Raymac Dam	4959.6	4964.0
McCoy Dam	4940.8	---
Maplewood Pond	4936.6	---

## 7 Conclusion

Due to the age of the effective maps and the use of newly collected lidar data supporting this LOMR request, it is not surprising to observe many areas with changes to the Special Flood Hazard Area (SFHA). No new structures are impacted as a result of the Black Mesa Three-Dam Outlet project, and many structures have been removed from the floodplain as a result of the capture of flooding at the dams combined with the primary outlet to the Rio Grande. There are several structures downstream of the dam which are mapped within the revised floodplains but were not previously mapped. This results from the use of a 2-D, rain-on-grid modeling approach that does not utilize pre-defined flowpaths.

Several criteria were applied to produce final mapping products. Upstream of dams (with fluvial flooding patterns), no depth limiting was applied and mapping was maintained regardless of drainage area due to existing extents. Outside of the drainage area for each dam, mapping was limited to only include areas flooding at a depth greater than 1 foot.

ESP recommends that this study serve as the basis for an approval of a LOMR for the Black Mesa Three-Dam Outlet project. MT-2 application forms have been provided in Appendix E.

## References

1. FEMA Flood Insurance Study Report, Bernalillo County, New Mexico and Incorporated Areas, November 4, 2016.
2. FEMA Guidance for Flood Risk Analysis and Mapping, General Hydraulics Considerations, December 2020
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4. Raymac Dam Watershed Drainage Management Plan, Weston Solutions, August 2011.
5. Abridged Drainage Management Plan For McCoy Dam, Bohannon Huston, June 2011.
6. Black Mesa Phase 1A Pipe Extension Project, Design Analysis Report, Wilson & Company, April 2012.
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11. Black Mesa 3 Dam Outlet, Raymac to Don Felipe Dam, Phase II As-builts, Wilson & Company, August 2018.
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14. Black Mesa 3 Dam Outlet, Raymac to McCoy Dam, Phase V As-builts, Wilson & Company, June 2020.
15. South Valley Solar Field Site, Site Plan, Bohannon Huston, February 13, 2015.
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## **Appendix A:**

### **Effective FIS Information**

**Table 12 – Summary of Discharges for Shallow Flooding Areas**

<u><b>Flooding Source and Location</b></u>	<u><b>Drainage Area (square miles)</b></u>	<u><b>Peak Discharges (cfs)</b></u>			
		<u><b>10-Percent- Annual-Chance</b></u>	<u><b>2-Percent- Annual-Chance</b></u>	<u><b>1-Percent- Annual-Chance</b></u>	<u><b>0.2-Percent- Annual- Chance</b></u>
Hubbell Lake Diversion Channel <sup>1</sup>					
Above dam	4.90	*	*	1,456	*
At dam outfall	4.90	*	*	80	*
At confluence of Sacate Blanco Arroyo	1.54	*	*	609 <sup>2</sup>	*
Just east of Diversion Dike	0.96	*	*	477	*
Arroyo de Domingo Baca <sup>3</sup>					
At North Diversion Channel	12.73	*	*	3,620	*
At Interstate Highway 25	7.11	*	*	2,146	*
At Ventura Street	5.84	*	*	1,142	*
Dam outflow	4.43	*	*	761	*
Dam inflow	4.43	*	*	3,845	*
At the confluence with Baca Tributary	3.26	*	*	2,550	*
Arroyo del Pino					
Just downstream from San Pedro Drive Northeast	8.90	*	*	2,639	*
Just downstream from Wyoming Boulevard	8.70	*	*	2,432	*
At North Diversion Channel	8.59	*	*	2,386	*
At Interstate Highway 25 <sup>3</sup>	7.06	*	*	1,604	*
At Ventura Street (Extended) <sup>3</sup>	6.44	*	*	1,250	*
Dam outflow <sup>3</sup>	4.65	*	*	206	*
Dam inflow	4.65	*	*	4,424	*

<sup>1</sup> Reference 9

<sup>2</sup> By regression analysis

<sup>3</sup> Reference 8

\* Data not available



**Table 12 - Summary of Discharges for Shallow Flooding Areas (Continued)**

<b><u>Flooding Source and Location</u></b>	<b><u>Drainage Area (square miles)</u></b>	<b><u>Peak Discharges (cfs)</u></b>			
		<b><u>10-Percent- Annual-Chance</u></b>	<b><u>2-Percent- Annual-Chance</u></b>	<b><u>1-Percent- Annual-Chance</u></b>	<b><u>0.2-Percent- Annual-Chance</u></b>
Arroyo de San Antonio-Middle <sup>1</sup>					
At Coors Boulevard	2	*	*	2,640	*
At Atrisco Drive Crossing	4.03	*	*	1,970	*
At Atrisco Drive	2.61	*	*	1,324	*
Bear Arroyo <sup>3</sup>					
At inflow to Arroyo del Oso Dam	15.00	*	*	2,159	*
At Wyoming Boulevard	12.09	*	*	1,957	*
At confluence with Bear Canyon Arroyo	0.40	*	*	149	*
At Juan Tabo Boulevard	0.26	*	*	159	*
Bear Arroyo Tributary					
At Wyoming Boulevard <sup>3</sup>	2.41	*	*	1,520	*
At Juan Tabo Boulevard <sup>3</sup>	1.87	*	*	1,400	*
Upstream of Bear Arroyo Tributary diversion structure	0.73	*	*	1,330	*
Bear Canyon Arroyo <sup>3</sup>					
At Eubank and confluence with Bear Arroyo	10.48	*	*	1,948	*
At outflow of Juan Tabo Dam	9.70	*	*	1,930	*

<sup>1</sup>Reference 9

<sup>2</sup>Contributing drainage area may be different because of interbasin transfer via roads and storm sewers

<sup>3</sup>Reference 8

\*Data not available

**Table 12 - Summary of Discharges for Shallow Flooding Areas (Continued)**

<u><b>Flooding Source and Location</b></u>	<u><b>Drainage Area (square miles)</b></u>	<u><b>Peak Discharges (cfs)</b></u>			
		<u><b>10-Percent- Annual-Chance</b></u>	<u><b>2-Percent- Annual-Chance</b></u>	<u><b>1-Percent- Annual-Chance</b></u>	<u><b>0.2-Percent- Annual-Chance</b></u>
Black Arroyo					
Black Arroyo Detention Dam outflow	9.86	*	*	2,468	*
Black Arroyo Detention Dam inflow	9.86	*	*	5,357	*
Boca Negra Arroyo <sup>1</sup>					
Just downstream from confluence with South Branch	7.20	*	*	2,911	*
At confluence with South Branch	4.38	*	*	1,653	*
Just West of Atrisco Drive	2.12	*	*	894	*
Boca Negra Arroyo – South <sup>1</sup>	2.82	*	*	1,282	*
Borrega Arroyo <sup>1</sup>					
At outfall	1.26	*	*	614 <sup>2</sup>	*
At confluence of Borrega Arroyo “A”	0.32	*	*	171	*
Approximately 3,000 feet Upstream of Borrega Dam	1.00	*	*	815	*
At Borrega Dam	1.35	*	*	1,000	*
Borrega Arroyo “A” <sup>1</sup>					
At confluence with Borrega Arroyo	0.60	*	*	293	*

<sup>1</sup>Reference 9

<sup>2</sup>By regression analysis

\*Data not available

**Table 12 - Summary of Discharges for Shallow Flooding Areas (Continued)**

<b><u>Flooding Source and Location</u></b>	<b><u>Drainage Area (square miles)</u></b>	<b><u>Peak Discharges (cfs)</u></b>			
		<b><u>10-Percent- Annual-Chance</u></b>	<b><u>2-Percent- Annual-Chance</u></b>	<b><u>1-Percent- Annual-Chance</u></b>	<b><u>0.2-Percent- Annual-Chance</u></b>
Embudito Channel <sup>1</sup>					
At confluence with Embudo Channel	2	*	*	1,680	*
At Menaul Boulevard	2	*	*	1,557	*
Downstream from confluence of north Glenwood Hills Channel	2	*	*	454	*
At Juan Tabo Boulevard	2	*	*	241	*
At Montgomery Boulevard	2	*	*	110	*
Embudo Arroyo					
At confluence with Interstate Highway 40 Channel	2	*	*	4,980	*
At Wyoming Boulevard	2	*	*	5,009	*
At Indian School Road	2	*	*	4,539	*
At Eubank Boulevard	2	*	*	4,533	*
At confluence of Embudito Canal	2	*	*	3,258	*
At confluence of Piedra Lisa Channel	2	*	*	579	*
At Juan Tabo Boulevard	2	*	*	647	*
At Tramway Boulevard	2	*	*	772	*
Hahn Channel <sup>1</sup>	2				
At North Diversion Channel	2	*	*	1,570	*
At Carlisle Boulevard	2	*	*	1,363	*
At San Mateo Boulevard	2	*	*	1,263	*
At confluence of North Hahn Arroyo	2	*	*	830	*
At Louisiana Boulevard	2	*	*	724	*

<sup>1</sup>Reference 6

<sup>2</sup>Drainage areas not applicable because of interbasin transfer via roads and storm sewers

\*Data not available

**Table 12 - Summary of Discharges for Shallow Flooding Areas (Continued)**

<u><b>Flooding Source and Location</b></u>	<u><b>Drainage Area (square miles)</b></u>	<u><b>Peak Discharges (cfs)</b></u>			
		<u><b>10-Percent- Annual-Chance</b></u>	<u><b>2-Percent- Annual-Chance</b></u>	<u><b>1-Percent- Annual-Chance</b></u>	<u><b>0.2-Percent- Annual-Chance</b></u>
La Rinconada Arroyo At outfall to gravel pit	1.98	*	*	814	*
Los Indos Arroyo "A" <sup>1</sup>					
Downstream from Raymac Dam	2.48	*	*	25	*
Upstream of Raymac Dam	2.48	*	*	1,194	*
At Gun Club Lateral	1.29	*	*	173	*
McKnight Storm Drain					
At Eubank Avenue	0.18	*	*	254 <sup>†</sup>	*
At Embudo Arroyo	0.21	*	*	354 <sup>†</sup>	*
Middle Branch of the Piedras Marcadas Arroyo					
Piedras Marcadas Dam outflow	5.62	*	*	80	*
Piedras Marcadas Dam inflow	5.62	*	*	2,375	*
Approximately 1,300 feet upstream of Piedras Marcadas Dam	4.86	*	*	1,786	*
North Arroyo de Domingo Baca					
At Wyoming Boulevard	3.79	*	*	658	*
Approximately 950 feet upstream of Barstow Street	3.42	*	*	538	*
At Holbrook Street	2.79	*	*	220	*
At inflow to Upper Dam	2.68	*	*	2,794	*
At Tramway Boulevard	0.89	*	*	1,080	*

\*Data not available

<sup>†</sup> Discharge value for both Storm Drain and Street Flooding

**Table 12 - Summary of Discharges for Shallow Flooding Areas (Continued))**

<b><u>Flooding Source and Location</u></b>	<b><u>Drainage Area (square miles)</u></b>	<b><u>Peak Discharges (cfs)</u></b>			
		<b><u>10-Percent- Annual-Chance</u></b>	<b><u>2-Percent- Annual-Chance</u></b>	<b><u>1-Percent- Annual-Chance</u></b>	<b><u>0.2-Percent- Annual-Chance</u></b>
North Pino Arroyo <sup>1</sup>					
At North Diversion Channel	2.07	*	*	1,175	*
At Interstate Highway 25	1.84	*	*	1,117	*
At Ventura Street	0.88	*	*	642	*
At Tramway Boulevard (diverted to Arroyo del Pino)	0.25	*	*	400	*
North Camino Arroyo <sup>1</sup>					
At outfall to Gravel Pit	2	*	*	1,590	*
At Interstate Highway 25	2	*	*	1,760	*
At Ventura Street	2	*	*	640	*
North La Cueva Arroyo					
At North Diversion Channel	8.52	*	*	4,869	*
At Interstate Highway 25	4.36	*	*	2,746	*
At Ventura Street <sup>1</sup>	3.54	*	*	3,494	*
At Tramway Boulevard <sup>1</sup>	2.81	*	*	3,759	*
North Glenwood Hills Channel <sup>3</sup>					
At confluence with Embudito Channel	2	*	*	1,450	*
At Tramway Boulevard	0.78	*	*	1,337	*
North Hahn Channel <sup>3</sup>					
At confluence with Hahn Arroyo	2	*	*	596	*
At Louisiana Boulevard	0.97	*	*	348	*

<sup>1</sup>Reference 8

<sup>2</sup>Drainage areas not applicable because of interbasin transfer via roads and storm sewers

<sup>3</sup>Reference 6

\*Data not available

**Table 12 - Summary of Discharges for Shallow Flooding Areas (Continued)**

<b><u>Flooding Source and Location</u></b>	<b><u>Drainage Area</u> (square miles)</b>	<b><u>10-Percent- Annual-Chance</u></b>	<b>Peak Discharges (cfs)</b>		
			<b><u>2-Percent- Annual-Chance</u></b>	<b><u>1-Percent- Annual-Chance</u></b>	<b><u>0.2-Percent- Annual-Chance</u></b>
Pajarito Arroyo - North					
Downstream from Don Felipe Dam	3.26	*	*	25	*
Upstream of Don Felipe Dam	3.26	*	*	1,706	*
Piedra Lisa Channel <sup>1</sup>					
At confluence with Embudo Channel	2	*	*	2,774	*
At Juan Tabo Boulevard	2	*	*	2,145	*
At the confluence of South Glenwood Hills Channel	2	*	*	1,065	*
At Tramway Boulevard	2	*	*	1,011	*
Sacate Blanco Arroyo <sup>1</sup>					
At confluence with Hubbell Lake Diversion Channel	0.43	*	*	238 <sup>3</sup>	*
South Domingo Baca Arroyo					
At Holbrook Street	5.52	*	*	811	*
At Browning Street	4.77	*	*	200	*
Inflow into dam	4.69	*	*	3,534	*
At Tramway Boulevard	3.29	*	*	2,352	*
South El Camino Arroyo					
At Interstate Highway 25	3.17	*	*	2,053	*
At Ventura Street <sup>4</sup>	2.59	*	*	3,301	*
At Tramway Boulevard <sup>4</sup>	1.85	*	*	2,853	*

<sup>1</sup>Reference 6

<sup>2</sup>Drainage areas not applicable because of interbasin transfer via roads and storm sewers

<sup>3</sup>By regression analysis

<sup>4</sup>Reference 8

\*Data not available

**Table 12 - Summary of Discharges for Shallow Flooding Areas (Continued)**

<b><u>Flooding Source and Location</u></b>	<b><u>Drainage Area (square miles)</u></b>	<b><u>Peak Discharges (cfs)</u></b>			
		<b><u>10-Percent- Annual-Chance</u></b>	<b><u>2-Percent- Annual-Chance</u></b>	<b><u>1-Percent- Annual-Chance</u></b>	<b><u>0.2-Percent- Annual-Chance</u></b>
South Glenwood Hills Channel <sup>1</sup>					
At confluence with Piedra Lisa	<sup>2</sup>	*	*	844	*
At Tramway Boulevard	0.426	*	*	727	*
Tijeras Arroyo Tributary A					
At confluence with Tijeras Arroyo	0.23	*	*	379	*
Tijeras Arroyo Tributary B					
At confluence with Tijeras Arroyo	0.27	*	*	411	*
Tijeras Arroyo Tributary C					
At confluence with Tijeras Arroyo	0.63	*	*	970	*
Tijeras Arroyo Tributary D					
At confluence with Tijeras Arroyo	2.22	*	*	1,999	*
Tijeras Arroyo Tributary E					
At confluence with Tijeras Arroyo	0.92	*	*	955	*
Tijeras Arroyo Tributary F					
At confluence with Tijeras Arroyo	0.68	*	*	989	*

<sup>1</sup>Reference 6

<sup>2</sup>Drainage areas not applicable because of interbasin transfer via roads and storm sewers

\*Data not available

**Table 13 – Summary of Stillwater Elevations**

<u>Area</u>	<u>Pond Invert Elevation (feet NAVD<sup>1</sup>)</u>	<u>Water Surface Elevations (feet NAVD<sup>1</sup>)</u>			
		<u>10-Percent- Annual-Chance</u>	<u>2-Percent- Annual-Chance</u>	<u>1-Percent- Annual-Chance</u>	<u>0.2-Percent- Annual- Chance</u>
Amole Detention Area	*	*	*	5,000.0	*
Arroyo del Oso	*	*	*	5,345.0	*
Arroyo del Pino	*	*	*	6,019.0	*
Basketball Pond	*	*	*	5,421.0	*
Black Arroyo Detention Facility	*	*	*	5,165.0	*
Detention Basin 1	*	*	*	5,430.0	*
Detention Basin 2	*	*	*	5,415.0	*
Detention Basin 3	*	*	*	5,386.0	*
Detention Basin 4	*	*	*	5,359.0	*
Detention Basin 5	*	*	*	5,336.7	*
Detention Basin 5S	*	*	*	5,446.6	*
Detention Basin 6	*	*	*	5,326.0	*
Detention Basin 7	*	*	*	5,305.0	*
Detention Basin 8	*	*	*	5,293.0	*
Detention Basin 9	*	*	*	5,274.0	*
Detention Basin 10	*	*	*	5,252.0	*
Detention Basin 11	*	*	*	5,258.2	*
Detention Basin 12	*	*	*	5,243.1	*
Detention Basin 13	*	*	*	5,243.1	*
Detention Basin 14	*	*	*	5,236.5	*
Detention Basin 15	*	*	*	5,236.5	*
Detention Basin 16	*	*	*	5,231.9	*

<sup>1</sup> North American Vertical Datum of 1988

\* Data not available



Table 13 - Summary of Stillwater Elevations (Continued)

<u>Area</u>	<u>Pond Invert Elevation (feet NAVD<sup>1</sup>)</u>	<u>Water Surface Elevations (feet NAVD<sup>1</sup>)</u>			
		<u>10-Percent- Annual-Chance</u>	<u>2-Percent- Annual-Chance</u>	<u>1-Percent- Annual-Chance</u>	<u>0.2-Percent- Annual- Chance</u>
Detention Basin 17	*	*	*	5,140.0	*
Don Felipe Dam	*	*	*	4,969.0	*
East Amole Surge Pond	*	*	*	5525.0	*
Gonzales Pond	4990.3	*	*	5007.8	*
Interim Pond 1	*	*	*	5489.0	*
Interim Pond 2	*	*	*	5415.0	*
Interim Pond 3	*	*	*	5374.0	*
Interim Pond 4	*	*	*	5333.0	*
Hubbell Lake Detention Area	*	*	*	4,928.0	*
Juan Tabo Dam	*	*	*	5,771.0	*
Kirtland Detention Pond	*	*	*	5,359.0	*
Lower North Baca Dam	*	*	*	5,320.0	*
Mariposa Detention Facility	*	*	*	5,118.0	*
North Domingo Baca Dam	5,721.4	5,740.3	5,748	5,750.8	5,753.3
North Pond	5,204.2	*	*	5,217.8	*
Odelia Park Dam	*	*	*	5,025.0	*
Pajarito Sedimentation Basin	*	*	*	5,001.0	*
Piedras Marcadas	*	*	*	5,032.0	*

<sup>1</sup> North American Vertical Datum of 1988

\* Data not available

**Table 13 - Summary of Stillwater Elevations (Continued)**

<u>Area</u>	<u>Pond Invert Elevation (feet NAVD<sup>1</sup>)</u>	<u>Water Surface Elevations (feet NAVD<sup>1</sup>)</u>			
		<u>10-Percent- Annual-Chance</u>	<u>2-Percent- Annual-Chance</u>	<u>1-Percent- Annual-Chance</u>	<u>0.2-Percent- Annual- Chance</u>
Pond 1	5,389.0	5,394.2	5,396.5	5,397.4	5,398.1
Pond 2					
Area bounded by 98 <sup>th</sup> Street to the east, 102 <sup>nd</sup> Street to the west, Avalon Road to the south, and Bluewater Road to the north	5,252.6	*	*	5,260.4	*
Pond 3	5,526.8	5,529.1	5,531.7	5,532.8	5,533.2
Pond 4	5,570.8	5,574.9	5,575.6	5,575.9	5,576.4
Pond 5					
Area bounded by 98 <sup>th</sup> Street to the east, 102 <sup>nd</sup> Street to the west, Avalon Road to the south, and Bluewater Road to the north	5,253.6	*	*	5,264.3	*
Pond D	*	*	*	5,202.0	*
Ponding Area 6	*	*	*	5,234.0	*
Ponding Area 7	*	*	*	5,197.0	*
Ponding Area 9	*	*	*	5,972.0	*
Ponding Area 10	*	*	*	5,990.0	*
Ponding Area 12	*	*	*	5,928.0	*
Ponding Area 13	*	*	*	5,523.0	*
Ponding Area 18	5,009.8	*	*	5,013.3	*
Ponding Area 20	*	*	*	5,414.0	*
Ponding Area 23	*	*	*	5,474.0	*
Ponding Area 25	*	*	*	5,031.0	*
Ponding Area 27	*	*	*	5,033.0	*
Ponding Area 28	*	*	*	5,030.0	*
Pond No. 6	*	*	*	5,130.0	*
Pond No. 16A	*	*	*	5,108.0	*
Pond No. 16B	*	*	*	5,105.0	*

<sup>1</sup> North American Vertical Datum of 1988

\* Data not available

Table 13 - Summary of Stillwater Elevations (Continued)

<u>Area</u>	<u>Pond Invert Elevation (feet NAVD<sup>1</sup>)</u>	<u>Water Surface Elevations (feet NAVD<sup>1</sup>)</u>			
		<u>10-Percent- Annual-Chance</u>	<u>2-Percent- Annual-Chance</u>	<u>1-Percent- Annual-Chance</u>	<u>0.2-Percent- Annual- Chance</u>
Raymac Dam	*	*	*	4,964.0	*
Retention Pond	*	*	*	5,233.0	*
South Domingo Baca Dam	5,878.8	5,900.8	5,911.3	5,915.4	5,921.4
South Pond	5,201.0	*	*	5,211.2	*
Unnamed Pond					
Area bounded by Sunset Gardens Road to the north, 106 <sup>th</sup> Street to the east and Eucariz Avenue to the south	*	*	*	5,248.7	*
Unnamed Pond					
Area bounded by Duke Avenue to the north and Eucariz Avenue to the south	*	*	*	5,230.9	*
Unnamed Ponding Area					
Generally located along El Camino Arroyo at Beverly Hills Avenue	*	*	*	5,324.0	*
Unnamed Ponding Area					
Generally located south of Acoma Road, north of Southern Avenue SE, and west of Britt Street	*	*	*	5,483.7	*

<sup>1</sup> North American Vertical Datum of 1988

\* Data not available



NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

**Coastal Base Flood Elevations** shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction, and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures in this jurisdiction.

The **projection** used in the preparation of this map was New Mexico State Plane, Central Zone (FIPS 3002). The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address:

NGS Information Services  
NOAA, NWS12  
National Geodetic Survey, SSMC-3, #9202  
1315 East-West Highway  
Silver Spring, Maryland 20910-3282  
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit their website at <http://www.ngs.noaa.gov/>.

**Base map** information shown on this FIRM was provided in digital format by City of Albuquerque, 2010, Bernalillo County, 2004, and 2010, Bureau of Land Management, 2003, National Geodetic Survey, 2003, and United States Geological Survey (USGS), 1999. Additional information was photogrammetrically compiled at a scale of 1:12,000 from U.S. Department of Agriculture aerial photography dated 2009.

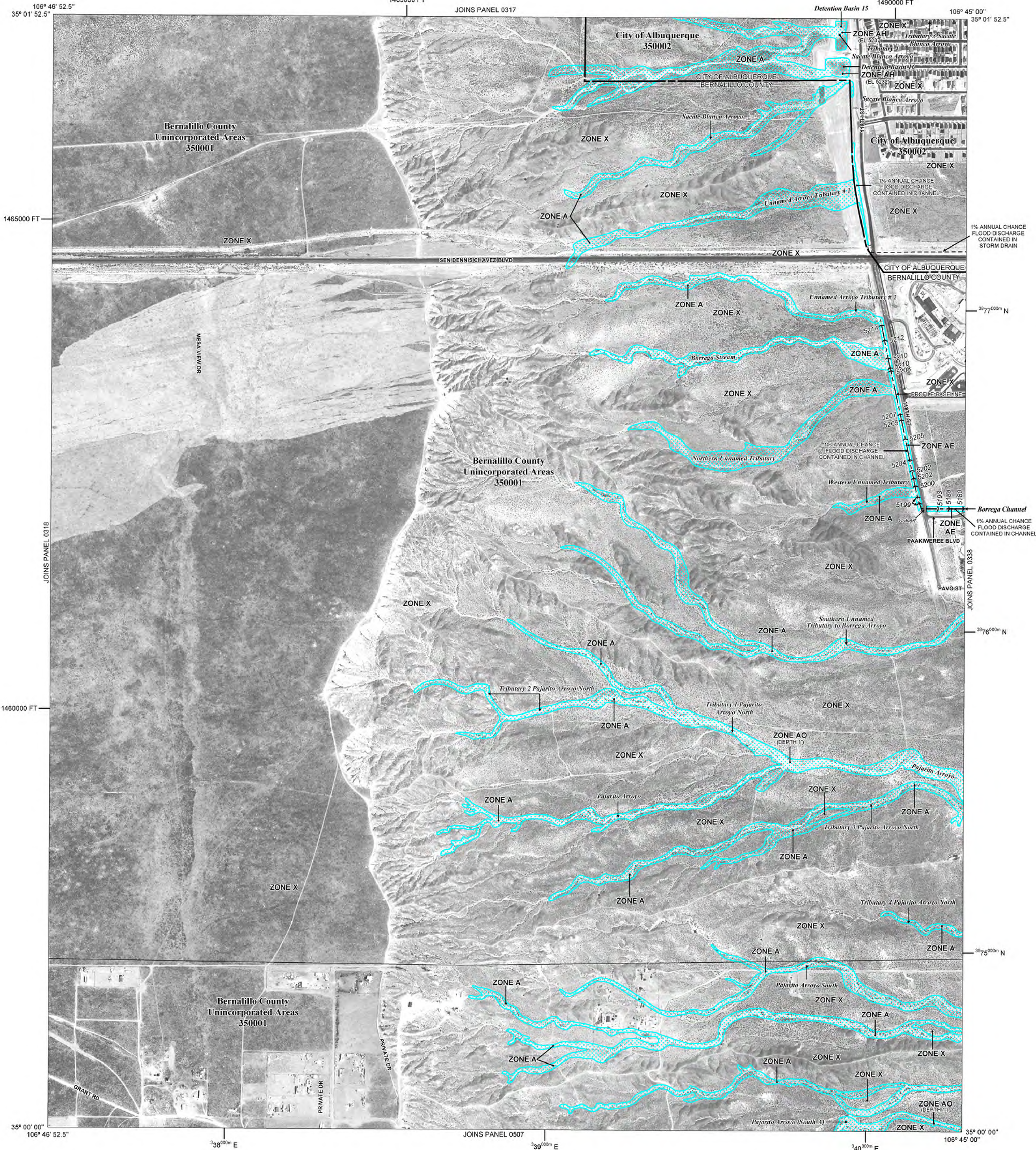
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at <http://msc.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/business/nfip>.



LEGEND

**SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD**

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- ZONE A** No Base Flood Elevations determined.
- ZONE AE** Base Flood Elevations determined.
- ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE AR** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

**FLOODWAY AREAS IN ZONE AE**

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

**OTHER FLOOD AREAS**

**ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

**OTHER AREAS**

**ZONE X** Areas determined to be outside the 0.2% annual chance floodplain. Areas in which flood hazards are undetermined, but possible.

**COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**

**OTHERWISE PROTECTED AREAS (OPAs)**

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- Base Flood Elevation line and value; elevation in feet
- Base Flood Elevation value where uniform within zone; elevation in feet

\*Referenced to the North American Vertical Datum of 1988

Transect line

Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere

1000-meter Universal Transverse Mercator grid values, zone 13

5000-foot grid ticks: New Mexico State Plane coordinate system, Central zone (FIPS3002), Transverse Mercator

Bench mark (see explanation in Notes to Users section of this FIRM panel)

River Mile

**MAP REPOSITORIES**

Refer to Map Repositories list on Map Index.

**EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP PANEL**

SEPTEMBER 20, 1996

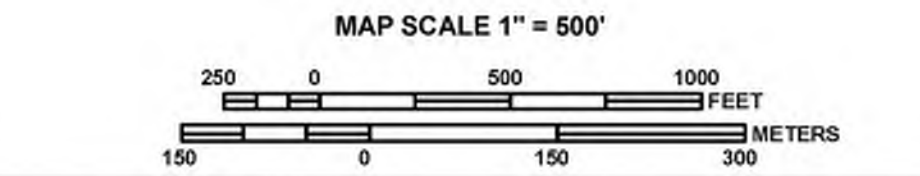
**EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL**

April 2, 2002  
November 19, 2003  
September 25, 2008

August 16, 2012 - to update corporate limits, to change Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to add roads and road names, to incorporate previously issued Letters of Map Change.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.



**PANEL 0319H**

**FIRM**  
**FLOOD INSURANCE RATE MAP**  
**BERNALILLO COUNTY,**  
**NEW MEXICO**  
**AND INCORPORATED AREAS**

**PANEL 319 OF 825**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

**CONTAINS:**

COMMUNITY	NUMBER	PANEL	SUFFIX
ALBUQUERQUE, CITY OF	350002	0319	H
BERNALILLO COUNTY UNINCORPORATED AREAS	350001	0319	H

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

**MAP NUMBER**  
**35001C0319H**

**MAP REVISED**  
**AUGUST 16, 2012**

Federal Emergency Management Agency



NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

**Coastal Base Flood Elevations** shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction, and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures in this jurisdiction.

The **projection** used in the preparation of this map was New Mexico State Plane, Central Zone (FIPS 3002). The **horizontal datum** was NAD83, GR80 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address:

NGS Information Services  
NOAA, NIMS12  
National Geodetic Survey, SSMC-3, #9202  
1315 East-West Highway  
Silver Spring, Maryland 20910-3282  
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit their website at <http://www.ngs.noaa.gov/>.

**Base map** information shown on this FIRM was provided in digital format by City of Albuquerque, 2010, Bernalillo County, 2004, and 2010, Bureau of Land Management, 2003, National Geodetic Survey, 2003, and United States Geological Survey (USGS), 1999. Additional information was photogrammetrically compiled at a scale of 1:12,000 from U.S. Department of Agriculture aerial photography dated 2009.

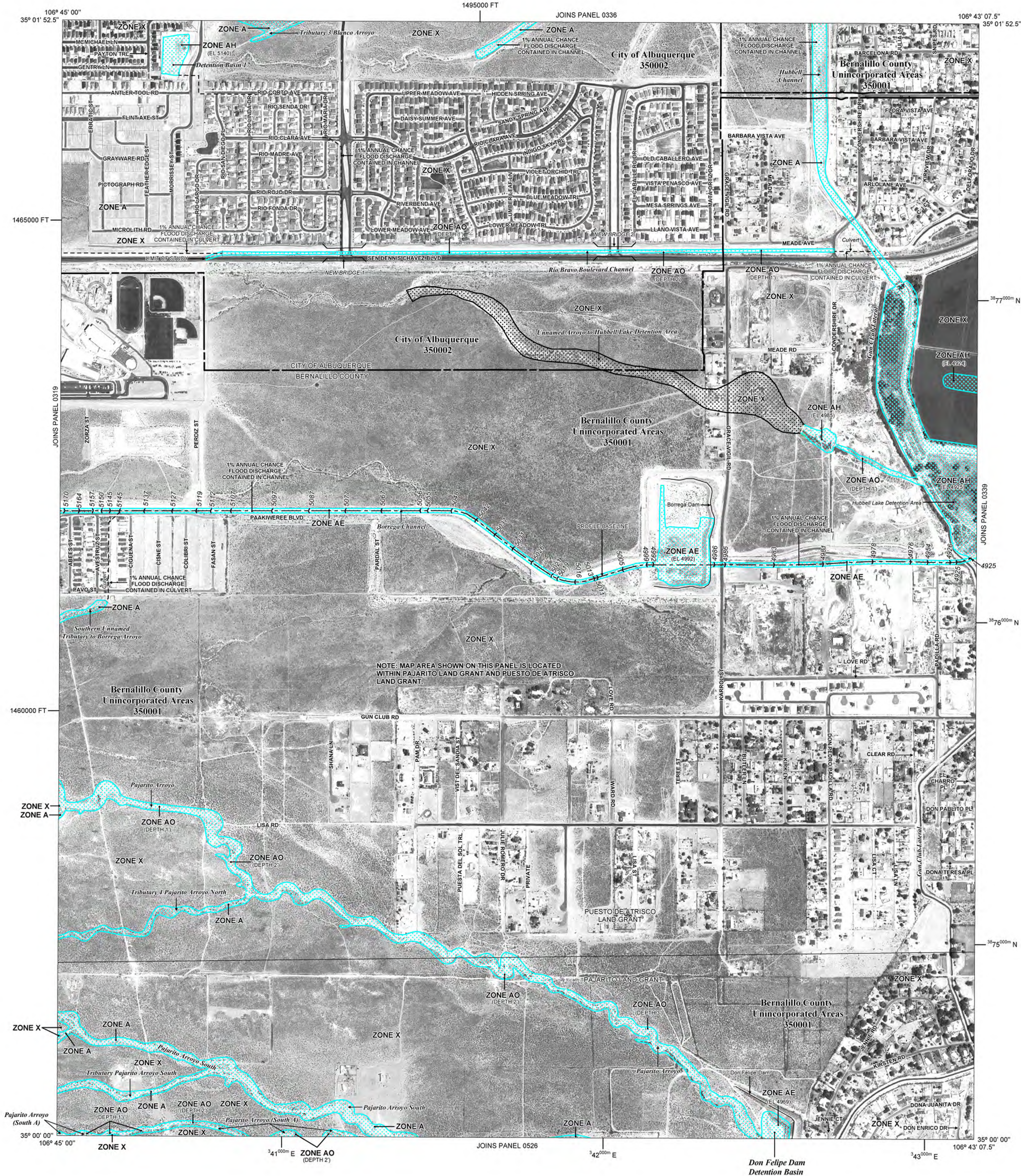
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel details that differ from what is shown on this map.

**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels, community map repository addresses, and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at <http://msc.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/business/nfp>.



LEGEND

**SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD**

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- ZONE A** No Base Flood Elevations determined. Base Flood Elevations determined.
- ZONE AE** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- ZONE AH** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE AO** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE AR** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE A99** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.
- ZONE VE**

**FLOODWAY AREAS IN ZONE AE**

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

**OTHER FLOOD AREAS**

**ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 3 feet or with drainage areas less than 1 square mile and areas protected by levees from 1% annual chance flood.

**OTHER AREAS**

**ZONE X** Areas determined to be outside the 0.2% annual chance floodplain. Areas in which flood hazards are undetermined, but possible.

**COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**

**OTHERWISE PROTECTED AREAS (OPAs)**

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities
- Base Flood Elevation line and value; elevation in feet
- Base Flood Elevation value where uniform within zone; elevation in feet

\*Referenced to the North American Vertical Datum of 1988

Cross section line

Transect line

Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere

1000-meter Universal Transverse Mercator grid values, zone 13

5000-foot grid ticks: New Mexico State Plane coordinate system, Central zone (FIPSZONE 3002), Transverse Mercator

Bench mark (see explanation in Notes to Users section of this FIRM panel)

River Mile

MAP REPOSITORIES

Refer to Map Repositories list on Map Index.

EFFECTIVE DATE OF COUNTY-WIDE FLOOD INSURANCE RATE MAP PANEL

SEPTEMBER 20, 1996

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

April 2, 2002

November 15, 2003

September 25, 2008

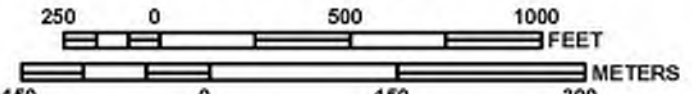
August 16, 2012 - to update corporate limits, to change Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to add roads and road names, to incorporate previously issued Letters of Map Change.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.



MAP SCALE 1" = 500'



NATIONAL FLOOD INSURANCE PROGRAM

FIRM

PANEL 0338H

FLOOD INSURANCE RATE MAP

BERNALILLO COUNTY, NEW MEXICO AND INCORPORATED AREAS

PANEL 338 OF 825

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ALBUQUERQUE, CITY OF	350002	0338	H
BERNALILLO COUNTY UNINCORPORATED AREAS	350001	0338	H

Notice to User: The Map Number shown below should be used when placing map orders. The Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER

35001C0338H

MAP REVISED

AUGUST 16, 2012

Federal Emergency Management Agency



NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

**Coastal Base Flood Elevations** shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures in this jurisdiction.

The **projection** used in the preparation of this map was New Mexico State Plane, Central Zone. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address:

NGS Information Services  
NOAA, N/NGS12  
National Geodetic Survey, SSMC-3, #9202  
1315 East-West Highway  
Silver Spring, Maryland 20910-3282  
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit their website at <http://www.ngs.noaa.gov>.

**Base map** information shown on this FIRM was provided in digital format by Bernalillo County produced at a scale of 1:12,000 from photography dated 1999 or later.

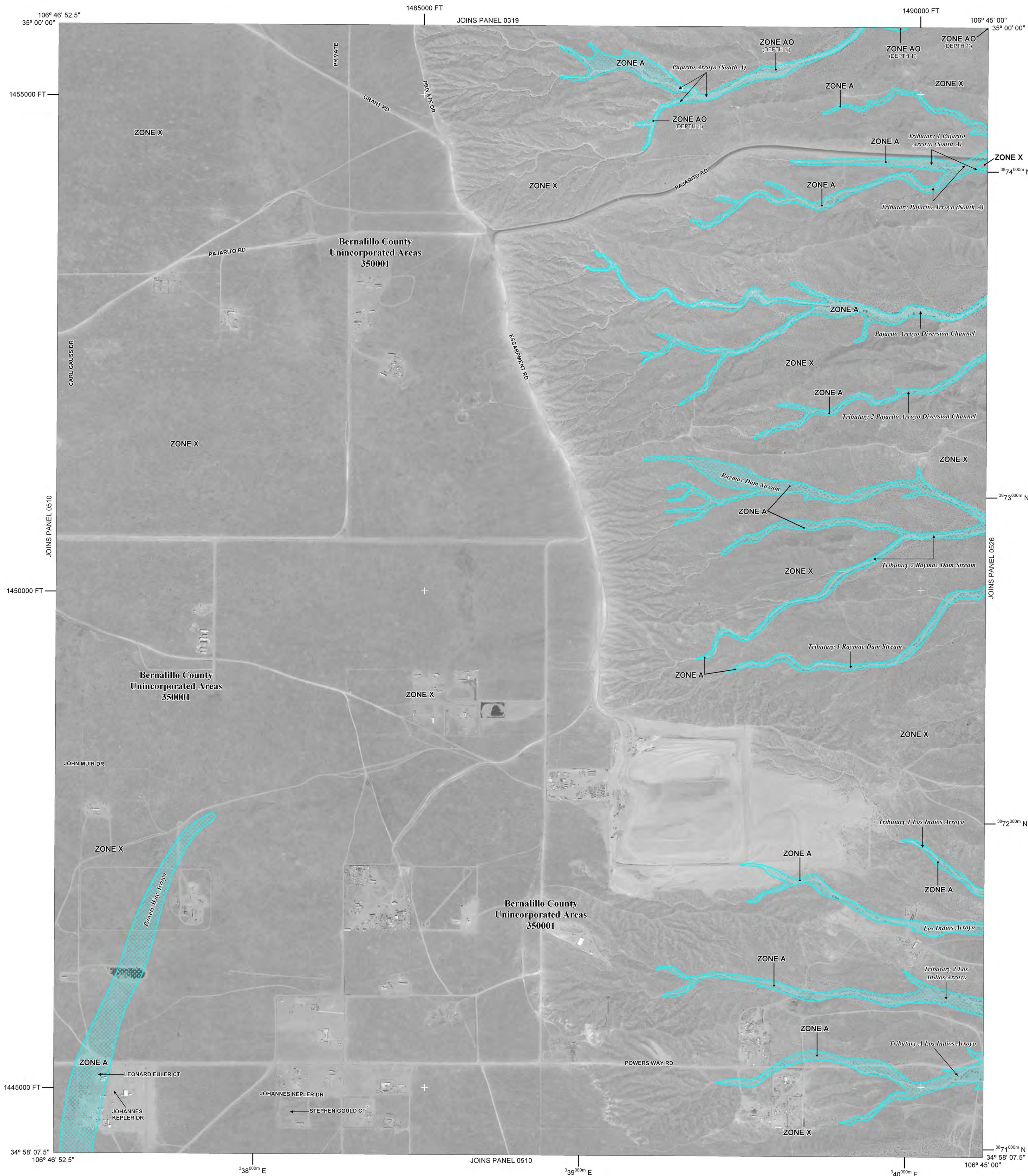
Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations** and **floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for the Flood Insurance Study report may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and their website at <http://www.msc.fema.gov>.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/business/nfip>.



LEGEND

**SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD**

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equalled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- ZONE A** No Base Flood Elevations determined.
- ZONE AE** Base Flood Elevations determined.
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- ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE AR** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

**FLOODWAY AREAS IN ZONE AE**

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

**OTHER FLOOD AREAS**

**ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

**OTHER AREAS**

**ZONE X** Areas determined to be outside the 0.2% annual chance floodplain. Areas in which flood hazards are undetermined, but possible.

**COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**

**OTHERWISE PROTECTED AREAS (OPAs)**

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary**
- 0.2% annual chance floodplain boundary**
- Floodway boundary**
- Zone D Boundary**
- CBRS and OPA Boundary**
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.**
- Base Flood Elevation line and value; elevation in feet\* (EL 987)**
- Base Flood Elevation value where uniform within zone; elevation in feet\***

\*Referenced to the North American Vertical Datum of 1988

**Cross section line**

**Transect line**

Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere  
1000-meter Universal Transverse Mercator grid values, zone 13  
5000-foot grid ticks: New Mexico State Plane coordinate system, Central zone (FIPSZONE 3002), Transverse Mercator  
Bench mark (see explanation in Notes to Users section of this FIRM panel)  
River Mile

**MAP REPOSITORIES**  
Refer to Map Repositories list on Map Index.

**EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP PANEL**  
SEPTEMBER 20, 1996

**EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL**  
April 2, 2002 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to add roads and road names, to reflect updated topographic information, and to incorporate previously issued Letters of Map Revision.

November 19, 2003 - to update corporate limits and to incorporate previously issued Letters of Map Revision.

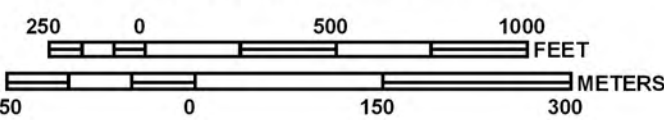
September 26, 2008 - to update corporate limits, to change Special Flood Hazard Areas, to add roads and road names, to incorporate previously issued Letters of Map Revision, to reflect updated topographic information, to change Base Flood Elevations, to add Base Flood Elevations.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.



MAP SCALE 1" = 500'



NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0507G

**FIRM**

**FLOOD INSURANCE RATE MAP**  
**BERNALILLO COUNTY,**  
**NEW MEXICO**  
**AND INCORPORATED AREAS**

**PANEL 507 OF 825**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

**CONTAINS:**

COMMUNITY	NUMBER	PANEL	SUFFIX
BERNALILLO COUNTY UNINCORPORATED AREAS	350001	0507	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.



**MAP NUMBER**  
**35001C0507G**

**MAP REVISED**  
**SEPTEMBER 26, 2008**

Federal Emergency Management Agency



This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

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Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures in this jurisdiction.

The **projection** used in the preparation of this map was New Mexico State Plane, Central Zone (FIPS 3002). The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

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NGS Information Services  
NOAA, N/NGS12  
National Geodetic Survey, SSMC-3, #9202  
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(301) 713-3242

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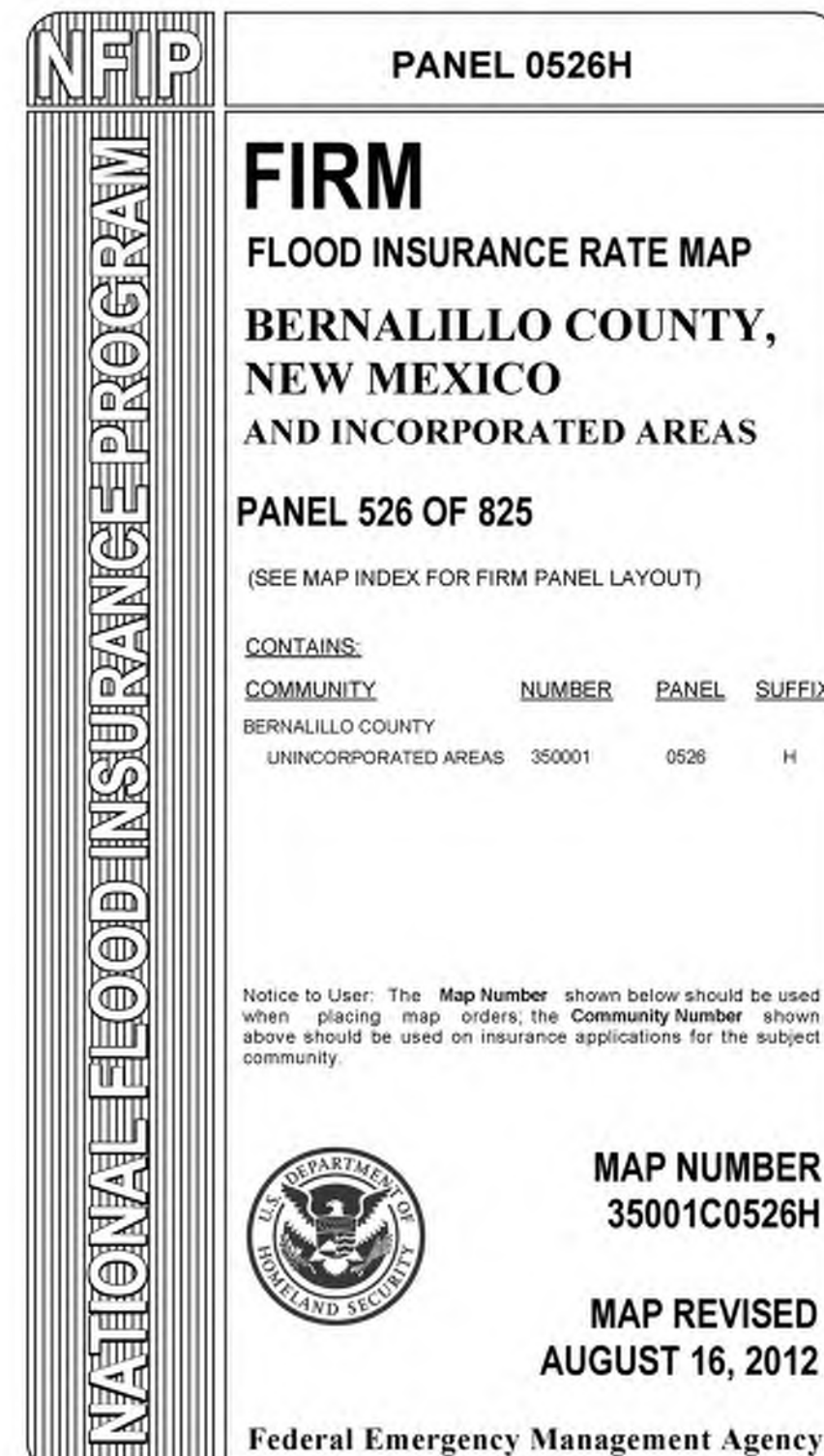
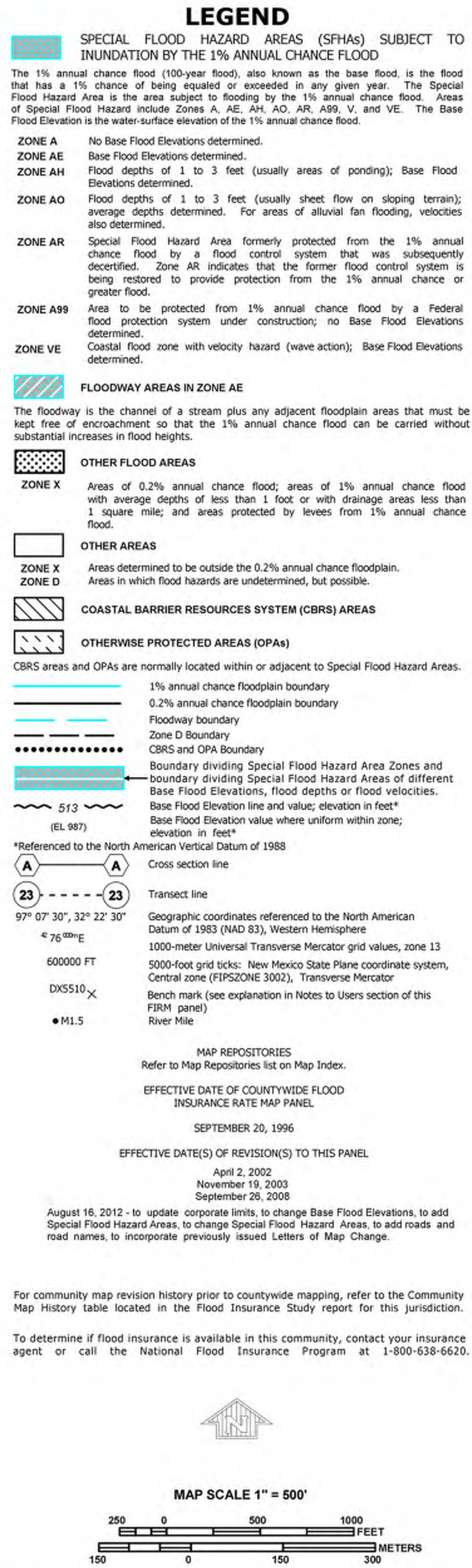
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

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NOTES TO USERS

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**Coastal Base Flood Elevations** shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction, and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

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The **projection** used in the preparation of this map was New Mexico State Plane, Central Zone (FIPS 3002). The **horizontal datum** was NAD83, GR80 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

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NGS Information Services  
NOAA, NWS12  
National Geodetic Survey, SSMC-3, #9202  
1315 East-West Highway  
Silver Spring, Maryland 20910-3282  
(301) 713-3242

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This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel details that differ from what is shown on this map.

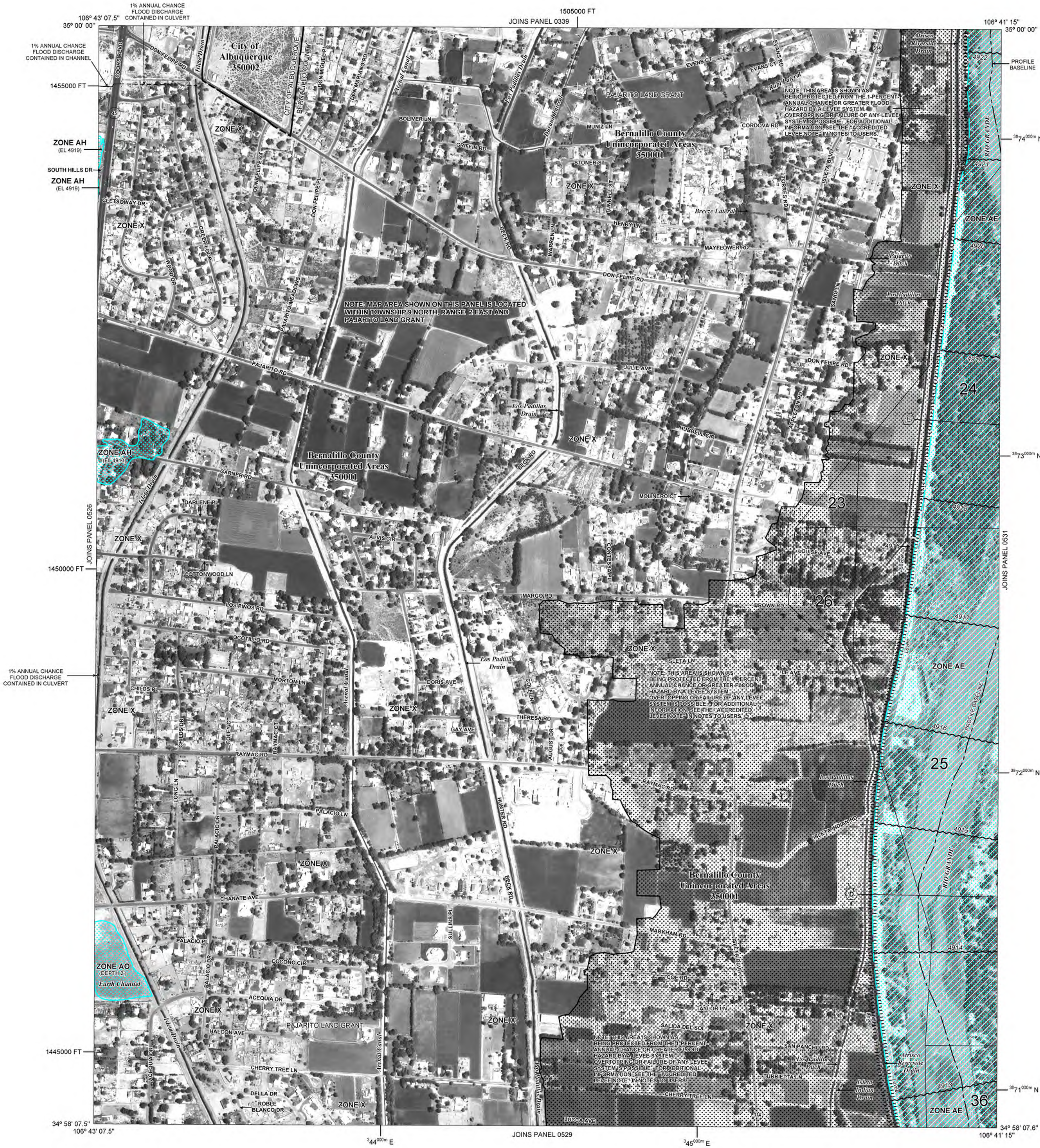
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**Accredited Levee Notes to Users:** Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at <http://www.fema.gov/business/nfip/index.shtm>.



LEGEND

**SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD**

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- ZONE A** No Base Flood Elevations determined.
- ZONE AE** Base Flood Elevations determined.
- ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE AR** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently identified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

**FLOODWAY AREAS IN ZONE AE**

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

**OTHER FLOOD AREAS**

**ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

**OTHER AREAS**

**ZONE X** Areas determined to be outside the 0.2% annual chance floodplain. Areas in which flood hazards are undetermined, but possible.

**COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**

**OTHERWISE PROTECTED AREAS (OPAs)**

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- Base Flood Elevation line and value; elevation in feet\*
- Base Flood Elevation value where uniform within zone; elevation in feet\*

\*Referenced to the North American Vertical Datum of 1988

- Transect line
- Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- 1000-meter Universal Transverse Mercator grid values, zone 13
- 5000-foot grid ticks: New Mexico State Plane coordinate system, Central zone (FIPSZONE 3002), Transverse Mercator
- Bench mark (see explanation in Notes to Users section of this FIRM panel)
- River Mile

**MAP REPOSITORIES**  
Refer to Map Repositories list on Map Index.

**EFFECTIVE DATE OF COUNTY-WIDE FLOOD INSURANCE RATE MAP PANEL**

SEPTEMBER 20, 1996

**EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL**

April 2, 2002

November 19, 2003

September 25, 2008

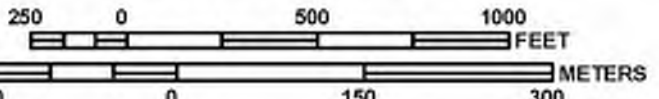
August 16, 2012 - to update corporate limits, to change Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to add roads and road names, to incorporate previously issued Letters of Map Change.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.



MAP SCALE 1" = 500'



**NATIONAL FLOOD INSURANCE PROGRAM**

**PANEL 0527H**

**FIRM**

**FLOOD INSURANCE RATE MAP**

**BERNALILLO COUNTY, NEW MEXICO**

**AND INCORPORATED AREAS**

**PANEL 527 OF 825**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

**CONTAINS:**

COMMUNITY	NUMBER	PANEL	SUFFIX
ALBUQUERQUE, CITY OF	350002	0527	H
BERNALILLO COUNTY UNINCORPORATED AREAS	350001	0527	H

Notice to User: The **Map Number** shown below should be used when placing map orders. The **Community Number** shown above should be used on insurance applications for the subject community.

**MAP NUMBER**  
35001C0527H

**MAP REVISED**  
AUGUST 16, 2012

**Federal Emergency Management Agency**



NOTES TO USERS

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Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

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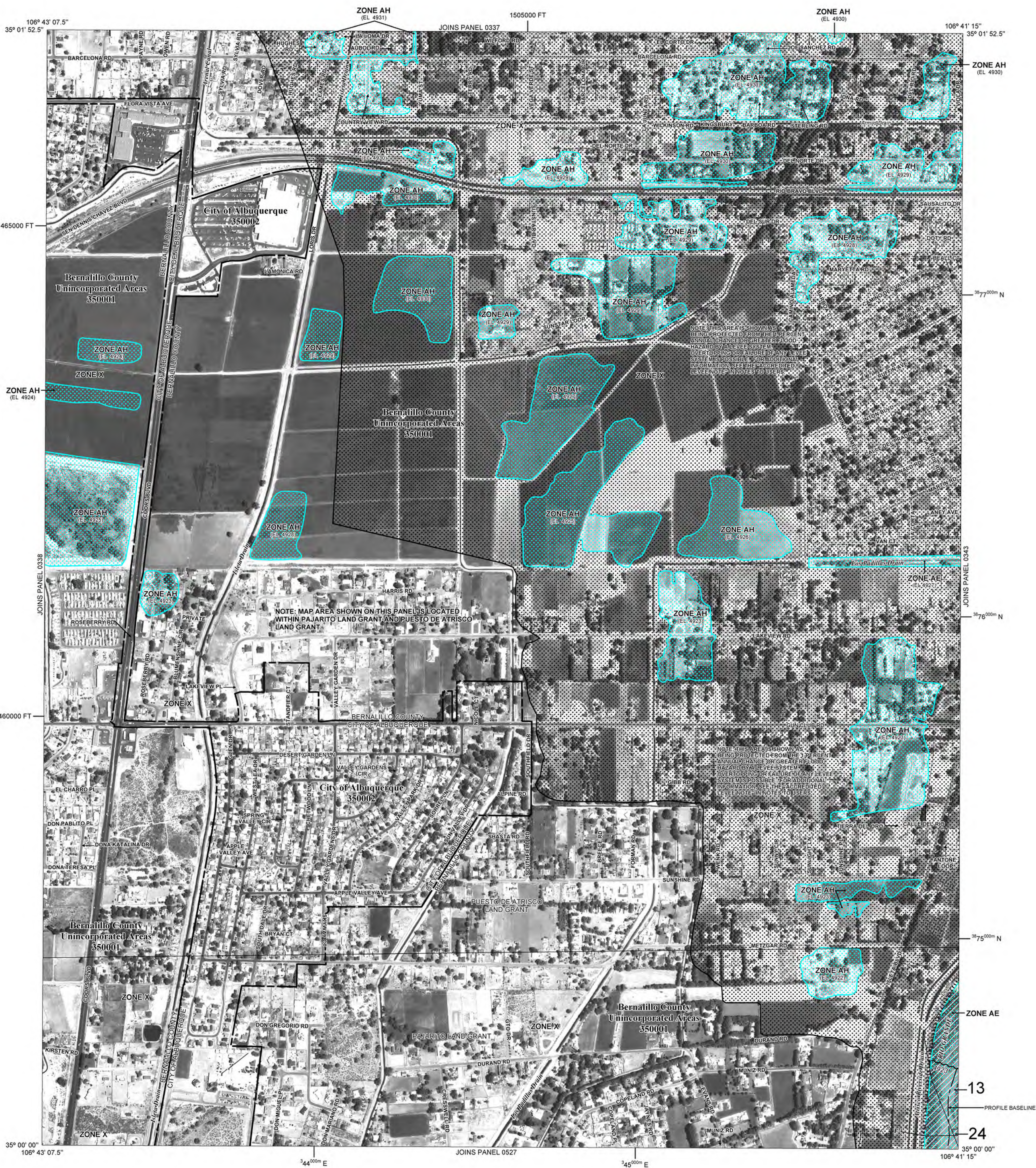
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**LEGEND**

**SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD**

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

**ZONE A** No Base Flood Elevations determined.

**ZONE AE** Base Flood Elevations determined.

**ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

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**ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

**ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

**FLOODWAY AREAS IN ZONE AE**

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

**OTHER FLOOD AREAS**

**ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile and areas protected by levees from 1% annual chance flood.

**OTHER AREAS**

**ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.

**ZONE D** Areas in which flood hazards are undetermined, but possible.

**COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**

**OTHERWISE PROTECTED AREAS (OPAs)**

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D Boundary

CBRS and OPA Boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

Base Flood Elevation line and value; elevation in feet\*

Base Flood Elevation value where uniform within zone; elevation in feet\*

\*Referenced to the North American Vertical Datum of 1988

Cross section line

23 - - - - 23

97° 07' 30", 32° 22' 30"

76°E

600000 FT

DX5510, X

M1.5

River Mile

**HAP REPOSITORIES**

Refer to Map Repositories list on Map Index.

**EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP PANEL**

SEPTEMBER 20, 1996

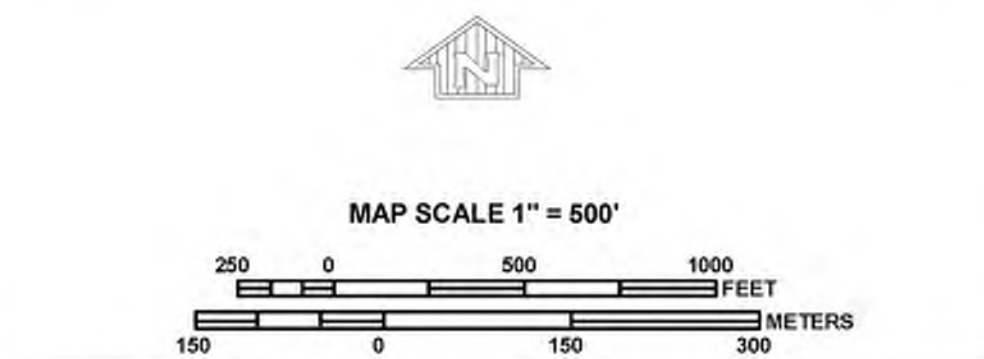
**EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL**

April 2, 2002  
November 19, 2003  
September 28, 2008

August 16, 2012 - to update corporate limits, to change Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to add roads and road names, to incorporate previously issued Letters of Map Change.

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**NATIONAL FLOOD INSURANCE PROGRAM**

**PANEL 0339H**

**FIRM**

**FLOOD INSURANCE RATE MAP**

**BERNALILLO COUNTY, NEW MEXICO AND INCORPORATED AREAS**

**PANEL 339 OF 825**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

**CONTAINS:**

COMMUNITY	NUMBER	PANEL	SUFFIX
ALBUQUERQUE, CITY OF	350002	0339	H
BERNALILLO COUNTY UNINCORPORATED AREAS	350001	0339	H

Notice to User: The Map Number shown below should be used when placing map orders. The Community Number shown above should be used on insurance applications for the subject community.

**MAP NUMBER**  
35001C0339H

**MAP REVISED**  
AUGUST 16, 2012

**Federal Emergency Management Agency**



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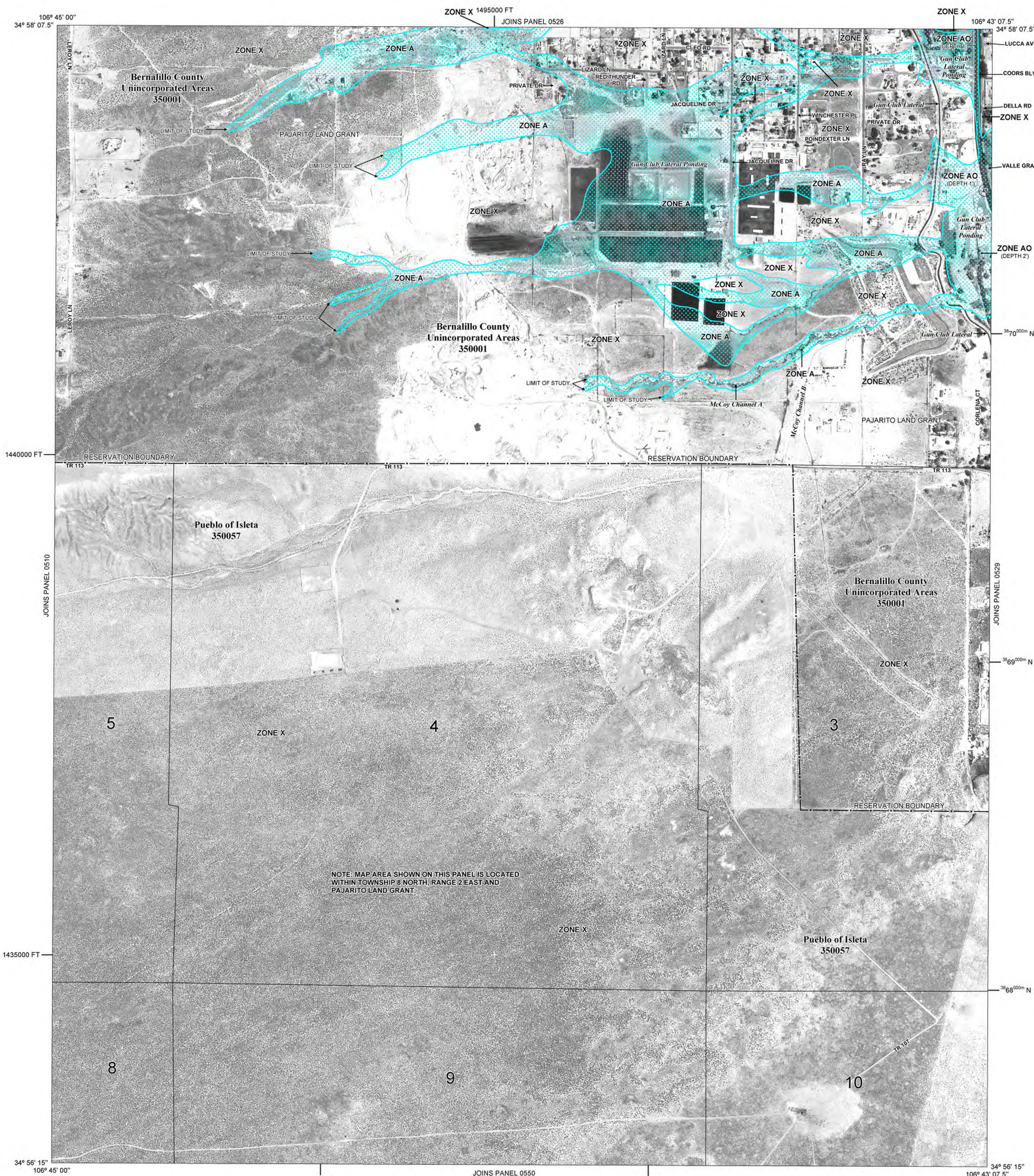
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LEGEND

- SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD**
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- The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.
- OTHER FLOOD AREAS**
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**Base Flood Elevation line and value; elevation in feet\***  
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- \*Referenced to the North American Vertical Datum of 1988
- Cross section line**
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- Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere  
1000-meter Universal Transverse Mercator grid values, zone 13  
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Bench mark (see explanation in Notes to Users section of this FIRM panel)  
River Mile

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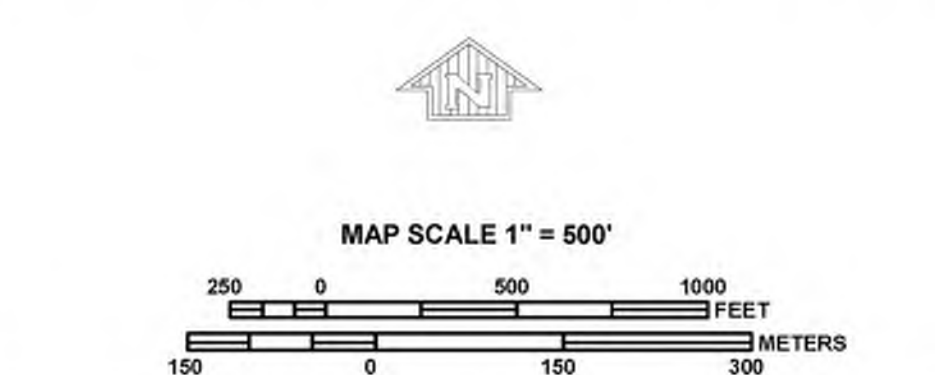
**EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP PANEL**  
SEPTEMBER 20, 1996

**EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL**  
April 2, 2002  
November 13, 2003  
September 25, 2008

August 16, 2012 - to update corporate limits, to change Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to add roads and road names, to incorporate previously issued Letters of Map Change.

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**NATIONAL FLOOD INSURANCE PROGRAM**

**PANEL 0528H**

**FIRM**  
**FLOOD INSURANCE RATE MAP**  
**BERNALILLO COUNTY, NEW MEXICO**  
**AND INCORPORATED AREAS**

**PANEL 528 OF 825**  
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

**CONTAINS:**

COMMUNITY	NUMBER	PANEL	SUFFIX
BERNALILLO COUNTY UNINCORPORATED AREAS	350001	0528	H
ISLETA, PUEBLO OF	350057	0528	H

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

**MAP NUMBER**  
**35001C0528H**

**MAP REVISED**  
**AUGUST 16, 2012**

**Federal Emergency Management Agency**



NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

**Coastal Base Flood Elevations** shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction, and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures in this jurisdiction.

The **projection** used in the preparation of this map was New Mexico State Plane, Central Zone (FIPS 3002). The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address:

NGS Information Services  
NOAA, NWS12  
National Geodetic Survey, SSMC-3, #9202  
1315 East-West Highway  
Silver Spring, Maryland 20910-3282  
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit their website at <http://www.ngs.noaa.gov/>.

**Base map** information shown on this FIRM was provided in digital format by City of Albuquerque, 2010, Bernalillo County, 2004, and 2010, Bureau of Land Management, 2003, National Geodetic Survey, 2003, and United States Geological Survey (USGS), 1999. Additional information was photogrammetrically compiled at a scale of 1:12,000 from U.S. Department of Agriculture aerial photography dated 2009.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel details that differ from what is shown on this map.

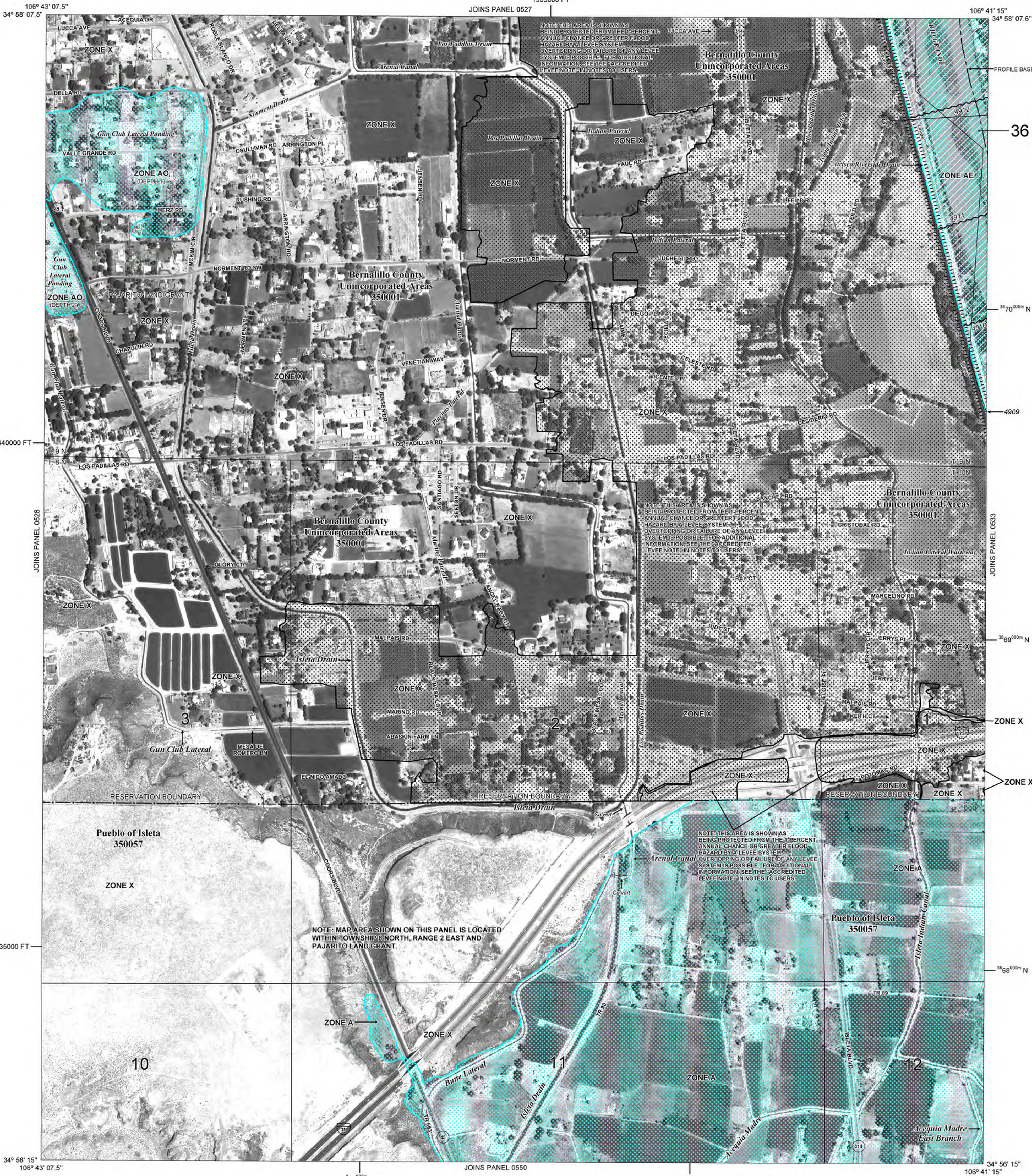
**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels, community map repository addresses, and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at <http://msc.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/business/nfip>.

**Accredited Levee Notes to Users:** Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at <http://www.fema.gov/business/nfip/index.shtm>.





## **Appendix B:**

### **2018 MRCOG Lidar Review Summary**

# Aerial Lidar Quality Report

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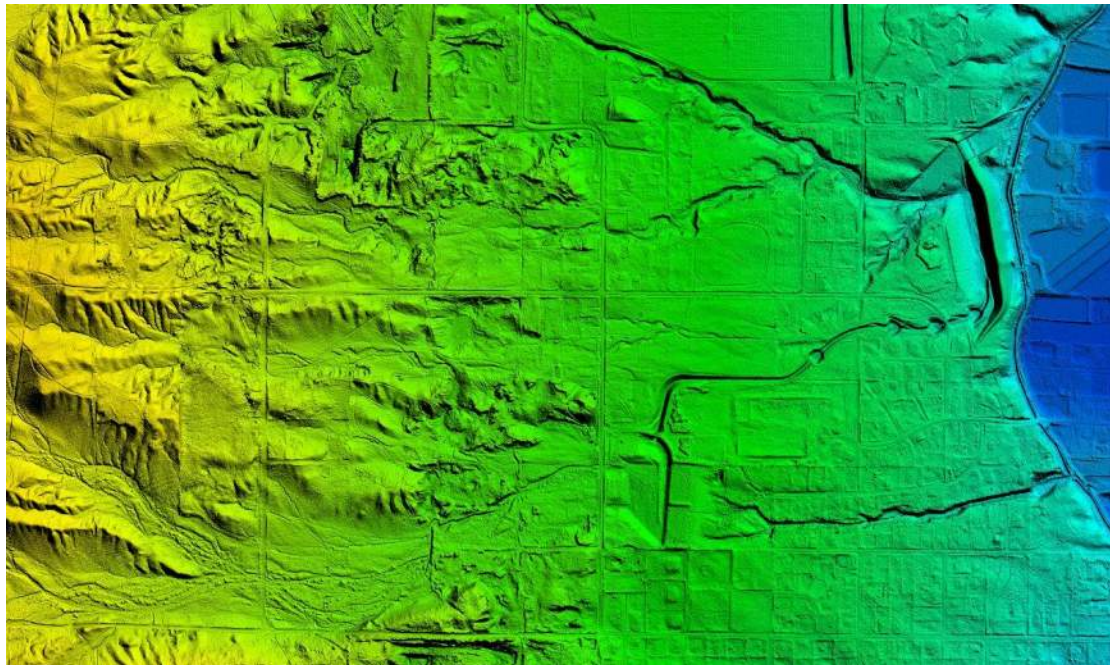
## 2018 Mid-Region Council of Governments Lidar - Black Mesa Three Dam Outlet Project Area of Interest

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### *Independent Data Quality Assessment*

ESP Associates, Inc. JN. IO11.704.000 Black Mesa Lidar QC

November 10, 2021



Prepared for:

**Albuquerque Metropolitan Arroyo Flood Control Authority**

Prepared by:



**ESP Associates, Inc.**

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## Summary

This Aerial Lidar Quality Report provides an independent assessment of a portion of the aerial lidar data collected for the Mid-Region Council of Governments (MRCOG) in 2018. The area of interest (AOI) within the MRCOG greater project area consisted of ~13 square miles of lidar identified by the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) as critical to a planned analysis of the arroyos and associated floodplains that were affected by the construction of the Black Mesa Three Dam Outlet Project in the far southwest mesa of Albuquerque, Bernalillo County. Based on the results of the lidar data review outlined in this report, ESP recommends that that new lidar be flown and processed for the AMAFCA Black Mesa AOI.

Figure 1 depicts the location of the AOI (colored area) against the larger backdrop of the 2018 MRCOG lidar project tile layout. A total of 69 MRCOG tiles covered the AMAFCA AOI.

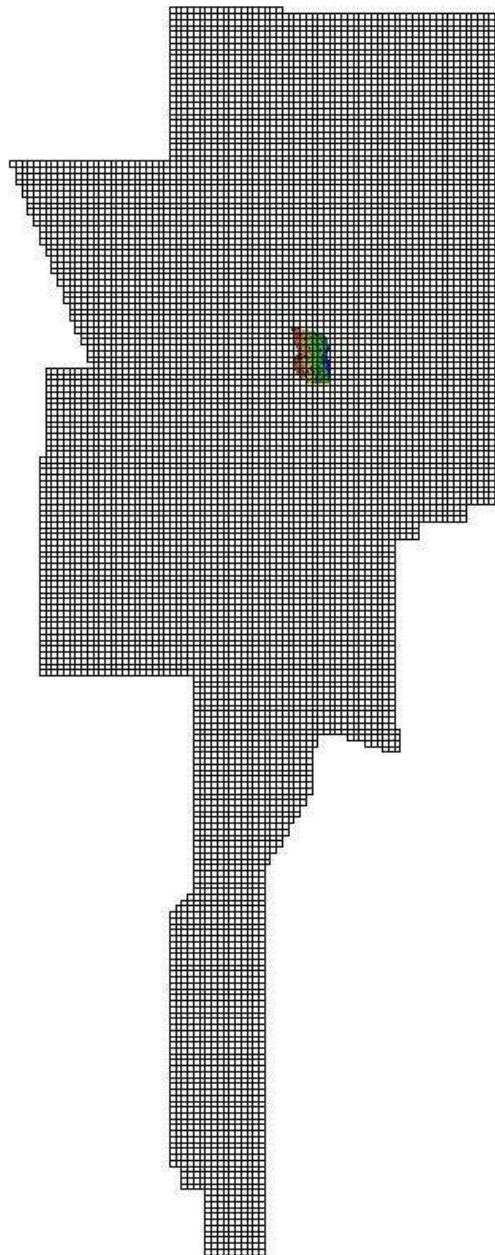


Figure 1. Project Area of Interest (AOI)

## Scope of Work Outline

ESP Associates, Inc. (ESP) was tasked with conducting qualitative and quantitative reviews of the existing 2018 aerial lidar data to be used for the AMAFCA AOI, to determine if the lidar in the AOI met the needs of the project and FEMA Guidelines and Specifications which references the USGS 3DEP Lidar Base Specification for QL2 lidar data. For the purpose of this review, ESP utilized the USGS specifications version that the 2018 MRCOG data was flown under and not the current, 2021 specifications. One exception to this is the consolidation of land cover classes used in accuracy testing in order to simplify the survey checkpoint plan.

ESP conducted a data analysis and review to determine suitability for use in the AMAFCA study. To facilitate the review, ESP received the following from AMAFCA:

- 2018 MRCOG lidar data encompassing the study area
- 2018 MRCOG lidar-derived DEMs encompassing the study area
- All metadata associated with the 2018 project (project report and FGDC-compliant xmls)
- Any available ground survey control or checkpoints within the study area that the AMAFCA and/or other agencies had access to

After review of the existing materials and data, ESP submitted a checkpoint survey plan that supplemented any existing checkpoints in order to ensure that the study area was covered by a well-distributed network of checkpoints, which is a requirement for validating the accuracy of a lidar dataset. Upon approval of the plan by AMAFCA, ESP team member High Mesa surveyed the additional lidar checkpoints and ESP then compared the full set of checkpoints against the 2018 lidar to determine the independently tested accuracy values in accordance with USGS requirements:

- Non-Vegetated Accuracy (NVA) RMSEz
- NVA RMSEz @ 95% Confidence,
- Vegetated Vertical Accuracy (VVA) RMSEz
- VVA RMSEz at the 95th Percentile

## Geodesy

The lidar data from the 2018 MRCOG project was provided in the North American Datum of 1983 HARN (1992), New Mexico State plane Coordinate System, South Central Zone and North American Vertical Datum of 1988, utilizing Geoid 12B, US Survey Feet. The independent lidar checkpoints surveyed by the ESP team were processed to the same.

## Qualitative Assessment

ESP performed a limited, qualitative assessment of the lidar data provided, to verify that minimum requirements were met by the data for use in the reanalysis of the Black Mesa AOI. The qualitative checks included the following reviews:

- Data completeness – the data were checked to ensure complete coverage of the AOI with no gaps caused by corrupt files or header issues
- Geodesy – verification that the data were in the correct coordinate system, Geoid, units
- Data density – checked against the FEMA/USGS specifications for QL2 thresholds



- Data classification accuracy – manually reviewed for ground omissions or artifacts that could affect modeling or analysis efforts

## Qualitative Assessment - Results

The data passed all qualitative reviews conducted by ESP. The results were as follows:

### Data Completeness

The lidar passed the data completeness review. ESP referenced the provided lidar point clouds against a buffered AOI polygon for the area of interest. The data for the AOI adequately covers the project and did not contain any gaps in coverage. Figure 2 depicts the coverage of the provided lidar tiles against the AOI boundary (yellow polygon).

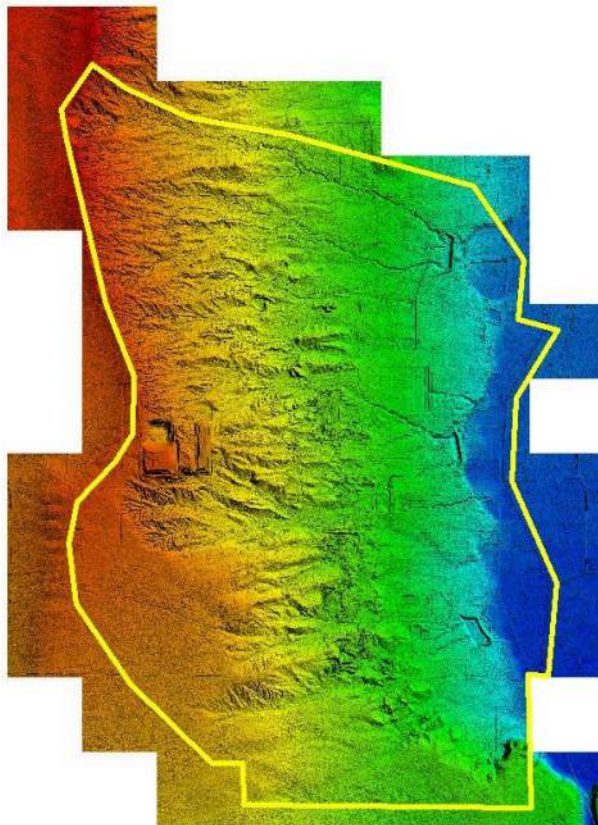


Figure 2: Coverage of provided lidar against AOI boundary

### Geodesy Check

The data passed the geodesy check and matched the parameters outlined in the “Scope of Work Outline” section of this report. ESP conducted an automated inspection of the LAS headers for geodesy information and displayed the data against the MRCOG and Black Mesa AOI boundaries to ensure that the data were provided in the correct coordinate system and units. The data provided were verified to be in the correct coordinate system and units. The LAS headers contained Well Known Text (WKT) entries for the LAS projection information, which provides the following information for each LAS (Figure 3):

### **Georegistration**

<b>Coordinate System:</b>	NAD83(HARN) / New Mexico Central (ftUS)
<b>Projection:</b>	NAD83(HARN) / New Mexico Central (ftUS)
<b>Geographic Citation:</b>	NAD83(HARN)
<b>Vertical Citation:</b>	NAVD88 height - Geoid12B (ftUS)
<b>Vertical CS:</b>	NAVD88 height (ftUS)
<b>Datum:</b>	North American Vertical Datum 1988
<b>Horizontal Units:</b>	US survey foot
<b>Vertical Units:</b>	US survey foot

Figure 3: Geodesy information contained within the LAS headers

### **Data Density**

The data passed the density check in accordance with FEMA/USGS requirements for QL2 data which dictates that a minimum density of  $\geq 2.0$  points per square meter (ppsm) must be met. It is acceptable that features containing water at the time of flight do not meet density requirements due to the lack of reliable lidar returns off of the surface of water. Within the AOI there was water in some of the drainage ditches and impoundment ponds as well as standing water in limited areas across the AOI. Figure 4 depicts the density rasters generated for this review. Green denotes areas meeting or exceeding minimum density. All LAS tiles passed with the average density exceeding requirements at  $\sim 3$  ppsm or greater in most areas.



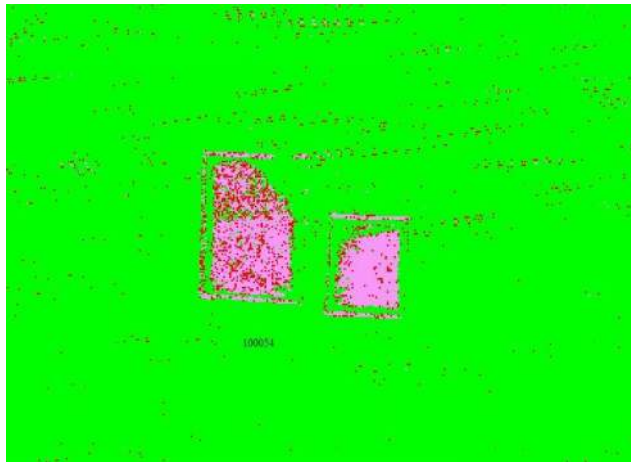


Figure 5: Example of acceptable low-density areas within the AOI due to the presence of water

### Data Classification Accuracy

Data density and overall cleanliness of the point cloud classifications generally met expectations when considered as part of the much larger MRCOG project area and the overall USGS deliverables. However, the AOI for the AMAFCA study on its own does contain classification errors that could affect the analysis of the arroyos and other hydrologically sensitive terrain features. These artifacts would require minimal correction for use. ESP identified ~72 locations in the data that would need minor reclassification if the existing data were to be used for AMAFCA purposes.

Examples of errors encountered include “shaved” terrain features in sensitive areas such as berms, arroyos embankments, and drainage ditches and above-ground artifacts where lidar points 5-13 ft above ground were erroneously classified as ground. Figure 6 depicts a significant portion of a berm “shaved” from the ground surface.

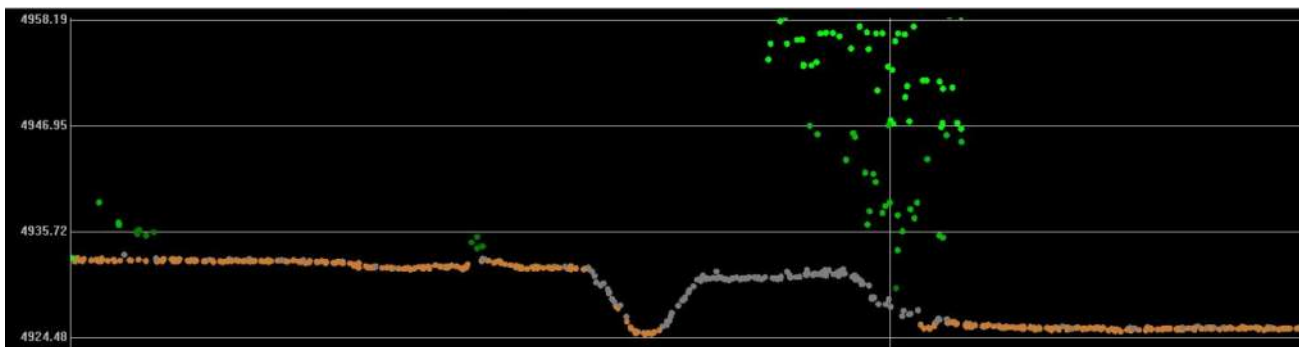


Figure 6: Significant portion of berm along drainage ditch misclassified (gray points)

Figure 7 is an example of a vegetation points 7-9 ft up in a tree, erroneously classified as ground.

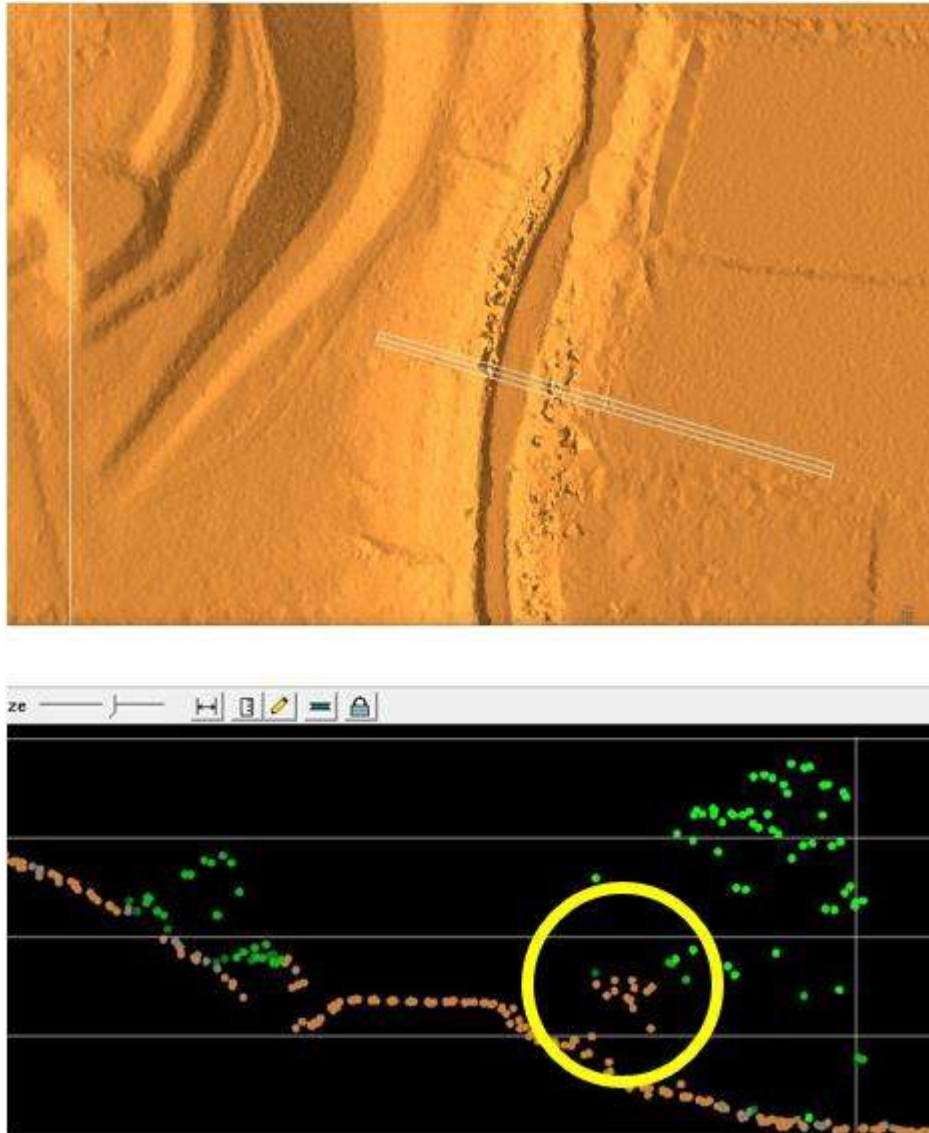


Figure 7: TIN surface showing numerous above-ground artifacts and profile of one location

## Quantitative Assessment

The provided LAS data for the project AOI did not pass the independent, quantitative (accuracy) assessment by ESP when compared against lidar survey checkpoints established by ESP team member High Mesa. ESP developed a lidar checkpoint survey layout covering the project AOI with a well-distributed network of non-vegetated vertical accuracy (NVA) and vegetated vertical accuracy (VVA) checkpoints.

## Checkpoint Descriptions

A total of 19 NVA and 5 VVA checkpoints were surveyed by High Mesa and provided to ESP for use in the assessment. A signed and sealed ground survey document reporting on the checkpoint survey was provided separately to AMAFCA. A single, independent checkpoint described in the provided lidar vendor report for the 2018 MRCOG project was located within the Black Mesa AOI. ESP supplemented the Black Mesa set of checkpoints with this existing one, labeled as UR07 in the vendor report, bringing the total checkpoints classified as NVA to 20. FEMA/USGS/ASPRS specifications now include urban points in NVA.

Table 1 lists the survey checkpoints used in this assessment, including the existing checkpoint from the 2018 MRCOG project located within the AOI. All units are in US Survey Feet.

Checkpoint	Easting	Northing	GCP Elev
NVA01	1484334.797	1459780.214	5487.130
NVA02	1491111.651	1459276.106	5178.970
NVA03	1495912.036	1458091.508	5035.870
NVA04	1499433.371	1455490.630	4928.650
NVA05	1496174.176	1453457.107	5012.520
NVA06	1487720.729	1456698.223	5312.820
NVA07	1490438.742	1452276.977	5199.860
NVA08	1492557.853	1449554.975	5144.530
NVA09	1498622.003	1447953.359	4935.590
NVA10	1490649.202	1445251.613	5195.280
NVA11	1499883.974	1444300.612	4913.720
NVA12	1496675.909	1444425.023	5006.030
NVA13	1484917.846	1445204.395	5412.050
NVA14	1495562.824	1440998.318	5049.050
NVA15	1489213.415	1441539.225	5313.550
NVA16	1495023.445	1450860.408	5058.580
NVA17	1486511.877	1439998.902	5329.700
NVA19	1493353.665	1438374.070	5154.250
NVA20	1499767.501	1436720.061	5023.440
VVA01	1498771.004	1447788.875	4918.620
VVA02	1499288.874	1444532.700	4924.780
VVA03	1486487.326	1439886.202	5328.190
VVA04	1493305.614	1438352.468	5156.100
VVA05	1499789.157	1440057.386	4939.690
*UR07	1500091.818	1446458.749	4909.069

Table 1: Ground survey lidar checkpoints

\* Denotes the existing 2018 MRCOG checkpoint reported by the aerial vendor and used in the assessment.

Distribution of the NVA checkpoints and the one checkpoint from the 2018 MRCOG project is depicted in Figure 8 and the distribution of VVA points in Figure 9. It should be noted that the Black Mesa AOI contains very little vegetation located within confined areas of the project. Therefore, the distribution of the VVA checkpoints was spread out as much as possible within the vegetated areas present but does not represent a significant representation of the landcover within the AOI.



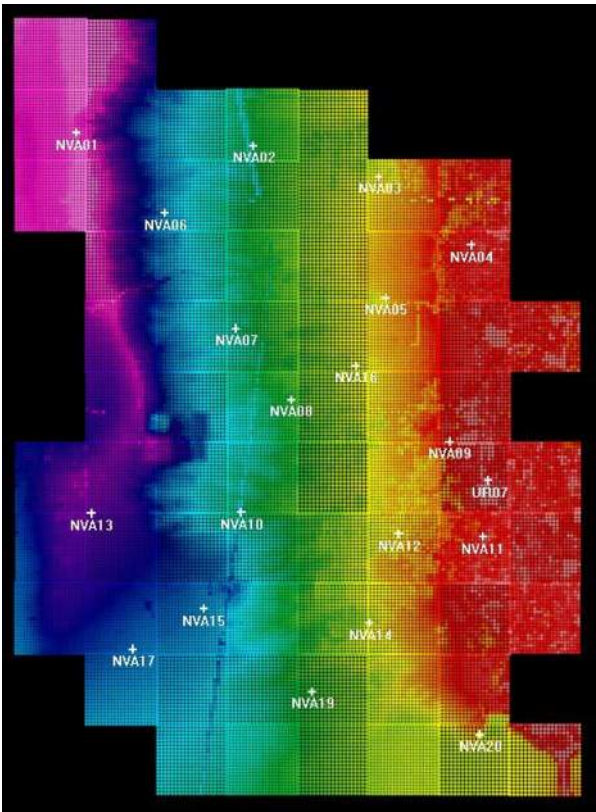


Figure 8: Distribution of open ground (NVA points and MRCOG point UR07)

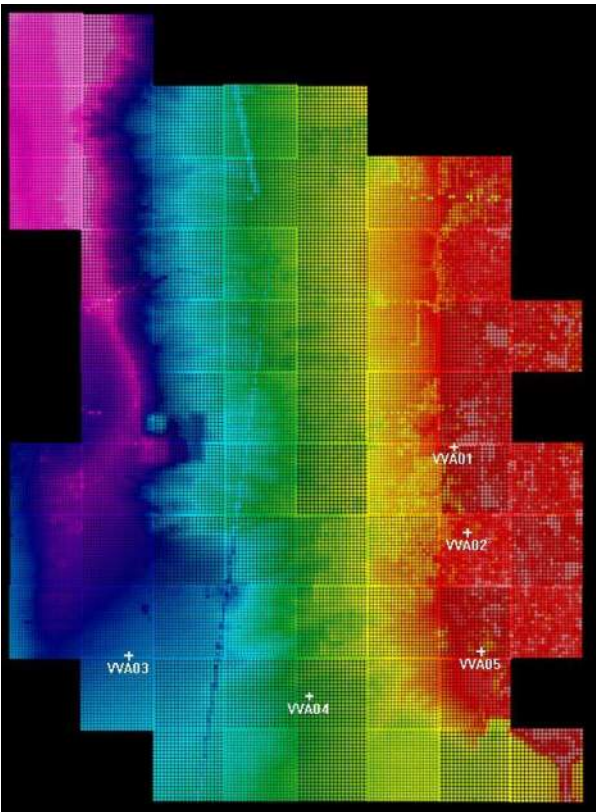


Figure 9: Distribution of VVA points

## Vertical Accuracy Testing

ESP's vertical accuracy assessment was conducted by testing the provided lidar against the specifications of the USGS QL2 accuracy thresholds for the NVA and VVA land cover categories. The specific thresholds for QL2 data are in red text in Table 2. Values in the USGS table are expressed in meters.

Quality level	RMSEz (nonvegetated) (m)	NVA at the 95-percent confidence level (m)	VVA at the 95th percentile (m)
QL0	≤0.050	≤0.098	≤0.15
QL1	≤0.100	≤0.196	≤0.30
QL2	≤0.100	≤0.196	≤0.30
QL3	≤0.200	≤0.392	≤0.60

Table 2: FEMA/USGS Lidar Quality Level Requirements

The vertical accuracy assessment was conducted utilizing the Control Report function within ESP Analyst, a proprietary lidar processing and QA/QC software. ESP Analyst measures the survey checkpoint elevations (considered to be elevation measurements of higher order or accuracy) against the corresponding surface of the lidar TIN as generated from the ground classification of the lidar point cloud. The elevation value of the lidar checkpoints are compared against the elevations of the TIN at the corresponding x,y location of each checkpoint, and the differences, or deltas, are computed. Based on these deltas the Root Mean Square Error (RMSE) is computed for the elevation deltas and then used in the computation to report accuracy at the 95% confidence level using RMSEz X 1.9600. VVA checkpoints are computed at the 95<sup>th</sup> percentile using RMSEz X 3.00.

A Certified Photogrammetrist (CP) / Certified Mapping Scientist – Lidar (CMS-Lidar) at ESP reviewed the initial results within the tool and investigated any checkpoint results that exhibit an elevation delta exceeding the threshold or that is close to the threshold. This was to eliminate any potential causes for error other than the lidar data itself. For instance, the investigation may find that the data is not clean enough at a checkpoint which can be resolved with some minor editing. Or, a checkpoint may be in a location where a gap occurs in the lidar ground due to vegetation or other obstruction. If elimination of a checkpoint can be supported by the investigation, the checkpoint can be removed from the calculation.

ID	X	Y	Z	Z Tin	Z Delta	M
✓ NVA03	1495912.036	1458091.508	5035.870	5036.739	0.869	
✓ NVA09	1498622.003	1447953.359	4935.590	4934.770	-0.820	
✓ NVA14	1495562.824	1440998.318	5049.050	5049.812	0.762	
✓ NVA16	1495023.445	1450860.408	5058.580	5059.336	0.756	
✓ NVA20	1499767.501	1436720.061	5023.440	5022.686	-0.754	
✓ NVA12	1496675.909	1444425.023	5006.030	5006.661	0.631	
✓ NVA19	1493353.665	1438374.070	5154.250	5154.832	0.582	
✓ NVA05	1496174.176	1453457.107	5012.520	5013.052	0.532	
✓ NVA08	1492557.853	1449554.975	5144.530	5145.057	0.527	
✓ NVA02	1491111.651	1459276.106	5178.970	5179.456	0.486	
✓ NVA01	1484334.797	1459780.214	5487.130	5486.689	-0.441	
✓ LR07	1500091.818	1446458.749	4909.069	4908.665	-0.404	
✓ NVA11	1499883.974	1444300.612	4913.720	4913.404	-0.316	

Figure 10: ESP Analyst Control Report Tool

For the Black Mesa AOI, no checkpoints were identified as potential candidates for removal.

## Vertical Accuracy Testing Results

Based on the provided data and a comparison of the lidar ground surface against ground survey checkpoints of a higher order, the provided lidar data covering the Black Mesa AOI failed the vertical accuracy assessment for NVA points. Although the VVA points passed, there were a couple of outliers that are excessively high and warranted further investigation. It is likely that the VVA points that tested well masked potential issues and not enough vegetated areas were present to add more test points. The NVA points, however, were distributed throughout the AOI enough to identify problematic areas. *It should be noted that the Black Mesa AOI is a small representative area and these results may not be indicative of the overall accuracy of the larger 2018 MRCOG project.*

Table 3 provides a summary of vertical check results by point for the NVA class (including the one, 2018 MRCOG point), and the VVA class. All values are in US Survey Feet.

Category	RMSEz	QL2 Target	RMSEz 95% Conf.	RMSEz 95 <sup>th</sup> Percentile	Mean	Skew	Std Dev	# Of Points	Min	Max
NVA	0.519	0.328	1.017	N/A	0.269	0.678	0.244	20	0.006	0.755
VVA	0.487	0.984	N/A	1.461	0.237	1.899	0.395	5	0.003	0.918

Table 3: Summary of vertical accuracy results

Tables 4 and 5 provide the detailed locations and delta calculations for the NVA and VVA checkpoints, respectively. It should be noted that the measurement delta between the 2018 MRCOG urban point (UR07) matches the result noted in the vendor's report for that project. All values are in US Survey Feet.

Name	Easting	Northing	Elev	Lidar TIN	Delta	Delta^2
NVA01	1484334.797	1459780.214	5487.130	5486.690	-0.441	0.195
NVA02	1491111.651	1459276.106	5178.970	5179.460	0.486	0.236
NVA03	1495912.036	1458091.508	5035.870	5036.740	0.869	0.755
NVA04	1499433.371	1455490.630	4928.650	4928.430	-0.224	0.050
NVA05	1496174.176	1453457.107	5012.520	5013.050	0.532	0.284
NVA06	1487720.729	1456698.223	5312.820	5313.060	0.239	0.057
NVA07	1490438.742	1452276.977	5199.860	5200.080	0.216	0.047
NVA08	1492557.853	1449554.975	5144.530	5145.060	0.527	0.278
NVA09	1498622.003	1447953.359	4935.590	4934.770	-0.820	0.672
NVA10	1490649.202	1445251.613	5195.280	5195.410	0.132	0.017
NVA11	1499883.974	1444300.612	4913.720	4913.400	-0.316	0.100
NVA12	1496675.909	1444425.023	5006.030	5006.660	0.631	0.398
NVA13	1484917.846	1445204.395	5412.050	5411.810	-0.243	0.059
NVA14	1495562.824	1440998.318	5049.050	5049.810	0.762	0.581
NVA15	1489213.415	1441539.225	5313.550	5313.450	-0.103	0.011
NVA16	1495023.445	1450860.408	5058.580	5059.340	0.756	0.571
NVA17	1486511.877	1439998.902	5329.700	5329.780	0.076	0.006
NVA19	1493353.665	1438374.070	5154.250	5154.830	0.582	0.338
NVA20	1499767.501	1436720.061	5023.440	5022.690	-0.754	0.569
UR07	1500091.818	1446458.749	4909.070	4908.670	-0.404	0.163

Table 4: Detailed NVA results



Name	Easting	Northing	Elev	Lidar TIN	Delta	Delta^2
VVA01	1498771.004	1447788.875	4918.620	4917.660	-0.958	0.918
VVA02	1499288.874	1444532.700	4924.780	4924.660	-0.118	0.014
VVA03	1486487.326	1439886.202	5328.190	5327.700	-0.495	0.245
VVA04	1493305.614	1438352.468	5156.100	5156.160	0.058	0.003
VVA05	1499789.157	1440057.386	4939.690	4939.760	0.071	0.005

Table 5: Detailed VVA results

## Results Investigation

ESP analyzed each point location for within the NVA and VVA classes exceeding their respective accuracy thresholds in order to determine if any mitigating circumstance would allow a point to be removed from the calculations or recalculated after a minor correction to the data, such as correcting an erroneous classification. ESP did not identify any mitigating circumstances that would allow for the elimination of any checkpoints.

Upon further investigation of the results, ESP found that the failed checkpoints were distributed within an area limited to portions of one or two of the seven flight lines covering the Black Mesa AOI. Areas of the AOI performed exceedingly well while other areas failed. This would seem to indicate a potential adjustment issue with one or more of the lidar swaths. However, the potential source of the error cannot be verified without interacting with the lidar vendor to determine if the line or lines had calibration errors.

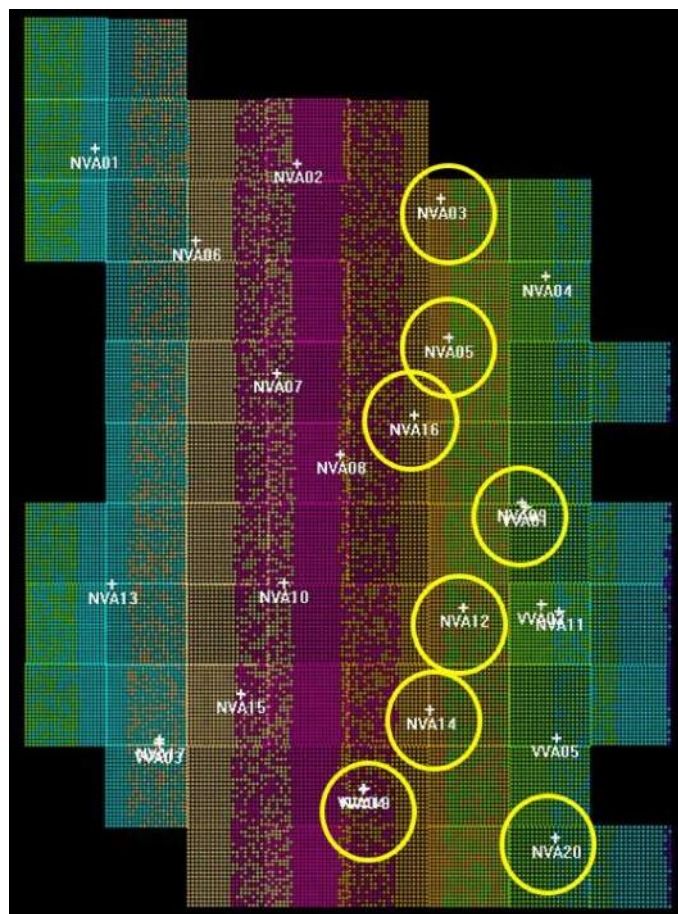


Figure 11: Distribution of failed checkpoints within the Black Mesa AOI

Another potential source of the error could be the lack of a well-distributed ground control points (GCP) used to support the calibration of the 2018 MRCOG project. Based on the information provided in the vendor report, ESP plotted the GCP points listed as being used for calibration purposes. Figure 12 shows the overall distribution of these 2018 MRCOG GCP along with the location of the AMAFCA AOI within the control scheme.

The distribution of the GCP points within the 2018 MRCOG project would seem to suggest that are several, large areas of the project without GCP which may have been a contributing factor to the Black Mesa AOI not meeting accuracy specifications. However, ESP cannot make a determination on this potential source of error without more information and can only assume that the GCP points outlined in the vendor report are, in fact, the only GCP used for the MRCOG project.

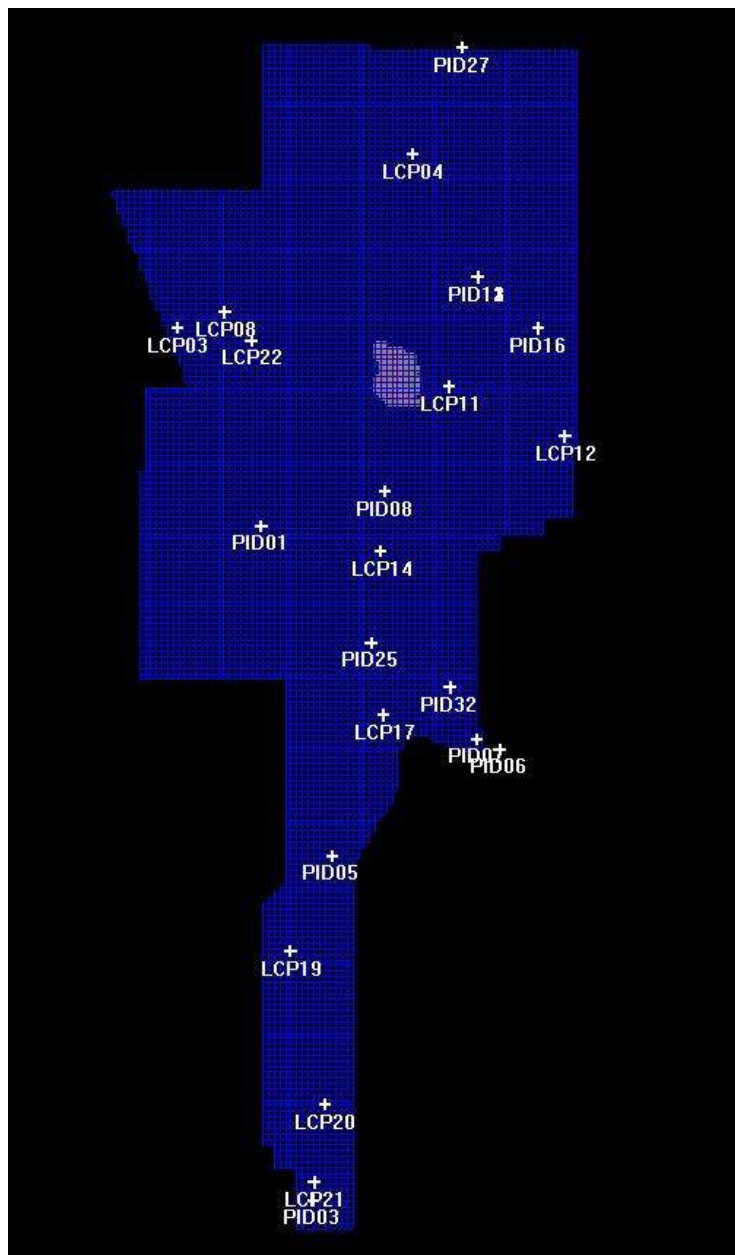


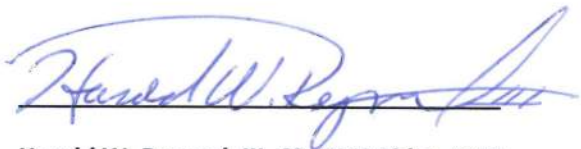
Figure 12: Map of GCP locations provided by the MRCOG vendor report (purple is the AMAFCA AOI)

## Conclusion and Recommendations

The data in its current form does not meet the needs of the AMAFCA as they pertain to the reanalysis of the Black Mesa AOI. The dataset encompassing the AOI fails the minimum accuracy thresholds for QL2 lidar data as established by previous and current FEMA and USGS specifications, dating back to the 2018 MRCOG project.

It is beyond the scope and ability of the AMAFCA Black Mesa project to reprocess or recalibrate the data in the affected area to improve the accuracy. Based on this fact, it is ESP's recommendation that this AOI be re-flown with new aerial lidar data and that a new, well-distributed GCP network be established in the Black Mesa AOI to support a new flight. Should the new lidar flight be conducted, ESP can reserve the checkpoints used in this report to independently check the new lidar.

### Preparation of Report and Accuracy Calculations and Review Conducted by:



Harold W. Rempel, III, CP, CMS-Lidar, GISP



11/10/21

## **Appendix C:**

### **2021 ESP Lidar Collection Summary**



# Aerial Lidar Acquisition and Processing Report

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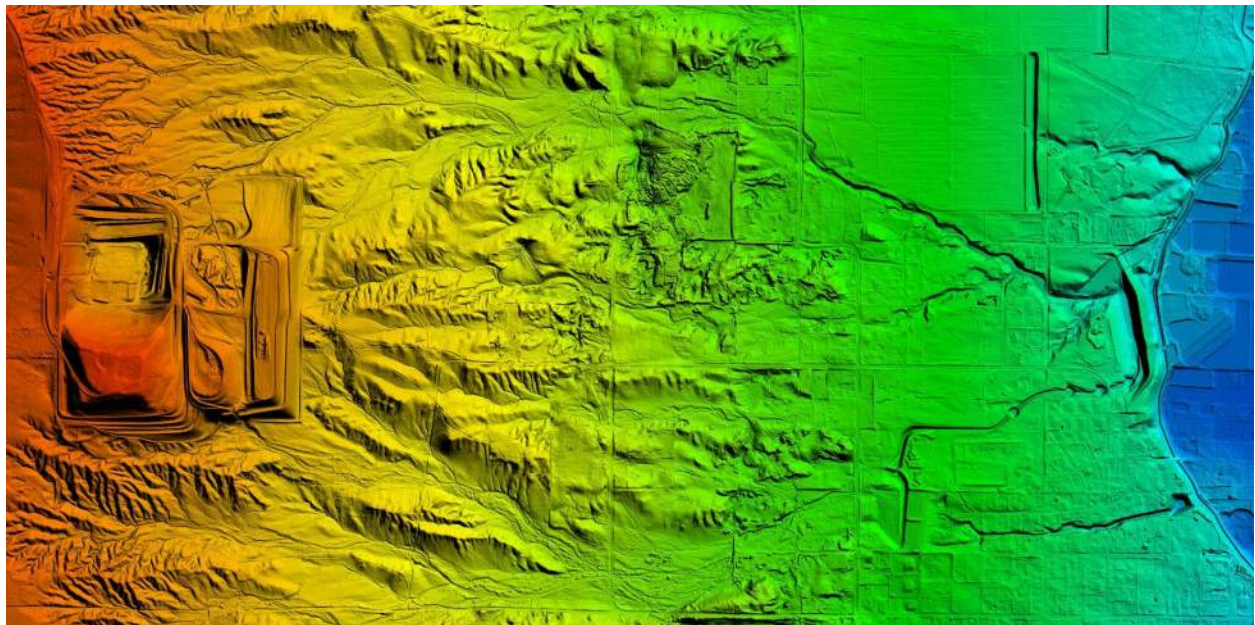
## 2021 Black Mesa Three Dam Outlet Project Area of Interest

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ESP Associates, Inc.

JN. IO11.704.000 Black Mesa 2021 Lidar

December 15, 2021



Prepared for:



**Albuquerque Metropolitan Arroyo Flood Control Authority**

Prepared by:



**ESP Associates, Inc.**

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## Summary

This Aerial Lidar Acquisition and Processing Report provides a comprehensive accounting of the lidar data collection and processing conducted in support of the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) goals for the planned analysis of the arroyos and associated floodplains that were affected by the construction of the Black Mesa Three Dam Outlet Project in the far southwest mesa of Albuquerque, Bernalillo County. The aerial data was acquired by team member Surdex Corporation (Surdex) and supporting ground control by team member High Mesa Consulting Group (High Mesa).

The project area of interest (AOI) consisted of a 13 sq. mi. area near Albuquerque, NM. A project buffer of approximately 100 m was applied to ensure coverage, resulting in a final AOI of approximately 13.4 sq mi.

Figure 1 depicts the location of the AOI (colored area) in relation to the metropolitan area of Albuquerque.

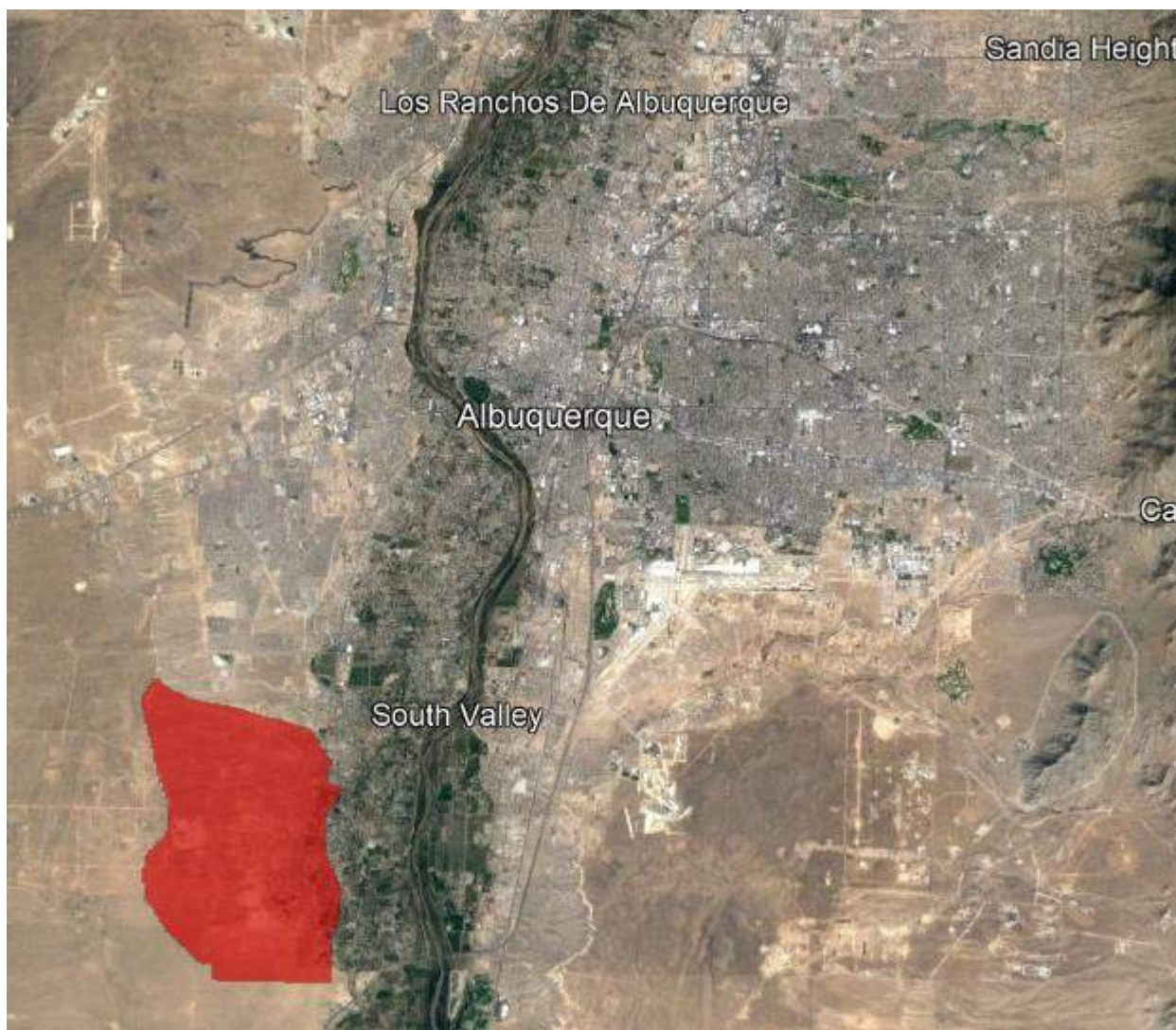


Figure 1. Project Area of Interest (Red shaded area) in relation to Albuquerque



## Scope of Work Outline

For this phase of the contract, ESP Associates, Inc. (ESP) was tasked with conducting ground survey and aerial lidar acquisition and processing to support the modeling needs of the project. Data accuracy was required to meet FEMA Guidelines and Specifications which references the USGS 3DEP Lidar Base Specification for QL2 lidar data. The version of the USGS Lidar Base Specification used to dictate accuracy for the project was 2021, Revision A; specifically, the QL2 criteria. The deliverables for the project were based on modeling and other needs and included:

- Ground Survey Control and Report
- Calibrated and classified aerial lidar
- Digital Elevation Models (DEMs)
- Hydro-flattening breaklines meeting USGS minimum map unit (MMU) criteria
- FGDC-compliant, project-level metadata
- Aerial Lidar Acquisition and Processing Report

## Geodesy

All data deliverables were provided in the North American Datum of 1983 HARN (1992), New Mexico State plane Coordinate System, South Central Zone and North American Vertical Datum of 1988, utilizing Geoid 12B, US Survey Feet.

## Aerial Data Acquisition

The project design for the aerial collection of lidar supported the USGS QL2 accuracy requirements. Data acquisition of the raw lidar was conducted by team member Surdex on November 30, 2021. No unusual flooding conditions or other project area impacts from environmental concerns were observed during flight.

The lidar data was acquired using an Optech Galaxy Prime lidar sensor, serial number 5060475. The sensor is capable of a scan rate of up to 2Mhz pulse repetition frequency (PRF) and up to 8 returns per pulse. The project AOI, depicted in figure 1, was collected in its entirety, ensuring that full tiles were delivered along the AOI buffered boundary. Surdex conducted flight operations management for the aerial lidar collection. Their responsibilities included data acquisition planning, ongoing flight plan management, crew coordination, issue mitigation, as well as progress reporting to ESP.

Surdex utilized a high-performance aircraft equipped with the aforementioned sensor. Lidar data was collected at an Aggregated Nominal Pulse Spacing (ANPS) of  $\leq 0.71$  meters; as determined against the aggregated swath, first return data. Planned density for the project was  $\geq 4$  points per square meter (ppsm). The laser was configured to collect multiple returns per pulse. This included, at a minimum, first, last, and at least one intermediate return. The signal strength (intensity) of each return pulse was also recorded, as well as GPS time in accordance with the project requirements. Figure 2 depicts the swaths of data collected, colored by flight line, along with the AOI production boundary.



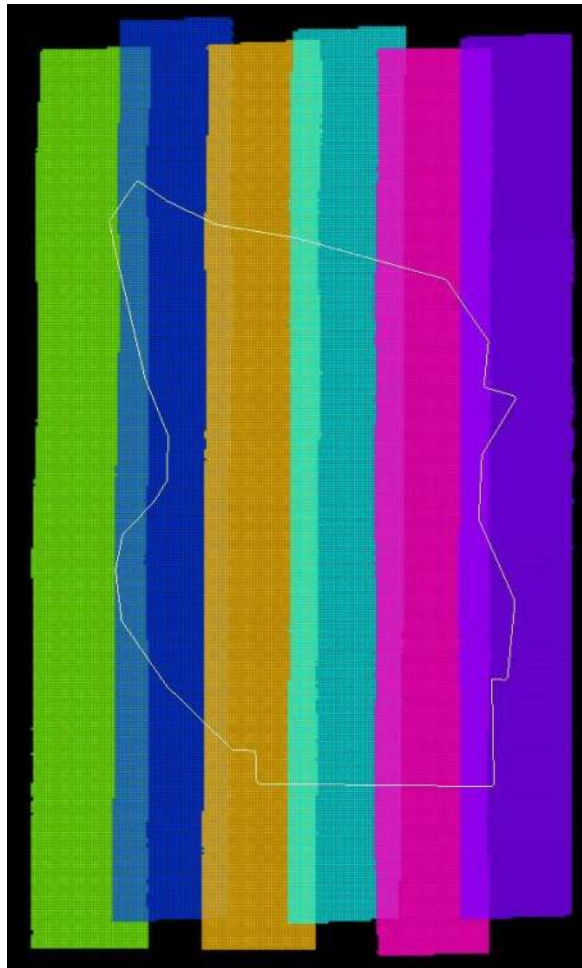


Figure 2: Collected lidar swaths and project AOI boundary

## Data Density Verification

The lidar data aggregated nominal pulse density (ANPD) was assessed using single swath, first return data located within the geometrically usable center portion of each swath. The data tested at an ANPD of 4-6 points for all 6 swaths which exceeds the USGS QL2 threshold of a minimum ANPD of 2 points. Table 1 outlines the results by swath.

Swath Number	ANPD	Pass/Fail
3_211130_173817_5060475	6.01	Pass
4_211130_173111_5060475	4.86	Pass
5_211130_172336_5060475	6.13	Pass
6_211130_171618_5060475	4.87	Pass
7_211130_170849_5060475	6.13	Pass
8_211130_170101_5060475	4.93	Pass

Table 1: ANPD check results for project lidar swaths

It is acceptable that features containing water at the time of flight do not meet density requirements due to the lack of reliable lidar returns off of the surface of water. Within the AOI there was water in some of the drainage ditches and impoundment ponds as well as standing water in limited areas. Once the

collected data was verified as being complete (no coverage voids) and the ground survey control points received, the data underwent lidar calibration.

## Lidar Data Calibration

The lidar calibration process was conducive to postprocessing an accurate data set. Significant attention was given to GPS baseline distances and GPS satellite constellation geometry and outages during the trajectory processing. Verification that proper Airborne GPS (ABGPS) surveying techniques were followed including: pre and post mission static initializations and review of In-air Inertial Measurement Unit (IMU) alignments, both before and after on-site collection activities, to ensure proper self-calibration of the IMU accelerometers and gyros were achieved.

As-flown trajectories and ABGPS quality plots were reviewed to ensure that no potential issues were missed and that all lines were flown to plan. The areas of overlap between flight lines were used to calibrate (aka boresight) the lidar point cloud to achieve proper flight line to flight line alignment in all 6 degrees of freedom. This included adjustment of IMU and scanner related variables such as roll, x, y, z, pitch, heading, and timing interval (calibration range bias by return).

The following section briefly describes the ground survey control used in the calibration of the lidar.

## Ground Survey Control

Team member High Mesa surveyed a total of 10 ground control points in support of the lidar calibration for this project in November of 2021 and verified and delivered the control by December 2, 2021. The locations of the control points were captured by first verifying and tying into the primary control baseline previously established during the checkpoint Survey conducted in October 2021 using Static GNSS observations. The original checkpoint survey was conducted for a previous phase of the contract with AMAFCA in order to test an existing lidar data set from 2018. This original checkpoint survey was also used to verify the accuracy of this lidar data acquired in 2021. The signed and sealed survey report materials were provided under separate cover to AMAFCA.

Table 2 lists the control survey points along with their measurements.

Name	Easting	Northing	Elevation
C1	1485421.873	1463152.853	5542.348
C2	1492689.715	1463638.880	5113.559
C3	1502002.875	1464186.309	4929.410
C4	1484190.837	1450569.882	5409.316
C5	1494854.488	1450956.250	5063.809
C6	1503174.820	1446629.651	4908.330
C7	1484733.607	1433970.512	5224.596
C8	1494057.949	1434058.607	5125.997
C9	1500567.401	1433953.145	5042.874
C10	1489915.871	1439859.995	5290.134

Table 2: Ground survey control utilized for data calibration

Figure 3 depicts the layout of the well-distributed lidar survey control points collected by the team.

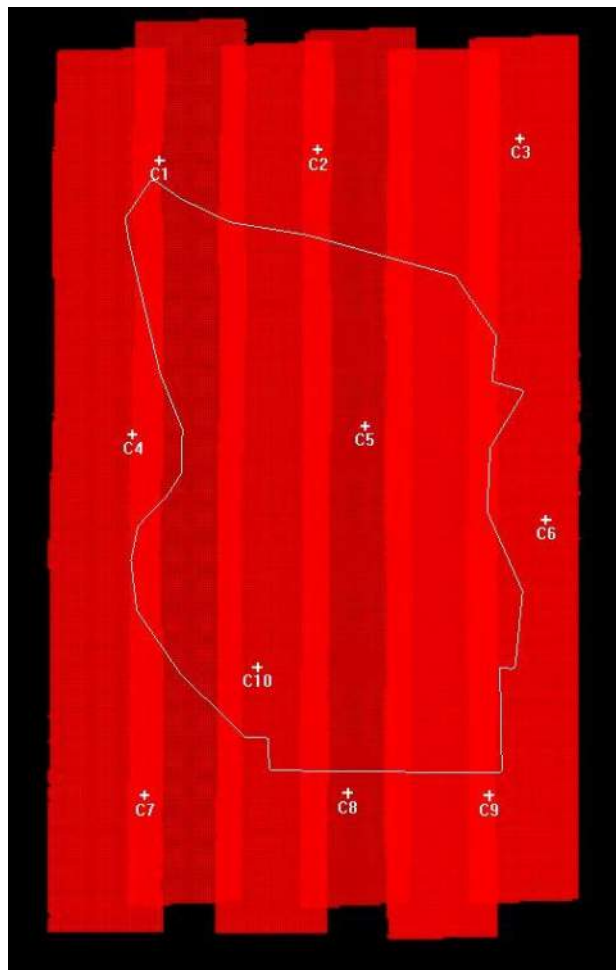


Figure 3: Distribution of project control. White polygon is project boundary

## Calibration Quality Control

The quality of the lidar calibration was verified by conducting the following checks:

- Vertical check against the survey control used
- Relative accuracy check
- Quantitative assessment against independently reserved lidar checkpoints

### Check Against Survey Control

The calibrated data were checked against the survey control used in the calibration. This check is to ensure that the calibration was correctly executed. It should be noted that this check is not used to assess data accuracy against the USGS specification, which requires the use of survey checkpoints that are reserved for an accuracy check and not used in data calibration. The vertical check against the survey control was good and indicated that the data were ready for post-processing. Table 3 outlines the results of the check against survey control. All values in U.S. Feet.

Number	Easting	Northing	Ground Control Elevation	Lidar Elevation	Delta
C1	1485421.873	1463152.853	5542.348	5542.470	0.122
C2	1492689.715	1463638.880	5113.559	5113.620	0.061
C3	1502002.875	1464186.309	4929.410	4929.520	0.110
C4	1484190.837	1450569.882	5409.316	5409.380	0.064
C5	1494854.488	1450956.250	5063.809	5063.940	0.131
C6	1503174.820	1450956.250	4908.330	4908.460	0.130
C7	1484733.607	1450956.250	5224.596	5224.720	0.124
C8	1494057.949	1450956.250	5125.997	5126.040	0.043
C9	1500567.401	1450956.250	5042.874	5042.850	-0.024
C10	1489915.871	1450956.250	5290.134	5290.190	0.056
Average	dz	0.082			
Minimum	dz	-0.024			
Maximum	dz	0.131			
Average	magnitude	0.087			
RMSE		0.095			
Std	deviation	0.051			

Table 3: Vertical results against survey control

### Relative Accuracy Check (Intraswath Consistency)

Overlap consistency was assessed to determine the relative vertical accuracy between swaths within the overlap areas of adjoining swaths. For QL2 data, the swath overlap difference, or RMSDz, must meet the USGS specification of  $\leq 8$  cm or  $\leq 0.26$  ft. The data passed with an RMSDz of 0.006 meters after assessing a total of 57,156 cells with a cell size equal to the ANPS X 2 or 1.42 sq. m.

### Quantitative Assessment

The 2021 lidar data for the project AOI passed the quantitative (vertical accuracy) assessment when compared against independently reserved lidar survey checkpoints established by ESP team member High Mesa for a previous phase of this contract. The checkpoints were not used in the data calibration and were reserved from the technicians conducting the lidar calibration. The lidar checkpoint survey layout covered the project AOI with a well-distributed network of non-vegetated vertical accuracy (NVA) and vegetated vertical accuracy (VVA) checkpoints.

### Checkpoint Descriptions

A total of 19 NVA and 5 VVA checkpoints were surveyed by High Mesa and provided to ESP for use in the assessment. A signed and sealed ground survey document reporting on the checkpoint survey was provided separately to AMAFCA. A single, independent checkpoint described in the provided lidar vendor report for the 2018 MRCOG project was located within the Black Mesa AOI. ESP supplemented the Black Mesa set of checkpoints with this existing one, labeled as UR07 in the vendor report, bringing the total checkpoints classified as NVA to 20. FEMA/USGS/ASPRS specifications now include urban points in NVA.

Table 4 lists the survey checkpoints used in this assessment, including the existing checkpoint from the 2018 MRCOG project located within the AOI. All units are in US Survey Feet.

Checkpoint	Easting	Northing	GCP Elev
NVA01	1484334.797	1459780.214	5487.130
NVA02	1491111.651	1459276.106	5178.970
NVA03	1495912.036	1458091.508	5035.870
NVA04	1499433.371	1455490.630	4928.650
NVA05	1496174.176	1453457.107	5012.520
NVA06	1487720.729	1456698.223	5312.820
NVA07	1490438.742	1452276.977	5199.860
NVA08	1492557.853	1449554.975	5144.530
NVA09	1498622.003	1447953.359	4935.590
NVA10	1490649.202	1445251.613	5195.280
NVA11	1499883.974	1444300.612	4913.720
NVA12	1496675.909	1444425.023	5006.030
NVA13	1484917.846	1445204.395	5412.050
NVA14	1495562.824	1440998.318	5049.050
NVA15	1489213.415	1441539.225	5313.550
NVA16	1495023.445	1450860.408	5058.580
NVA17	1486511.877	1439998.902	5329.700
NVA19	1493353.665	1438374.070	5154.250
NVA20	1499767.501	1436720.061	5023.440
VVA01	1498771.004	1447788.875	4918.620
VVA02	1499288.874	1444532.700	4924.780
VVA03	1486487.326	1439886.202	5328.190
VVA04	1493305.614	1438352.468	5156.100
VVA05	1499789.157	1440057.386	4939.690
*UR07	1500091.818	1446458.749	4909.069

Table 4: Ground survey lidar checkpoints

\* Denotes the existing 2018 MRCOG checkpoint reported by the MRCOG aerial vendor and used in the assessment.

Distribution of the NVA checkpoints and the one checkpoint from the 2018 MRCOG project is depicted in Figure 4 and the distribution of VVA points in Figure 5. It should be noted that the Black Mesa AOI contains very little dense vegetation located within confined areas of the project. Therefore, the distribution of the VVA checkpoints was spread out as much as possible within the vegetated areas present but does not represent a significant representation of the landcover within the AOI.

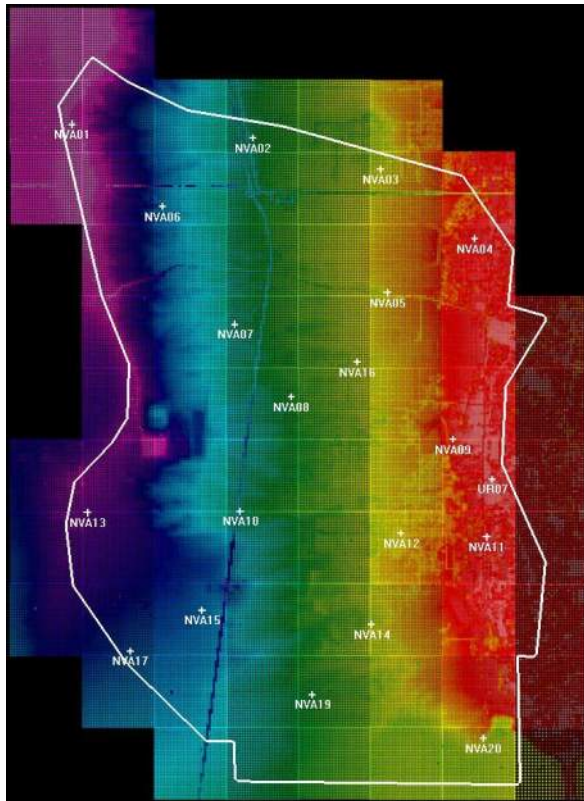


Figure 4: Distribution of open ground (NVA points and MRCOG point UR07)

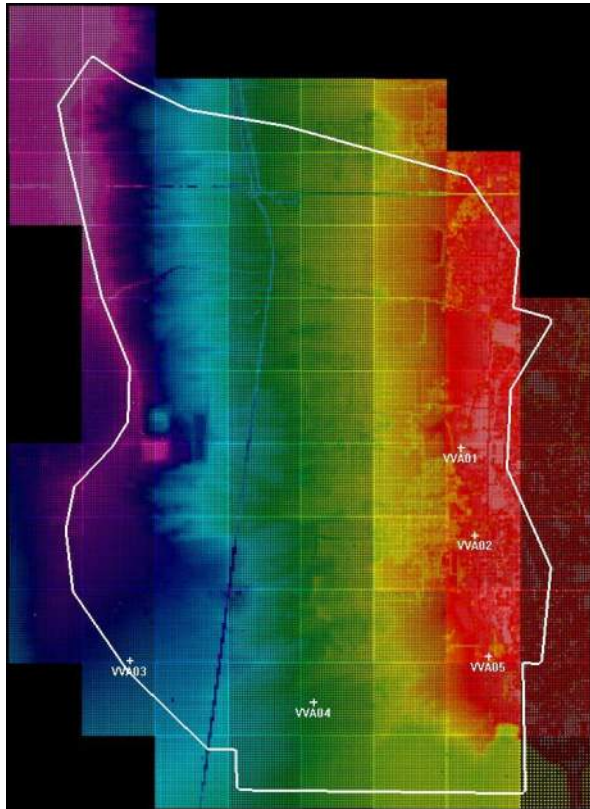


Figure 5: Distribution of VVA points



## Vertical Accuracy Testing Methodology

ESP's vertical accuracy assessment was conducted by testing the provided lidar against the specifications of the USGS QL2 accuracy thresholds for the NVA and VVA land cover categories. The specific thresholds for QL2 data are in red text in Table 5. Values in the USGS table are expressed in meters.

Quality level	RMSEz (nonvegetated) (m)	NVA at the 95-percent confidence level (m)	VVA at the 95th percentile (m)
QL0	≤0.050	≤0.098	≤0.15
QL1	≤0.100	≤0.196	≤0.30
QL2	≤0.100	≤0.196	≤0.30
QL3	≤0.200	≤0.392	≤0.60

Table 5: FEMA/USGS Lidar Quality Level Requirements

The vertical accuracy assessment was conducted utilizing the Control Report function within ESP Analyst, a proprietary lidar processing and QA/QC software. ESP Analyst measures the survey checkpoint elevations (considered to be elevation measurements of higher order or accuracy) against the corresponding surface of the lidar TIN as generated from the ground classification of the lidar point cloud. The elevation value of the lidar checkpoints are compared against the elevations of the TIN at the corresponding x,y location of each checkpoint, and the differences, or deltas, are computed. Based on these deltas the Root Mean Square Error (RMSE) is computed for the elevation deltas and then used in the computation to report accuracy at the 95% confidence level using RMSEz X 1.9600. VVA checkpoints are computed at the 95<sup>th</sup> percentile using RMSEz X 3.00.

A Certified Photogrammetrist (CP) / Certified Mapping Scientist – Lidar (CMS-Lidar) at ESP reviewed the initial results within the tool and investigated any checkpoint results that exhibit an elevation delta exceeding the threshold or that is close to the threshold. This may be done to eliminate any potential causes for error other than the lidar data itself. For instance, the investigation may find that the data is not clean enough at a checkpoint which can be resolved with some minor editing. Or, a checkpoint may be in a location where a gap occurs in the lidar ground due to vegetation or other obstruction. If elimination of a checkpoint can be supported by the investigation, the checkpoint can be removed from the calculation.

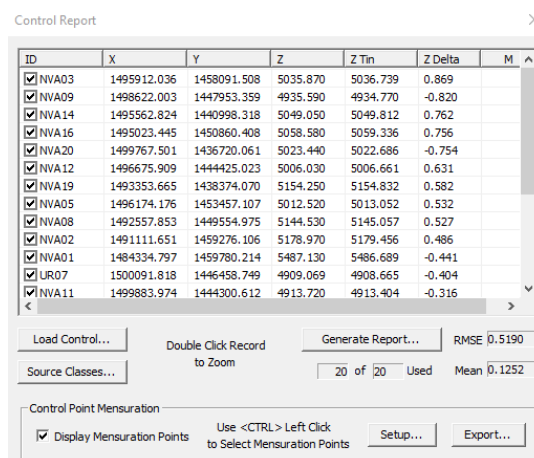


Figure 6: ESP Analyst Control Report Tool

For the Black Mesa AOI, no checkpoints were identified as potential candidates for removal and all checkpoints were well below the accuracy threshold.

### Vertical Accuracy Testing Results

Based on the comparison of the lidar ground surface against ground survey checkpoints of a higher order, the 2021 lidar produced for this project passes the quantitative (vertical accuracy assessment) for both the NVA and VVA points.

Table 6 provides a summary of vertical check results by point for the NVA (including the one, 2018 MRCOG point), and the VVA classes. All values are in US Survey Feet.

Category	RMSEz	QL2 Target	RMSEz 95% Conf.	RMSEz 95 <sup>th</sup> Percentile	Mean	Skew	Std Dev	# Of Points	Min	Max
NVA	0.134	0.328	0.26	N/A	0.100	2.19	0.02	20	0.000	0.08
VVA	0.208	0.984	N/A	0.408	-0.050	1.350	0.061	5	0.000	0.141

Table 6: Summary of vertical accuracy results

Tables 7 and 8 provide the detailed locations and delta calculations for the NVA and VVA checkpoints, respectively. It should be noted that the measurement delta between the 2018 MRCOG urban point (UR07) matches the result noted in the vendor's report for that project. All values are in US Survey Feet.

Name	Easting	Northing	Elev	Lidar TIN	Delta	Delta^2
NVA01	1484334.797	1459780.214	5487.130	5487.220	0.087	0.008
NVA02	1491111.651	1459276.106	5178.970	5179.050	0.081	0.007
NVA03	1495912.036	1458091.508	5035.870	5035.950	0.081	0.006
NVA04	1499433.371	1455490.630	4928.650	4928.660	0.015	0.000
NVA05	1496174.176	1453457.107	5012.520	5012.790	0.274	0.075
NVA06	1487720.729	1456698.223	5312.820	5313.000	0.177	0.031
NVA07	1490438.742	1452276.977	5199.860	5199.970	0.109	0.012
NVA08	1492557.853	1449554.975	5144.530	5144.640	0.113	0.013
NVA09	1498622.003	1447953.359	4935.590	4935.700	0.108	0.012
NVA10	1490649.202	1445251.613	5195.280	5195.410	0.129	0.017
NVA11	1499883.974	1444300.612	4913.720	4913.850	0.131	0.017
NVA12	1496675.909	1444425.023	5006.030	5006.130	0.104	0.011
NVA13	1484917.846	1445204.395	5412.050	5412.150	0.101	0.010
NVA14	1495562.824	1440998.318	5049.050	5049.170	0.121	0.015
NVA15	1489213.415	1441539.225	5313.550	5313.830	0.280	0.078
NVA16	1495023.445	1450860.408	5058.580	5058.660	0.082	0.007
NVA17	1486511.877	1439998.902	5329.700	5329.740	0.040	0.002
NVA19	1493353.665	1438374.070	5154.250	5154.430	0.179	0.032
NVA20	1499767.501	1436720.061	5023.440	5023.360	-0.083	0.007
UR07	1500091.818	1446458.749	4909.070	4909.060	-0.008	0.000

Table 7: Detailed NVA results

Name	Easting	Northing	Elev	Lidar TIN	Delta	Delta^2
VVA01	1498771.004	1447788.875	4918.620	4918.240	-0.376	0.141
VVA02	1499288.874	1444532.700	4924.780	4924.780	-0.004	0.000
VVA03	1486487.326	1439886.202	5328.190	5328.120	-0.068	0.005
VVA04	1493305.614	1438352.468	5156.100	5156.040	-0.064	0.004
VVA05	1499789.157	1440057.386	4939.690	4939.950	0.259	0.067

Table 8: Detailed VVA results

Lidar Data Classification

The lidar classification process encompassed a series of automated and manual steps to classify the calibrated point cloud dataset. Each project represents unique characteristics in terms of cultural features (urbanized vs. rural areas), terrain type, and vegetation coverage. These characteristics were thoroughly evaluated at the onset of the project to ensure that the appropriate automated filters were applied and that subsequent manual filtering yielded correctly classified data.

### Lidar Classification Schema

ESP classified the lidar point cloud in accordance with the following classifications as shown in Table 8, for this task. Additional classifications were assigned based on standard macros. No accuracy of classification is implied for the additional classifications.

FEMA/USGS Minimum Required Classifications	
Class 1 – Processed, but unclassified	Class 18 – High Noise
Class 2 – Bare Earth (ground)	Class 10 – Ignored Ground (Breakline Proximity)
Class 7 - Low Noise	Class 21 - Culverts
Class 9 - Water	Class 17 - Bridge Decks
Class 17 – Bridge Deck	Class 18 – High Noise
Additional Classifications Utilized	
Class 3 – Low Vegetation (0.5-3 ft)	Class 6 – Buildings
Class 4 – Medium Vegetation (3-10 ft)	Class 12 - Overlap
Class 5 – High Vegetation (10-220 ft)	

Table 9: Lidar classifications utilized for this project

It should be noted that no bridges are present within the project AOI. There are box culvert and other structures that the USGS typically does not treat as bridges so these remain in the ground classification.

### Auto Filter (Classification)

Filtering macro(s), which may contain one or more filtering algorithms, were developed and executed to classify lidar points as defined in the classification table. The macros were tested in several portions of the project area to verify the appropriateness of the filters. Often, there is a combination of several filter macros that optimize the filtering based on the unique characteristics of the project. Automatic filtering generally yields a ground surface that is 85-90% valid, so additional editing (hand filtering) is required to produce a more robust ground surface.

## Re-classification Editing

The next task associated with lidar classification was to manually re-classify (or hand-filter) “noise” and other features that may remain in the ground classification after the auto filtering. Cross-sections of the post-auto-filtered surface were viewed to assist in the reclassification of non-ground data artifacts. Certain features such as berms, hilltops, cliffs and other features that may have been aggressively auto-filtered and points were re-classified into the ground classification. Conversely, above-ground artifacts such as decks, bushes, and other subtle features that remained in the ground classification after automated filtering were classified manually out of the layer.

## Hydro-Flattening Breakline Collection

FEMA/USGS specifications require that closed waterbodies 2 acres or greater in size, permanent islands greater than 1 acre in size, and streams/rivers greater than 30 meters in width be collected with hydro-flattening breaklines. For this project, no rivers or islands meeting the USGS minimum map unit (MMU) criteria were observed. Some closed water impoundments do exist and those were collected for this project for the purpose of identification and modeling.

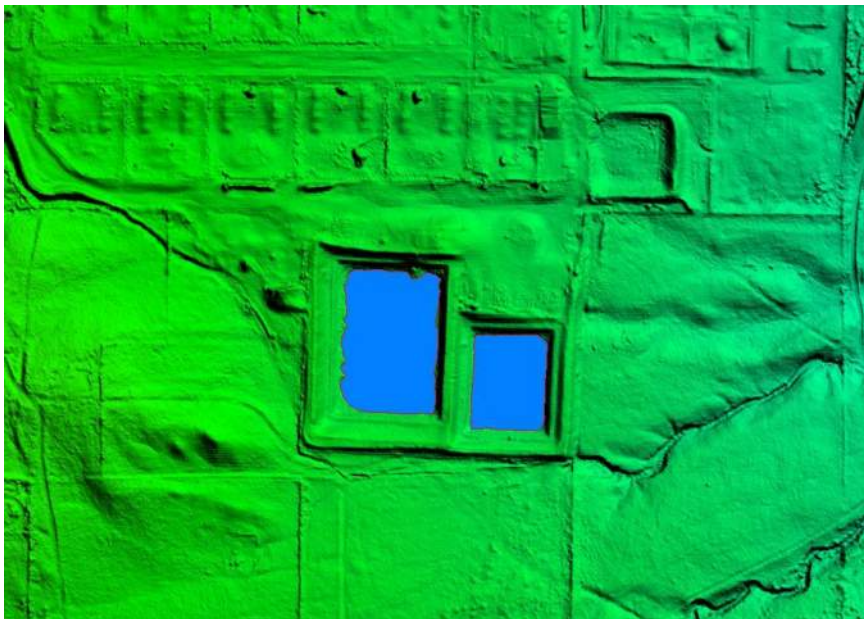


Figure 7: Water impoundments in the Black Mesa AOI

## Raster Digital Elevation Models

Hydro-flattened raster DEMs were produced to facilitate the modeling process. As the project is in English coordinates, the cell size requirement for the DEM raster is 3.125 ft to meet QL2 specifications. Any hydro-flattening linework within the project AOI was utilized in the DEM creation. DEMs were generating using ESP Utilities, proprietary software developed for lidar processing. The DEMs were produced in GeoTIFF format.

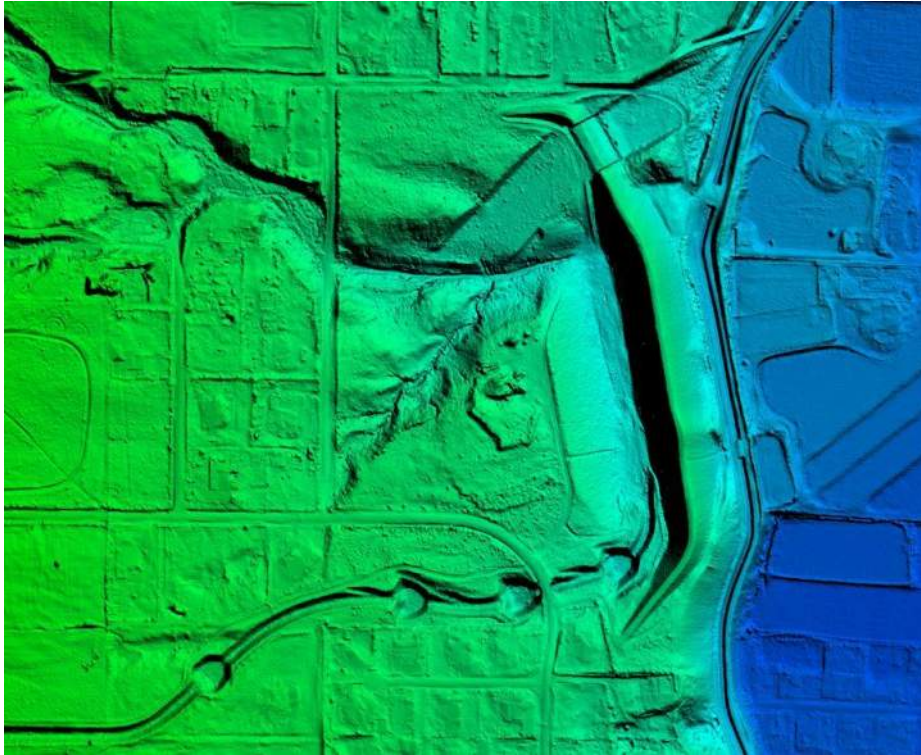


Figure 8: Example of 3.125ft DEM within the AOI

## Preliminary Contours

To assist with some preliminary analysis requirements, ESP generated 1ft contours from the lidar bare earth points using proprietary software, with a contour index of 5ft. The contours were delivered “as is” with no express statement as to the accuracy. Classified ground points from the lidar files were converted to an even grid. This helped to remove the jagged contours common to lidar-derived contour data and smooth the lines. The grid was then used to generate a surface that supported the generations of the contours. No new breaklines were created or used for the process, however any project hydro-flattening layers were used for closed water bodies to help enforce the contours.

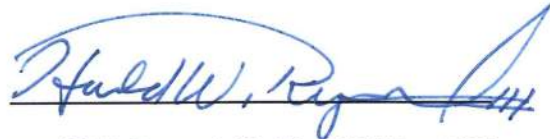


## Accuracy Statement

Due to the availability of independent quality checkpoints, described in this report, ESP conducted vertical accuracy testing on the classified lidar point cloud. The checkpoints were not used in the calibration of the lidar. The data meets FEMA/USGS accuracy specifications for QL2 data as defined by ASPRS. U.S. Survey Foot values in the below statement are rounded to the nearest hundredth.

This data set was tested to meet ASPRS Positional Accuracy Standards for Digital Geospatial Data (2014) for a 10 cm (0.328 ft) RMSEz Vertical Accuracy Class. Actual NVA accuracy was found to be RMSEz = 4 cm (0.134 ft), equating to +/- 7.93 cm (0.26 ft) at 95% confidence level. Actual VVA accuracy was found to be +/- 12 cm (0.41 ft) at the 95th percentile.

**Preparation of Report and Accuracy Calculations and Review Conducted by:**



Harold W. Rempel, III, CP, CMS-Lidar, GISP



12/15/21



## **Appendix D:**

### **Annotated FIRMs and FIS Tables**

Table 13 - Summary of Stillwater Elevations

<u>Area</u>	<u>Pond Invert Elevation (feet NAVD<sup>1</sup>)</u>	<u>Water Surface Elevations (feet NAVD<sup>1</sup>)</u>			
		<u>10-Percent- Annual-Chance</u>	<u>2-Percent- Annual-Chance</u>	<u>1-Percent- Annual-Chance</u>	<u>0.2-Percent- Annual-Chance</u>
Amole Detention Area	*	*	*	5,000.0	*
Arroyo del Oso	*	*	*	5,345.0	*
Arroyo del Pino	*	*	*	6,019.0	*
Basketball Pond	*	*	*	5,421.0	*
Black Arroyo Detention Facility	*	*	*	5,165.0	*
Detention Basin 1	*	*	*	5,430.0	*
Detention Basin 2	*	*	*	5,415.0	*
Detention Basin 3	*	*	*	5,386.0	*
Detention Basin 4	*	*	*	5,359.0	*
Detention Basin 5	*	*	*	5,336.7	*
Detention Basin 5S	*	*	*	5,446.6	*
Detention Basin 6	*	*	*	5,326.0	*
Detention Basin 7	*	*	*	5,305.0	*
Detention Basin 8	*	*	*	5,293.0	*
Detention Basin 9	*	*	*	5,274.0	*
Detention Basin 10	*	*	*	5,252.0	*
Detention Basin 11	*	*	*	5,258.2	*
Detention Basin 12	*	*	*	5,243.1	*
Detention Basin 13	*	*	*	5,243.1	*
Detention Basin 14	*	*	*	5,236.5	*
Detention Basin 15	*	*	*	5,236.5	*
Detention Basin 16	*	*	*	5,231.9	*
Detention Basin 17	*	*	*	5,140.0	*
Don Felipe Dam	*	*	*	4,968.8	*
East Amole Surge Pond	*	*	*	5,525.0	*
Gonzales Pond	4,990.3	*	*	5,007.8	*
Interim Pond 1	*	*	*	5,489.0	*
Interim Pond 2	*	*	*	5,415.0	*
Interim Pond 3	*	*	*	5,374.0	*
Interim Pond 4	*	*	*	5,333.0	*
Hubbell Lake Detention Area	*	*	*	4,928.0	*
Juan Tabo Dam	*	*	*	5,771.0	*

<sup>1</sup>North American Vertical Datum of 1988

\*Data not available

Table 13 - Summary of Stillwater Elevations

Kirtland Detention Pond	*	*	*	5,359.0	*
Lower North Baca Dam	*	*	*	5,320.0	*
McCoy Dam	*	*	*	4,940.8	*
Maplewood Pond	*	*	*	4,936.6	*
Mariposa Detention Facility	*	*	*	5,118.0	*
North Domingo Baca Dam	5,721.4	5,740.3	5,748.0	5,750.8	5,753.3
North Pond	5,204.2	*	*	5,217.8	*
Odelia Park Dam	*	*	*	5,025.0	*
Pajarito Sedimentation Basin	*	*	*	5,000.0	*
Piedras Marcadas	*	*	*	5,032.0	*
Pond 1	5,389.0	5,394.2	5,396.5	5,397.4	5,398.1
Pond 2					
Area Bounded by 98th Street to the east, 102nd Street to the west, Avalon Road to the south, and Bluewater Road to the north	5,252.6	*	*	5,260.4	*
Pond 3	5,526.8	5,529.1	5,531.7	5,532.8	5,533.2
Pond 4	5,570.8	5,574.9	5,575.6	5,575.9	5,576.4
Pond 5					
Area bounded by 98th Street to the east, 102nd Street to the west, Avalon Road to the south, and Bluewater Road to the north	5,253.6	*	*	5,264.3	*
Pond D	*	*	*	5,202.0	*
Ponding Area 6	*	*	*	5,234.0	*
Ponding Area 7	*	*	*	5,197.0	*
Ponding Area 9	*	*	*	5,972.0	*
Ponding Area 10	*	*	*	5,990.0	*
Ponding Area 12	*	*	*	5,928.0	*
Ponding Area 13	*	*	*	5,523.0	*
Ponding Area 18	5,009.8	*	*	5,013.3	*
Ponding Area 20	*	*	*	5,414.0	*
Ponding Area 23	*	*	*	5,474.0	*
Ponding Area 25	*	*	*	5,031.0	*
Ponding Area 27	*	*	*	5,033.0	*
Ponding Area 28	*	*	*	5,030.0	*
Pond No. 6	*	*	*	5,130.0	*
Pond No. 16A	*	*	*	5,108.0	*

<sup>1</sup>North American Vertical Datum of 1988

\*Data not available

Table 13 - Summary of Stillwater Elevations

Pond No. 16B	*	*	*	5,105.0	*
Raymac Dam	*	*	*	4,959.6	*
Retention Pond	*	*	*	5,233.0	*
South Domingo Baca Dam	5,878.8	5,900.8	5,911.3	5,915.4	5,921.4
South Pond	5,201.0	*	*	5,211.2	*
Unnamed Pond					
Area bounded by Sunset Gardens Road to the north, 106th Street to the east and Eucariz Avenue to the south	*	*	*	5,248.7	*
Unnamed Pond					
Area bounded by Duke Avenue to the north and Eucariz Avenue to the south	*	*	*	5,230.9	*
Unnamed Pond					
Generally located along El Camino Arroyo at Beverly Hills Avenue	*	*	*	5,324.0	*
Unnamed Pond					
Generally located south of Acoma Road, north of Southern Avenue SE, and west of Britt Street	*	*	*	5,483.7	*

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NOTES TO USERS

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NGS Information Services  
NOAA, NINGS12  
National Geodetic Survey, SSMC-3, #9202  
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Silver Spring, Maryland 20910-3282  
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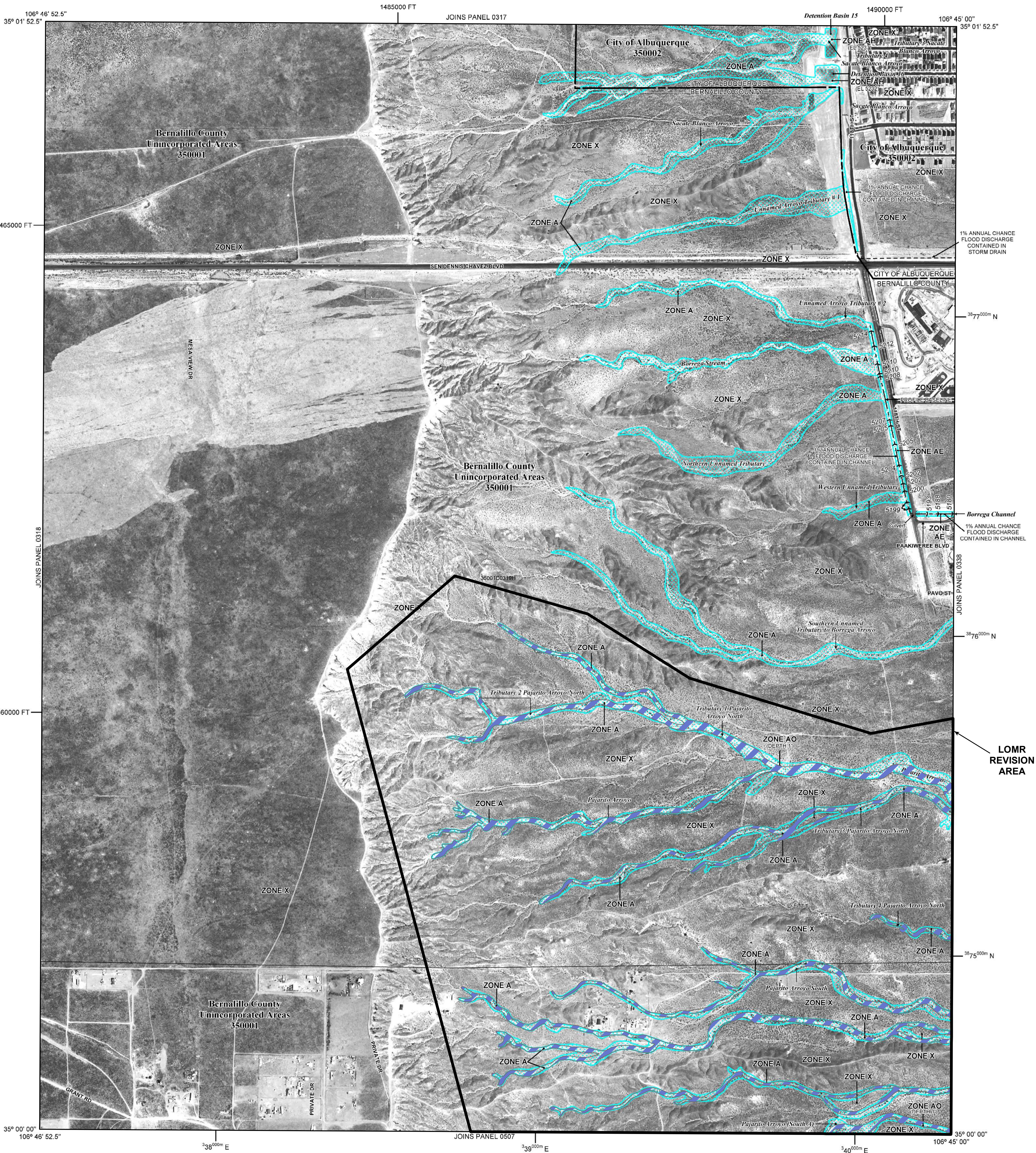


LOMR

Revised 100-Year Floodplain



Shaded X



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- ZONE A No Base Flood Elevations determined.
- ZONE AE Base Flood Elevations determined.
- ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D Boundary
- CBRS and OPA Boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- Base Flood Elevation line and value; elevation in feet
- Base Flood Elevation value where uniform within zone; elevation in feet

\*Referenced to the North American Vertical Datum of 1988

- Cross section line
- Traverse line
- Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- 1000-meter Universal Transverse Mercator grid values, zone 13
- 5000-foot grid ticks: New Mexico State Plane coordinate system, Central zone (FIPS ZONE 3002), Transverse Mercator
- Bench mark (see explanation in Notes to Users section of this FIRM panel)
- River Mile

MAP REPOSITORIES  
Refer to Map Repositories list on Map Index.

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP PANEL

SEPTEMBER 20, 1996

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

April 2, 2002  
November 19, 2003  
September 26, 2008

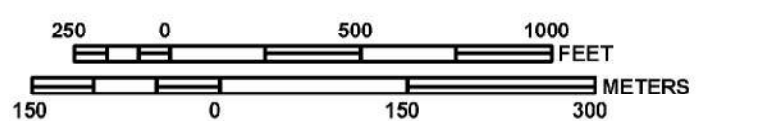
August 16, 2012 - to update corporate limits, to change Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to add roads and road names, to incorporate previously issued Letters of Map Change.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.



MAP SCALE 1" = 500'



PANEL 0319H

**FIRM**  
FLOOD INSURANCE RATE MAP  
BERNALILLO COUNTY,  
NEW MEXICO  
AND INCORPORATED AREAS

PANEL 319 OF 825

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:			
COMMUNITY	NUMBER	PANEL	SUFFIX
ALBUQUERQUE, CITY OF	350002	0319	H
BERNALILLO COUNTY UNINCORPORATED AREAS	350001	0319	H

REVISED TO REFLECT  
LOMR EFFECTIVE:

Notice to User: The Map Number shown below should be used when placing map orders, the Community Number shown above should be used on insurance applications for the subject community.



MAP NUMBER  
35001C0319H

MAP REVISED  
AUGUST 16, 2012

Federal Emergency Management Agency



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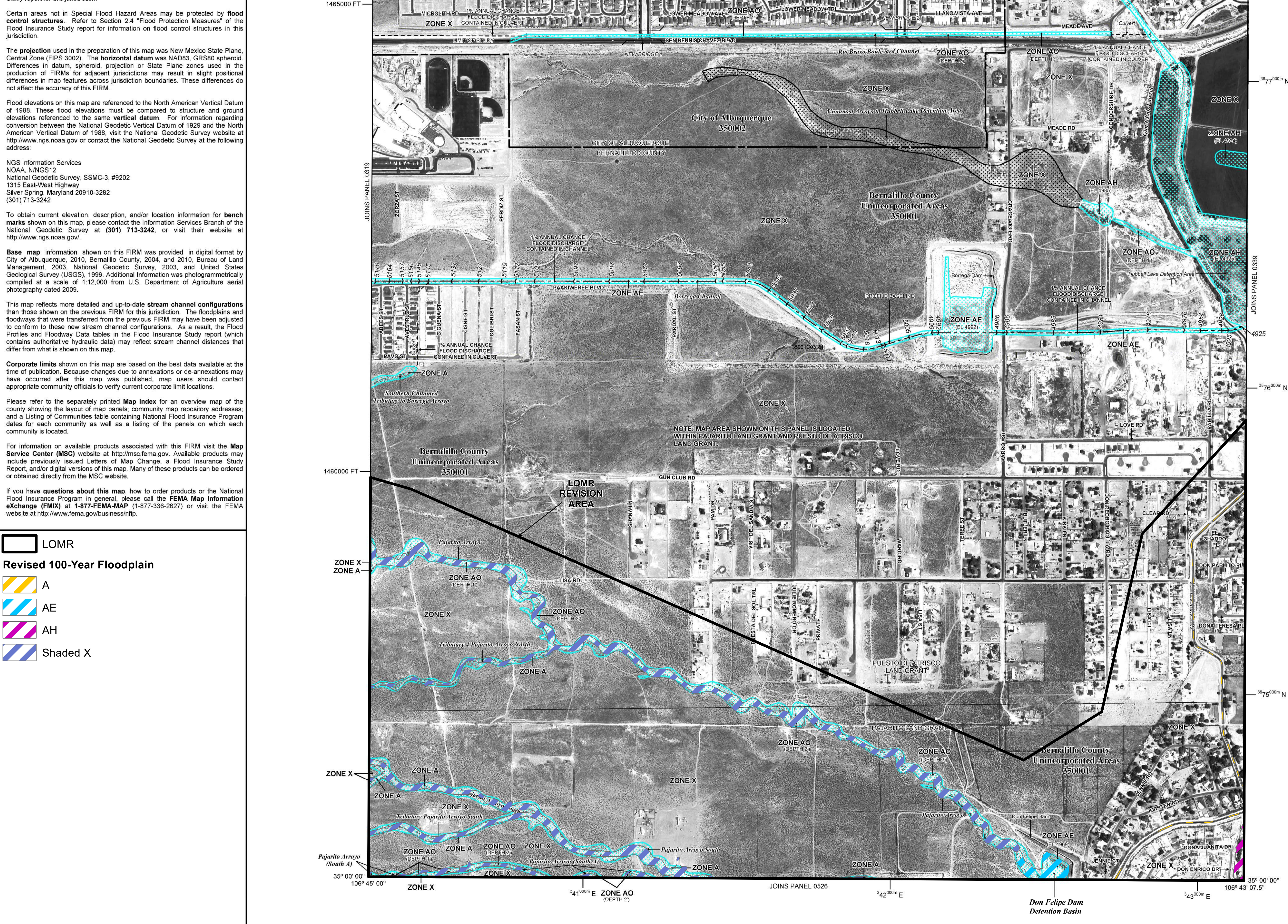
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LOMR

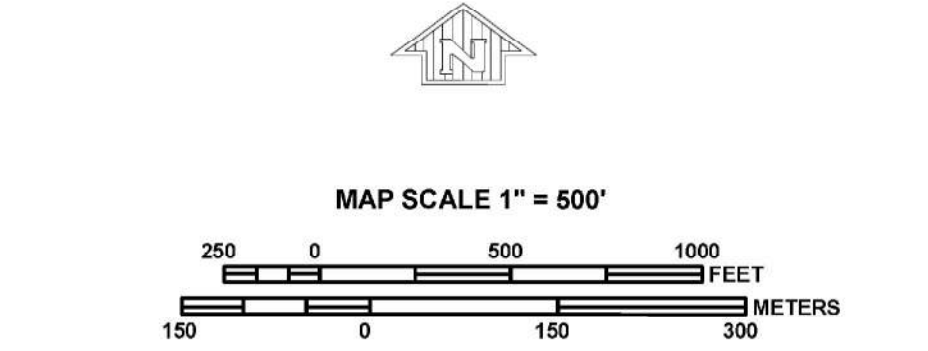
Revised 100-Year Floodplain

- A
- AE
- AH
- Shaded X



LEGEND

- SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD**
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September 26, 2008  
August 16, 2012 - to update corporate limits, to change Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to add roads and road names, to incorporate previously issued Letters of Map Change.



NATIONAL FLOOD INSURANCE PROGRAM

FIRM

PANEL 0338H

FLOOD INSURANCE RATE MAP

BERNALILLO COUNTY, NEW MEXICO

AND INCORPORATED AREAS

PANEL 338 OF 825

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ALBUQUERQUE, CITY OF	350002	0338	H
BERNALILLO COUNTY			
UNINCORPORATED AREAS	350001	0338	H

REVISED TO REFLECT LOMR EFFECTIVE:

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MAP NUMBER

35001C0338H

MAP REVISED

AUGUST 16, 2012

Federal Emergency Management Agency



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(301) 713-3242

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**Base map** information shown on this FIRM was provided in digital format by City of Albuquerque, 2010, Bernalillo County, 2004, and 2010, Bureau of Land Management, 2003, National Geodetic Survey, 2003, and United States Geological Survey (USGS), 1999. Additional information was photogrammetrically compiled at a scale of 1:12,000 from U.S. Department of Agriculture aerial photography dated 2009.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

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For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at <http://msc.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

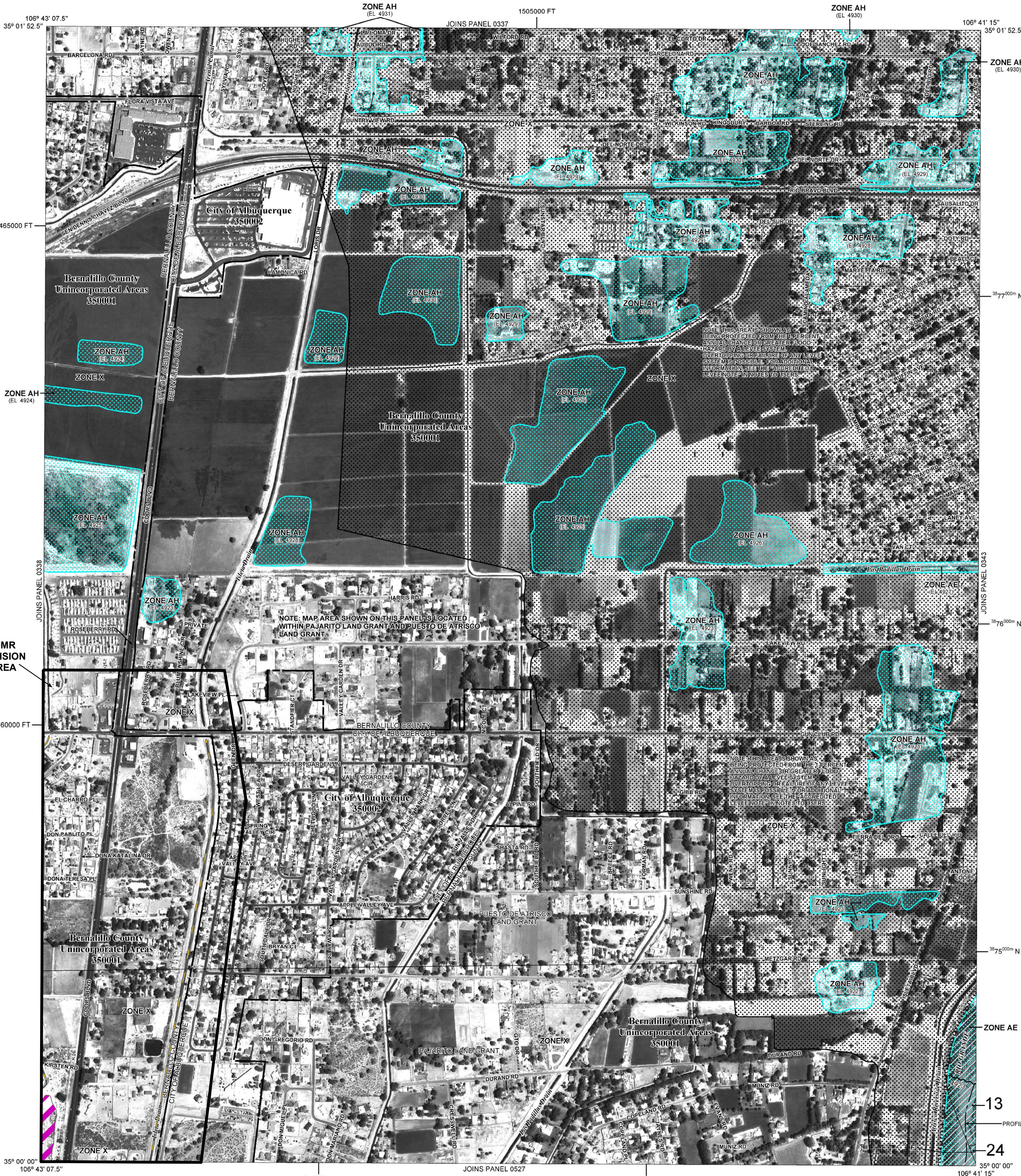
If you have **questions about this map**, how to order products or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/business/nfp>.

**Accredited Levee Notes to Users:** Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at <http://www.fema.gov/business/nfp/index.shtm>.

LOMR

Revised 100-Year Floodplain

A  
AH





NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

**Coastal Base Flood Elevations** shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures in this jurisdiction.

The **projection** used in the preparation of this map was New Mexico State Plane, Central Zone. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address:

NGS Information Services  
NOAA, N/NGS12  
National Geodetic Survey, SSMC-3, #9202  
1315 East-West Highway  
Silver Spring, Maryland 20910-3282  
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit their website at <http://www.ngs.noaa.gov>.

**Base map** information shown on this FIRM was provided in digital format by Bernalillo County produced at a scale of 1:12,000 from photography dated 1999 or later.

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations** and **floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for the Flood Insurance Study report may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

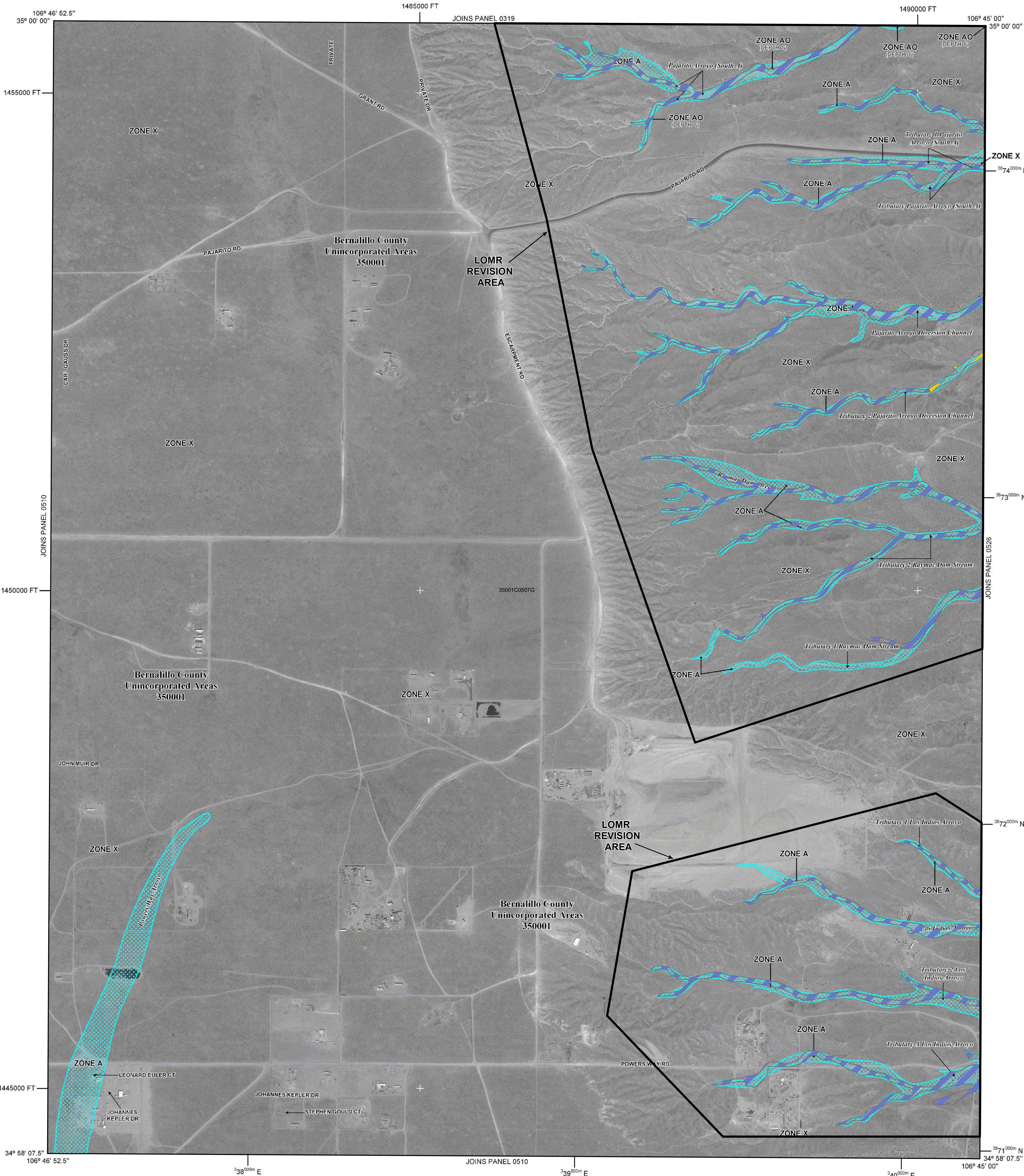
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Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and their website at <http://www.msc.fema.gov>.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/business/nfip>.

- LOMR
- Revised 100-Year Floodplain
- A
- Shaded X



SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equalled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A

No Base Flood Elevations determined.

ZONE AE

Base Flood Elevations determined.

ZONE AH

Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO

Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR

Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently dewatered. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99

Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE VE

Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X

Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance or greater flood.

OTHER AREAS

ZONE X

Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D

Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

Base Flood Elevation line and value; elevation in feet\* (EL 987)

Base Flood Elevation value where uniform within zone; elevation in feet\*

\*Referenced to the North American Vertical Datum of 1988

Cross section line

Transect line

Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere

1000-meter Universal Transverse Mercator grid values, zone 13

5000-foot grid ticks: New Mexico State Plane coordinate system, Central zone (FIPSZONE 3002), Transverse Mercator

Bench mark (see explanation in Notes to Users section of this FIRM panel)

ML5

River Mile

MAP REPOSITORIES

Refer to Map Repositories list on Map Index.

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP PANEL

SEPTEMBER 20, 1996

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

April 2, 2002 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to add roads and road names, to reflect updated topographic information, and to incorporate previously issued Letters of Map Revision.

November 19, 2003 - to update corporate limits and to incorporate previously issued Letters of Map Revision.

September 26, 2008 - to update corporate limits, to change Special Flood Hazard Areas, to add roads and road names, to incorporate previously issued Letters of Map Revision, to reflect updated topographic information, to change Base Flood Elevations, to add Base Flood Elevations.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0507G

FIRM

FLOOD INSURANCE RATE MAP

BERNALILLO COUNTY, NEW MEXICO AND INCORPORATED AREAS

PANEL 507 OF 825

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BERNALILLO COUNTY			
UNINCORPORATED AREAS	350001	0507	G

REVISED TO REFLECT LOMR EFFECTIVE:

Notice to User: The Map Number shown below should be used when placing map orders. The Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER

35001C0507G

MAP REVISED

SEPTEMBER 26, 2008

Federal Emergency Management Agency



NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the **Flood Profiles and Floodway Data** and/or **Summary of Stillwater Elevations** tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

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Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures in this jurisdiction.

The **projection** used in the preparation of this map was New Mexico State Plane, Central Zone (FIPS 3002). The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address:

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NOAA/NNGS12  
National Geodetic Survey, SSMC-3, #9202  
1315 East-West Highway  
Silver Spring, Maryland 20910-3282  
(301) 713-3242

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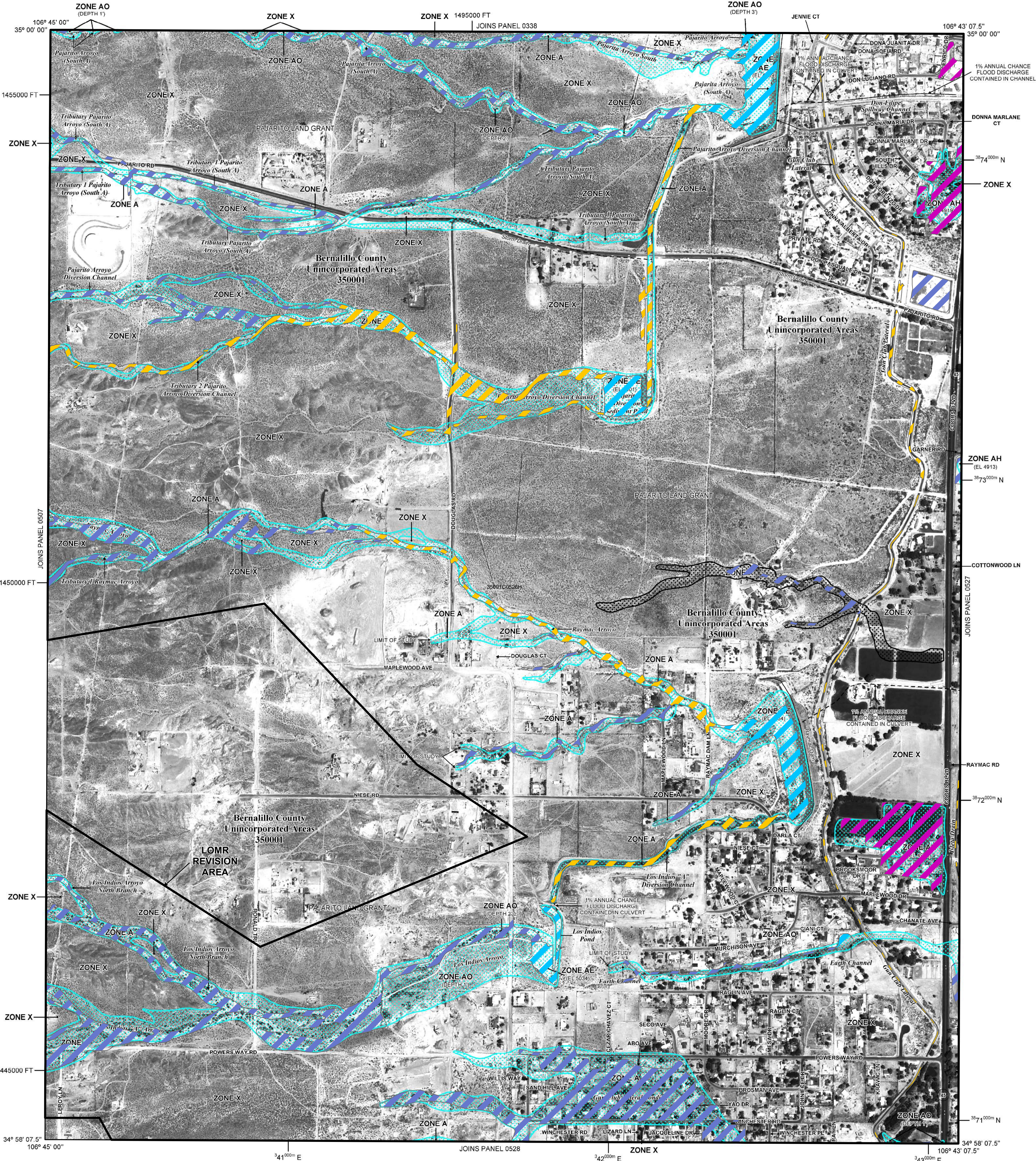
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LOMR

Revised 100-Year Floodplain

- A
- AE
- AH
- Shaded X



LEGEND

- SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD**
  - The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.
- ZONE A**
  - No Base Flood Elevations determined.
- ZONE AE**
  - Base Flood Elevations determined.
- ZONE AH**
  - Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- ZONE AO**
  - Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE AR**
  - Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE A99**
  - Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE VE**
  - Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.
- FLOODWAY AREAS IN ZONE AE**
  - The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.
- OTHER FLOOD AREAS**
  - ZONE X**
    - Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot, or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
  - ZONE D**
    - Areas determined to be outside the 0.2% annual chance floodplain. Areas in which flood hazards are undetermined, but possible.
- COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**
- OTHERWISE PROTECTED AREAS (OPAs)**
  - CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.
- 1% annual chance floodplain boundary**
- 0.2% annual chance floodplain boundary**
- Floodway boundary**
- Zone D boundary**
- CBRS and OPA boundary**
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, Flood depths or flood velocities.**
- Base Flood Elevation line and value; elevation in feet\***
- Base Flood Elevation value where uniform within zone; elevation in feet**
- \*Referenced to the North American Vertical Datum of 1988**
- Cross section line**
- Transect line**
- Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere**
- 1000-meter Universal Transverse Mercator grid values, zone 13**
- 5000-foot grid ticks: New Mexico State Plane coordinate system, Central zone (FIPS3002), Transverse Mercator**
- Bench mark (see explanation in Notes to Users section of this FIRM panel)**
- River Mile**

**MAP REPOSITORIES**  
Refer to Map Repositories list on Map Index.

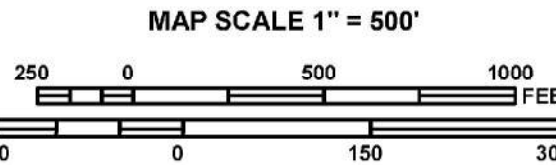
**EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP PANEL**  
SEPTEMBER 20, 1996

**EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL**  
April 2, 2002  
November 19, 2003  
September 25, 2008

August 16, 2012 - to update corporate limits, to change Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to add roads and road names, to incorporate previously issued Letters of Map Change.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.



NATIONAL FLOOD INSURANCE PROGRAM

FIRM

PANEL 0526H

FIRM

FLOOD INSURANCE RATE MAP

BERNALILLO COUNTY, NEW MEXICO

AND INCORPORATED AREAS

PANEL 526 OF 825

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY: BERNALILLO COUNTY UNINCORPORATED AREAS

NUMBER: 350001

PANEL: 0526

SUFFIX: H

REVISED TO REFLECT LOMR EFFECTIVE:

Notice to User: The Map Number shown below should be used when placing map orders. The Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER 35001C0526H

MAP REVISED AUGUST 16, 2012

Federal Emergency Management Agency







NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the **Flood Profiles and Floodway Data** and/or **Summary of Stillwater Elevations** tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

**Coastal Base Flood Elevations** shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction, and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures in this jurisdiction.

The **projection** used in the preparation of this map was New Mexico State Plane, Central Zone (FIPS 3002). The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

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This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

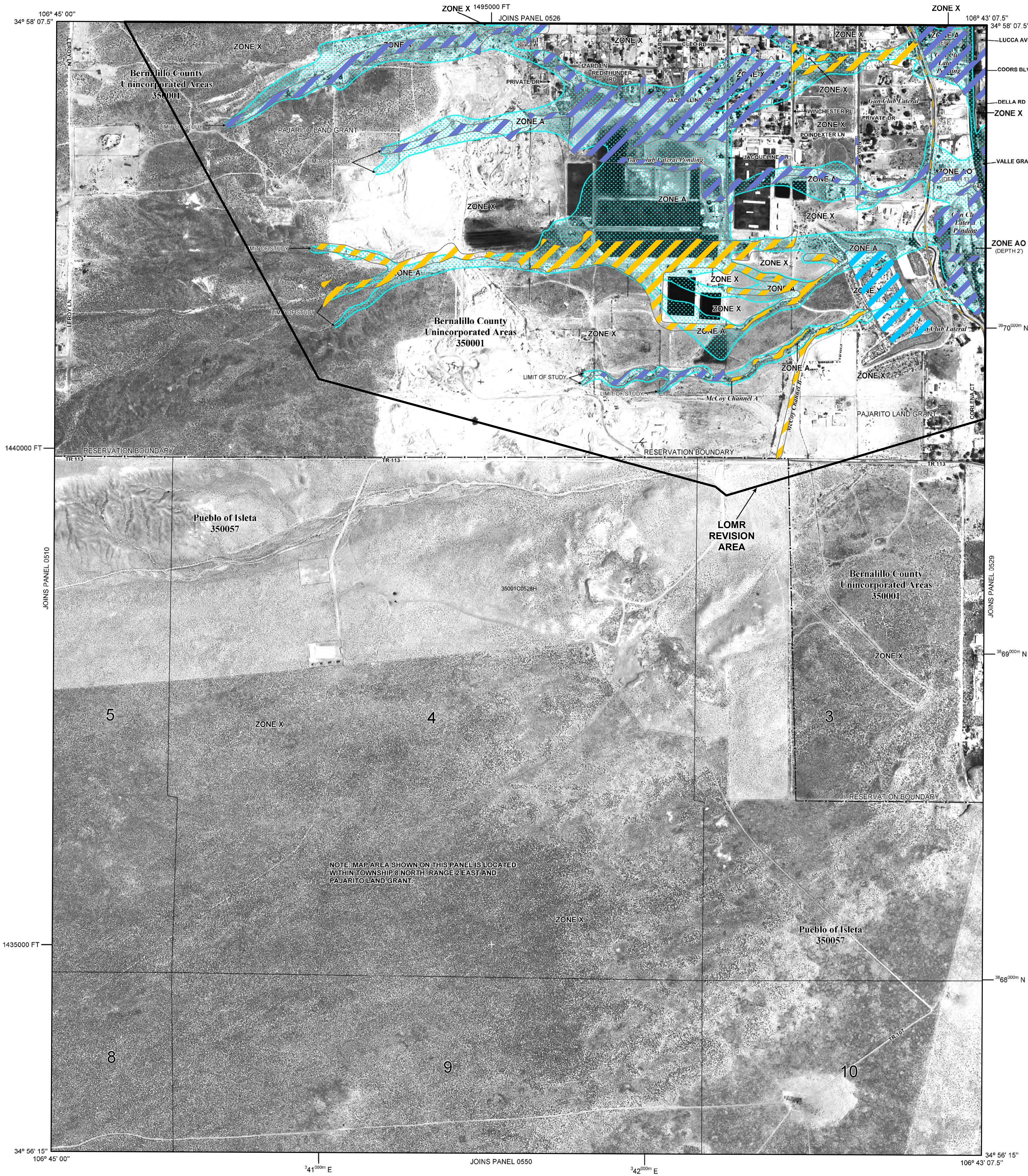
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- LOMR
- Revised 100-Year Floodplain
- A
- AE
- Shaded X



SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A

No Base Flood Elevations determined.

ZONE AE

Base Flood Elevations determined.

ZONE AH

Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO

Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR

Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99

Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE VE

Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X

Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X

Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D

Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D Boundary

CBRS and OPA Boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

Base Flood Elevation line and value; elevation in feet\*

Base Flood Elevation value where uniform within zone; elevation in feet\*

\*Referenced to the North American Vertical Datum of 1988

Cross section line

Transect line

Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere

1000-meter Universal Transverse Mercator grid values, zone 13

5000-foot grid ticks: New Mexico State Plane coordinate system, Central zone (FIPSZONE 3002), Transverse Mercator

Bench mark (see explanation in Notes to Users section of this FIRM panel)

River Mile

MAP REPOSITORIES

Refer to Map Repositories list on Map Index.

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP PANEL

SEPTEMBER 20, 1996

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

April 2, 2002  
November 13, 2003  
September 26, 2008

August 16, 2012 - to update corporate limits, to change Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to add roads and road names, to incorporate previously issued Letters of Map Change.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0528H

FIRM

FLOOD INSURANCE RATE MAP

BERNALILLO COUNTY, NEW MEXICO

AND INCORPORATED AREAS

PANEL 528 OF 825

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY

NUMBER

PANEL

SUFFIX

BERNALILLO COUNTY

350001

0528

H

UNINCORPORATED AREAS

350057

0528

H

ISLETA, PUEBLO OF

REVISED TO REFLECT LOMR EFFECTIVE:

Notice to User: The Map Number shown below should be used when placing map orders. The Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER

35001C0528H

MAP REVISED

AUGUST 16, 2012

Federal Emergency Management Agency



NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the **Flood Profiles and Floodway Data** and/or **Summary of Stillwater Elevations** tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

**Coastal Base Flood Elevations** shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction, and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures in this jurisdiction.

The **projection** used in the preparation of this map was New Mexico State Plane, Central Zone (FIPS 3002). The **horizontal datum** was NAD83, GR80 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address:

NGS Information Services  
NOAA, NWS/12  
National Geodetic Survey, SSMC-3, #9202  
1315 East-West Highway  
Silver Spring, Maryland 20910-3282  
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit their website at <http://www.ngs.noaa.gov/>.

**Base map** information shown on this FIRM was provided in digital format by City of Albuquerque, 2010, Bernalillo County, 2004, and 2010, Bureau of Land Management, 2003, National Geodetic Survey, 2003, and United States Geological Survey (USGS), 1999. Additional information was photogrammetrically compiled at a scale of 1:12,000 from U.S. Department of Agriculture aerial photography dated 2009.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

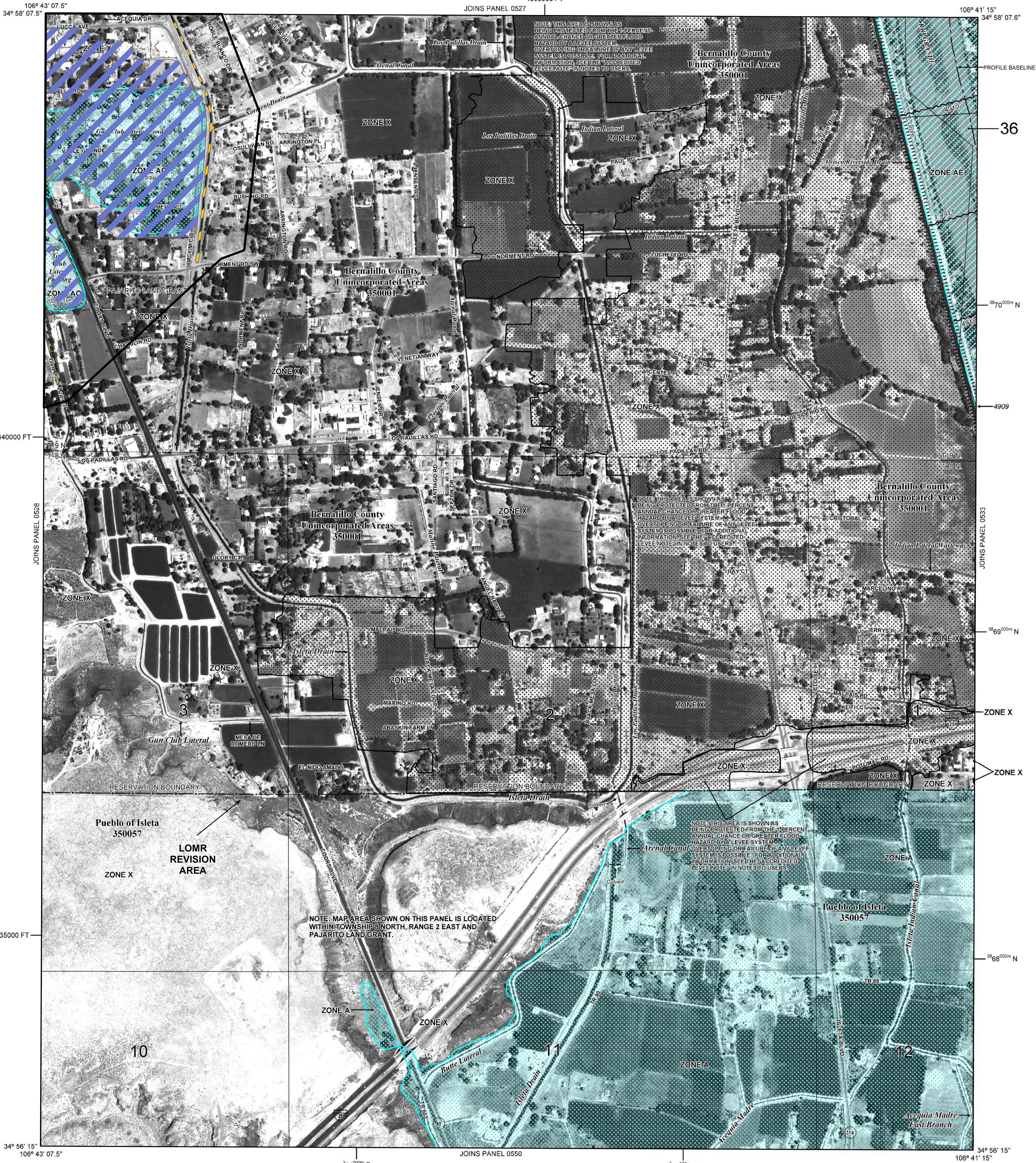
For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at <http://msc.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/business/nfp>.

**Accredited Levee Notes to Users:** Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at <http://www.fema.gov/business/nfp/index.shtm>.

- LOMR
- A
- Shaded X

Revised 100-Year Floodplain

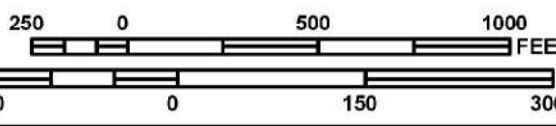


LEGEND

- SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD**
  - The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.
- ZONE A**
  - No Base Flood Elevations determined.
- ZONE AE**
  - Base Flood Elevations determined.
- ZONE AH**
  - Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- ZONE AO**
  - Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE AR**
  - Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently deteriorated. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE A99**
  - Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE VE**
  - Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.
- FLOODWAY AREAS IN ZONE AE**
  - The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.
- OTHER FLOOD AREAS**
  - ZONE X**
    - Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
  - ZONE D**
    - Areas determined to be outside the 0.2% annual chance floodplain. Areas in which flood hazards are undetermined, but possible.
- COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**
- OTHERWISE PROTECTED AREAS (OPAs)**
  - CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.
- 1% annual chance floodplain boundary**
- 0.2% annual chance floodplain boundary**
- Floodway boundary**
- Zone D Boundary**
- CBRS and OPA Boundary**
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.**
- Base Flood Elevation line and value: elevation in feet\***
- Base Flood Elevation value where uniform within zone; elevation in feet\***
- \*Referenced to the North American Vertical Datum of 1988**
- Cross section line**
- Transect line**
- Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere**
- 1000-meter Universal Transverse Mercator grid values, zone 13**
- 5000-foot grid ticks: New Mexico State Plane coordinate system, Central zone (FIPS 3002), Transverse Mercator**
- Bench mark (see explanation in Notes to Users section of this FIRM panel)**
- River Mile**
- MAP REPOSITORIES**
  - Refer to Map Repositories list on Map Index.
- EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP PANEL**
  - SEPTEMBER 20, 1996
- EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL**
  - April 2, 2002
  - November 19, 2003
  - September 26, 2008
  - August 16, 2012 - to update corporate limits, to change Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to add roads and road names, to incorporate previously issued Letters of Map Change.
- For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.**
- To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.**



MAP SCALE 1" = 500'



**PANEL 0529H**

**FIRM**

**FLOOD INSURANCE RATE MAP**

**BERNALILLO COUNTY, NEW MEXICO AND INCORPORATED AREAS**

**PANEL 529 OF 825**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

**CONTAINS:**

COMMUNITY	NUMBER	PANEL	SUFFIX
BERNALILLO COUNTY UNINCORPORATED AREAS	350001	0529	H
ISLETA, PUEBLO OF	350057	0529	H

**REVISED TO REFLECT LOMR EFFECTIVE:**

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

**MAP NUMBER**  
35001C0529H

**MAP REVISED**  
AUGUST 16, 2012

Federal Emergency Management Agency



## **Appendix E:**

### **MT-2 Application Forms**



DEPARTMENT OF HOMELAND SECURITY  
Federal Emergency Management Agency  
**OVERVIEW & CONCURRENCE FORM**

OMB Control Number: 1660-0016  
Expiration: 1/31/2024

**PAPERWORK BURDEN DISCLOSURE NOTICE**

Public reporting burden for this form is estimated to average 1 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless it displays a valid OMB control number. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 500 C Street, SW, Washington, DC 20472 , Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

**PRIVACY ACT STATEMENT**

**AUTHORITY:** The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

**PRINCIPAL PURPOSE(S):** This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

**ROUTINE USE(S):** The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP); Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

**DISCLOSURE:** The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a (NFIP) Flood Insurance Rate Maps (FIRM).

**A. REQUESTED RESPONSE FROM DHS-FEMA**

This request is for a (check one):

☐ CLOMR: A letter from DHS-FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision or proposed hydrology changes (See 44 CFR Ch. 1, Parts 60, 65 & 72). All CLOMRs require documentation of compliance with the Endangered Species Act. Refer to the Instructions for details.

☐ LOMR: A letter from DHS-FEMA officially revising the current NFIP map to show the changes to floodplains, regulatory floodway or flood elevations. (See 44 CFR Ch. 1, Parts 60, 65 & 72).

**B. OVERVIEW**

1. The NFIP map panel(s) affected for all impacted communities is (are):

Community No.	Community Name	State	Map No.	Panel No.	Effective Date

2. a. Flooding Source:

b. Types of Flooding: ☐ Riverine ☐ Coastal ☐ Shallow Flooding (e.g., Zones AO and AH)  
☐ Alluvial Fan ☐ Lakes ☐ Other (Attach Description)

3. Project Name/Identifier:

4. FEMA zone designations (choices: A, AH, AO, A1-A30, A99, AE, AR, V, V1-V30, VE, B, C, D, X)

a. Effective:

b. Revised:



5. Basis for Request and Type of Revision:

a. The basis for this revision request is (check all that apply)

- |  |  |   |   |
|--|--|---|---|
| <input type="checkbox"/> Physical Change                 | <input type="checkbox"/> Improved Methodology/Data     | <input type="checkbox"/> Regulatory Floodway Revision   | <input type="checkbox"/> Base Map Changes       |
| <input type="checkbox"/> Coastal Analysis                | <input checked="" type="checkbox"/> Hydraulic Analysis | <input checked="" type="checkbox"/> Hydrologic Analysis | <input checked="" type="checkbox"/> Corrections |
| <input checked="" type="checkbox"/> Weir-Dam Changes     | <input type="checkbox"/> Levee Certification           | <input type="checkbox"/> Alluvial Fan Analysis          | <input type="checkbox"/> Natural Changes        |
| <input checked="" type="checkbox"/> New Topographic Data | <input type="checkbox"/> Other (Attach Description)    |   |   |

Note: A photograph and narrative description of the area of concern is not required, but is very helpful during review.

b. The area of revision encompasses the following structures (check all that apply)

- Structures:
- |   |  |   |
|---|--|---|
| <input type="checkbox"/> Channelization | <input type="checkbox"/> Levee/Floodwall | <input checked="" type="checkbox"/> Bridge/Culvert  |
| <input checked="" type="checkbox"/> Dam | <input type="checkbox"/> Fill            | <input type="checkbox"/> Other (Attach Description) |

6. ☐ Documentation of ESA compliance is submitted (required to initiate CLOMR review). Please refer to the instructions for more information.

C. REVIEW FEE

Has the review fee for the appropriate request category been included?

- ☐ Yes      Fee amount: \$ \_\_\_\_\_
- ☒ No, Attach Explanation

- Please see the DHS-FEMA Web site at <http://www.fema.gov/forms-documents-and-software/flood-map-related-fees> for Fee Amounts and Exemptions.

D. SIGNATURES

1. REQUESTOR'S SIGNATURE

All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Name: <b>NICOLE FRIEDT</b>	Company: <b>AMAFCA</b>
Mailing Address: <b>2600 Prospect Ave NE Albuquerque, NM 87107</b>	Daytime Telephone: <b>505 884 2215</b> Fax No.: <b>505</b>
	E-mail Address: <b>nfriedt@amafca.org</b>
	Date: <b>5/15/2023</b>

Signature of Requestor (required): 

2. COMMUNITY CONCURRENCE

As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of Map Revision (LOMR) or conditional LOMR request. Based upon the community's review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, including the requirements for when fill is placed in the regulatory floodway, and that all necessary Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. For Conditional LOMR requests, the applicant has documented Endangered Species Act (ESA) compliance to FEMA prior to FEMA's review of the Conditional LOMR application. For LOMR requests, I acknowledge that compliance with Sections 9 and 10 of the ESA has been achieved independently of FEMA's process. For actions authorized, funded, or being carried out by Federal or State agencies, documentation from the agency showing its compliance with Section 7(a)(2) of the ESA will be submitted. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44CFR 65.2(c), and that we have available upon request by FEMA, all analyses and documentation used to make this determination.

Community Official's Name and Title: **Elias Archuleta, P.E., Deputy County Manager/County Engineer**

Mailing Address: <b>415 Silver Ave SW Albuquerque, NM 87102</b>	Community Name: <b>Bernalillo County</b>
	Daytime Telephone: <b>505-319-8981</b> Fax No.: <b>N/A</b>
	E-mail Address: <b>earchuleta@bernco.gov</b>

Community Official's Signature (required): 

Date: **6/5/2023**



### 3. CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is to be signed and sealed by a licensed land surveyor, registered professional engineer, or architect authorized by law to certify elevation information data, hydrologic and hydraulic analysis, and any other supporting information as per NFIP regulations paragraph 65.2(b) and as described in the MT-2 Forms Instructions. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier's Name: Mathew Hornack, PE, CFM		License No.: 25590	Expiration Date: 12/31/2024
Company Name: ESP Associates, Inc.		Mailing Address: 2200 Gateway Centre Boulevard Suite 216 Morrisville, NC 27560	
Telephone No.: 9196781070	Fax No.:		
E-mail Address: mhornack@espassociates.com			
Signature: Mathew C. Hornack			Date: 5/5/2023

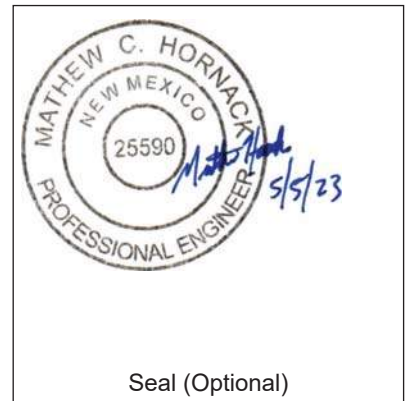
Digitally signed by Mathew C. Hornack  
DN: cn=Mathew C. Hornack, o=ESP Associates, Inc., ou=RE7, email=mathornack@espassociates.com, c=US  
Date: 2023.05.05 14:10:55 -0400

**Ensure the forms that are appropriate to your revision request are included in your submittal.**

**Form Name and (Number)**

**Required if ...**

- |   |   |
|---|---|
| <input checked="" type="checkbox"/> Riverine Hydrology and Hydraulics Form (Form 2) | New or revised discharges or water-surface elevations   |
| <input checked="" type="checkbox"/> Riverine Structures Form (Form 3)               | Channel is modified, addition/revision of bridge/culverts, addition/revision of levee/floodwall, addition/revision of dam |
| <input type="checkbox"/> Coastal Analysis Form (Form 4)                             | New or revised coastal elevations   |
| <input type="checkbox"/> Coastal Structures Form (Form 5)                           | Addition/revision of coastal structure  |
| <input type="checkbox"/> Alluvial Fan Flooding Form (Form 6)                        | Flood control measures on alluvial fans   |





## Fee Exemption Request

Fee exemption support information, including a letter from USACE, financial documentation and a cost share letter, have been provided as digital attachments to support the fee exemption request for this LOMR. As discussed within the narrative, this entire project was initially designed by USACE in the late 90s. The main outlet pipe was constructed by the US Army Corps of Engineers (USACE), but the project ran out of funding and AMAFCA was forced to take it over.



DEPARTMENT OF HOMELAND SECURITY  
Federal Emergency Management Agency  
**RIVERINE HYDROLOGY & HYDRAULICS FORM (FORM 2)**

OMB Control Number: 1660-0016  
Expiration: 1/31/2024

**PAPERWORK BURDEN DISCLOSURE NOTICE**

Public reporting burden for this form is estimated to average 3.5 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless it displays a valid OMB control number. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 500 C Street, SW, Washington, DC 20472, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

**PRIVACY ACT STATEMENT**

**AUTHORITY:** The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

**PRINCIPAL PURPOSE(S):** This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

**ROUTINE USE(S):** The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP); Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

**DISCLOSURE:** The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a (NFIP) Flood Insurance Rate Maps (FIRM).

Flooding Source: Pajarito Arroyo, Raymac Arroyo, Los Indios Arroyo, Isleta Arroyo

**Note:** Fill out one form for each flooding source studied

**A. HYDROLOGY**

1. Reason for New Hydrologic Analysis (check all that apply):

- |  |  |  |
|--|--|--|
| <input type="checkbox"/> Not revised (skip to section B) | <input checked="" type="checkbox"/> No existing analysis | <input checked="" type="checkbox"/> Improved data                |
| <input type="checkbox"/> Alternative methodology         | <input type="checkbox"/> Proposed Conditions (CLOMR)     | <input type="checkbox"/> Changed physical condition of watershed |

2. Comparison of Representative 1%-Annual-Chance Discharges

Location	Drainage Area (Sq. Mi.)	Effective/FIS (cfs)	Revised (cfs)
----------	-------------------------	---------------------	---------------

3. Methodology for New Hydrologic Analysis (check all that apply)

- ☒ Precipitation/Runoff Model → Specify Model: HEC-RAS      Duration: 24 hours      Rainfall Amount: 2.65 inches
- ☐ Statistical Analysis of Gage Records
- ☐ Regional Regression Equations      ☐ Other (please attach description)

Please enclose all relevant models in digital format, maps, computations (including computation of parameters), and documentation to support the new analysis.

4. Review/Approval of Analysis

If your community requires a regional, state, or federal agency to review the hydrologic analysis, please attach evidence of approval/review.

4. HEC-RAS File Description\*\*:

5. Impacts of Sediment Transport on Hydrology

Is the hydrology for the revised flooding source(s) affected by sediment transport?      ☐ Yes      ☒ No

If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation.



## B. HYDRAULICS

### 1. Reach to be Revised

Description	Cross Section	Water-Surface Elevation (ft.)	
		Effective	Proposed/Revised
Downstream Limit*			
Upstream Limit*			

\*Proposed/Revised elevations must tie-into the Effective elevations within 0.5 foot at the downstream and upstream limits of revision.

### 2. Hydraulic Method/Model Used: \_\_\_\_\_

☐ Steady State    ☐ Unsteady State    ☐ One-Dimensional    ☐ Two-Dimensional

### 3. Pre-Submittal Review of Hydraulic Models\*

DHS-FEMA has developed two review programs, CHECK-2 and CHECK-RAS, to aid in the review of HEC-2 and HEC-RAS hydraulic models, respectively. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS.

### 4. HEC-RAS File Description\*\*:

Models Submitted	Natural Run		Floodway Run		Datum
Duplicate Effective Model*	File Name:	Plan Name:	File Name:	Plan Name:	
Corrected Effective Model*	File Name:	Plan Name:	File Name:	Plan Name:	
Existing or Pre-Project Conditions Model	File Name:	Plan Name:	File Name:	Plan Name:	
Revised or Post-Project Conditions Model	File Name:	Plan Name:	File Name:	Plan Name:	
Other - (attach description)	File Name:	Plan Name:	File Name:	Plan Name:	

\* For details, refer to the corresponding section of the instructions.

\*\*See instructions for information about modeling other than HEC-RAS. ☐ Digital Models Submitted? (Required)

## C. MAPPING REQUIREMENTS

A **certified topographic work map** must be submitted showing the following information (where applicable): the boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1%- and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions); location and alignment of all cross sections with stationing control indicated; stream, road, and other alignments (e.g., dams, levees, etc.); current community easements and boundaries; boundaries of the requester's property; certification of a registered professional engineer registered in the subject State; location and description of reference marks; and the referenced vertical datum (NGVD, NAVD, etc.).

Topographic Information:

☐ Digital Mapping (GIS/CADD) Data Submitted (preferred)

Source:

Date:

Vertical Datum:

Spatial Projection:

Accuracy:

Note that the boundaries of the existing or proposed conditions floodplains and regulatory floodway to be shown on the revised FIRM and/or FBFM must tie-in with the effective floodplain and regulatory floodway boundaries. Please attach a **copy of the effective FIRM and/or FBFM**, at the same scale as the original, annotated to show the boundaries of the revised 1%-and 0.2%-annual-chance floodplains and regulatory floodway that tie-in with the boundaries of the effective 1%-and 0.2%-annual-chance floodplain and regulatory floodway at the upstream and downstream limits of the area on revision.

☐ Annotated FIRM and/or FBFM (Required)



#### D. COMMON REGULATORY REQUIREMENTS\*

1. For LOMR/CLOMR requests, do Base Flood Elevations (BFEs) or Special Flood Hazard Areas (SFHAs) increase compared to the effective BFEs? ☒ Yes ☐ No
- If Yes, please attach **proof of property owner notification**. Examples of property owner notifications can be found in the MT-2 Form 2 Instructions.
2. For CLOMR requests, if either of the following is true, please submit **evidence of compliance with Section 65.12 of the NFIP regulations**:
- The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot compared to pre-project conditions.
  - The proposed project encroaches upon a SFHA with or without BFEs established and would result in increases above 1.00 foot compared to pre-project conditions.
3. Does the request involve the placement or proposed placement of fill? ☒ Yes ☐ No
- If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures or proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in accordance with the NFIP regulations set forth at 44 CFR 60.3(A)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more information.
4. Does the request involve the placement or proposed placement of fill? ☐ Yes ☒ No
- If Yes, attach **evidence of regulatory floodway revision notification**. As per Paragraph 65.7(b)(1) of the NFIP Regulations, notification is required for requests involving revisions to the regulatory floodway Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.
5. For CLOMR requests, please submit documentation to FEMA and the community to show that you have complied with Sections 9 and 10 of the Endangered Species Act (ESA). For actions authorized, funded, or being carried out by Federal or State agencies, please submit documentation from the agency showing its compliance with Section 7(a)(2) of the ESA. Please see the MT-2 instructions for more detail.



## Sediment Transport

Don Felipe, Raymac, and McCoy dams have been in place for over 30 years without any evidence of sediment transport issues along the previously studied streams. While sediment bulking could affect BFEs within the LOMR area, Table 2 within the narrative shows that sediment transport and bulking would not affect the ability of the dams to capture and store the 1% annual chance flows.



DEPARTMENT OF HOMELAND SECURITY  
Federal Emergency Management Agency  
**RIVERINE STRUCTURES FORM (FORM 3)**

OMB Control Number: 1660-0016  
Expiration: 1/31/2024

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**PRIVACY ACT STATEMENT**

**AUTHORITY:** The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

**PRINCIPAL PURPOSE(S):** This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

**ROUTINE USE(S):** The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP); Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

**DISCLOSURE:** The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a (NFIP) Flood Insurance Rate Maps (FIRM).

Flooding Source: Pajarito Arroyo

**Note:** Fill out one form for each flooding source studied

**A. GENERAL**

Complete the appropriate section(s) for each Structure listed below:

Channelization:	complete Section B
Bridge/Culvert:	complete Section C
Dam:	complete Section D
Levee/Floodwall:	complete Section E
Sediment Transport:	complete Section F (if required)

**Description Of Modeled Structure**

1. Name of Structure: Don Felipe Dam

Type (check one): ☐ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☒ Dam

Location of Structure: 1,600 feet west of Coors Boulevard

Downstream Limit/Cross Section: N/A

Upstream Limit/Cross Section: N/A
2. Name of Structure: \_\_\_\_\_

Type (check one): ☐ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

Location of Structure: \_\_\_\_\_

Downstream Limit/Cross Section: \_\_\_\_\_

Upstream Limit/Cross Section: \_\_\_\_\_
3. Name of Structure: \_\_\_\_\_

Type (check one): ☐ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

Location of Structure: \_\_\_\_\_

Downstream Limit/Cross Section: \_\_\_\_\_

Upstream Limit/Cross Section: \_\_\_\_\_

**NOTE: FOR MORE STRUCTURES, ATTACH ADDITIONAL PAGES AS NEEDED.**



**D. DAM/BASIN**Flooding Source: Pajarito ArroyoName of Structure: Don Felipe Dam1. This request is for (check one): ☒ Existing Dam/Basin ☐ New Dam/Basin ☐ Modification of existing Dam/Basin2. The Dam/Basin was designed by (check one): ☐ Federal Agency ☐ State Agency ☒ Private Organization☐ Local Government Agency Name of the Agency or Organization: Bovay Engineers, Inc.3. The Dam was permitted as (check one): ☐ Federal Dam ☒ State Dam

Provide the permit or identification number (ID) for the dam and the appropriate permitting agency or organization

Permit or ID number NM00458 Permitting Agency or Organization New Mexico Dam Safetya. ☒ Local Government Dam ☐ Private Dam

Provided related drawings, specification and supporting design information.

4. Does the project involve revised hydrology? ☒ Yes ☐ No

If Yes, complete the Riverine Hydrology &amp; Hydraulics Form (Form 2).

Was the dam/basin designed using critical duration storm? (must account for the maximum volume of runoff)

☒ Yes, provide supporting documentation with your completed Form 2.☐ No, provide a written explanation and justification for not using the critical duration storm.5. Does the submittal include debris/sediment yield analysis? ☐ Yes ☒ No

If Yes, then fill out Section F (Sediment Transport). If No, then attach your explanation for why debris/sediment analysis was not considered?

6. Does the Base Flood Elevation behind the dam/basin or downstream of the dam/basin change? ☒ Yes ☐ No

If Yes, complete the Riverine Hydrology &amp; Hydraulics Form (Form 2) and complete the table below.

Stillwater Elevation Behind the Dam/Basin

FREQUENCY (% annual chance)	FIS	REVISED
10-year (10%)	N/A	N/A
50-year (2%)	N/A	N/A
100-year (1%)	4969	4968.8
500-year (0.2%)	N/A	N/A
Normal Pool Elevation	N/A	N/A

7. Please attach a copy of the formal Operation and Maintenance Plan

**E. LEVEE/FLOODWALL**1. System Elements

a. This Levee/Floodwall analysis is based on (check one):

<input type="checkbox"/> Upgrading of an existing levee/floodwall system	<input type="checkbox"/> A newly constructed levee/floodwall system	<input type="checkbox"/> Reanalysis of an existing levee/floodwall system
--	---	---

b. Levee elements and locations are (check one):

☐ Earthen embankment, dike, berm, etc

Stationed \_\_\_\_\_ to \_\_\_\_\_

☐ Structured floodwall

Stationed \_\_\_\_\_ to \_\_\_\_\_

☐ Other (describe): \_\_\_\_\_

Stationed \_\_\_\_\_ to \_\_\_\_\_



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**AUTHORITY:** The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

**PRINCIPAL PURPOSE(S):** This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

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Flooding Source: Isleta Arroyo

**Note:** Fill out one form for each flooding source studied

**A. GENERAL**

Complete the appropriate section(s) for each Structure listed below:

Channelization:	complete Section B
Bridge/Culvert:	complete Section C
Dam:	complete Section D
Levee/Floodwall:	complete Section E
Sediment Transport:	complete Section F (if required)

**Description Of Modeled Structure**

- Name of Structure: McCoy Dam  
Type (check one): ☐ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☒ Dam  
Location of Structure: 1,000 feet west of Coors Boulevard and Norment Rd  
Downstream Limit/Cross Section: N/A  
Upstream Limit/Cross Section: N/A
- Name of Structure: \_\_\_\_\_  
Type (check one): ☐ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam  
Location of Structure: \_\_\_\_\_  
Downstream Limit/Cross Section: \_\_\_\_\_  
Upstream Limit/Cross Section: \_\_\_\_\_
- Name of Structure: \_\_\_\_\_  
Type (check one): ☐ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam  
Location of Structure: \_\_\_\_\_  
Downstream Limit/Cross Section: \_\_\_\_\_  
Upstream Limit/Cross Section: \_\_\_\_\_

**NOTE: FOR MORE STRUCTURES, ATTACH ADDITIONAL PAGES AS NEEDED.**



**D. DAM/BASIN**Flooding Source: Isleta ArroyoName of Structure: McCoy Dam1. This request is for (check one): ☐ Existing Dam/Basin ☒ New Dam/Basin ☐ Modification of existing Dam/Basin2. The Dam/Basin was designed by (check one): ☐ Federal Agency ☐ State Agency ☒ Private Organization☐ Local Government Agency Name of the Agency or Organization: Boyle Engineering Corporation3. The Dam was permitted as (check one): ☐ Federal Dam ☒ State Dam

Provide the permit or identification number (ID) for the dam and the appropriate permitting agency or organization

Permit or ID number NM00539 Permitting Agency or Organization New Mexico Dam Safetya. ☒ Local Government Dam ☐ Private Dam

Provided related drawings, specification and supporting design information.

4. Does the project involve revised hydrology? ☒ Yes ☐ No

If Yes, complete the Riverine Hydrology &amp; Hydraulics Form (Form 2).

Was the dam/basin designed using critical duration storm? (must account for the maximum volume of runoff)

☒ Yes, provide supporting documentation with your completed Form 2.☐ No, provide a written explanation and justification for not using the critical duration storm.5. Does the submittal include debris/sediment yield analysis? ☐ Yes ☒ No

If Yes, then fill out Section F (Sediment Transport). If No, then attach your explanation for why debris/sediment analysis was not considered?

6. Does the Base Flood Elevation behind the dam/basin or downstream of the dam/basin change? ☒ Yes ☐ No

If Yes, complete the Riverine Hydrology &amp; Hydraulics Form (Form 2) and complete the table below.

Stillwater Elevation Behind the Dam/Basin

FREQUENCY (% annual chance)	FIS	REVISED
10-year (10%)	N/A	N/A
50-year (2%)	N/A	N/A
100-year (1%)	N/A	4940.8
500-year (0.2%)	N/A	N/A
Normal Pool Elevation	N/A	N/A

7. Please attach a copy of the formal Operation and Maintenance Plan

**E. LEVEE/FLOODWALL**1. System Elements

a. This Levee/Floodwall analysis is based on (check one):

<input type="checkbox"/> Upgrading of an existing levee/floodwall system	<input type="checkbox"/> A newly constructed levee/floodwall system	<input type="checkbox"/> Reanalysis of an existing levee/floodwall system
--	---	---

b. Levee elements and locations are (check one):

☐ Earthen embankment, dike, berm, etc

Stationed \_\_\_\_\_ to \_\_\_\_\_

☐ Structured floodwall

Stationed \_\_\_\_\_ to \_\_\_\_\_

☐ Other (describe): \_\_\_\_\_

Stationed \_\_\_\_\_ to \_\_\_\_\_



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Flooding Source: Raymac Arroyo

**Note:** Fill out one form for each flooding source studied

**A. GENERAL**

Complete the appropriate section(s) for each Structure listed below:

Channelization:	complete Section B
Bridge/Culvert:	complete Section C
Dam:	complete Section D
Levee/Floodwall:	complete Section E
Sediment Transport:	complete Section F (if required)

**Description Of Modeled Structure**

- Name of Structure: Raymac Dam  
Type (check one): ☐ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☒ Dam  
Location of Structure: 1,000 feet west of Coors Boulevard and Raymac Rd  
Downstream Limit/Cross Section: N/A  
Upstream Limit/Cross Section: N/A
- Name of Structure: \_\_\_\_\_  
Type (check one): ☐ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam  
Location of Structure: \_\_\_\_\_  
Downstream Limit/Cross Section: \_\_\_\_\_  
Upstream Limit/Cross Section: \_\_\_\_\_
- Name of Structure: \_\_\_\_\_  
Type (check one): ☐ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam  
Location of Structure: \_\_\_\_\_  
Downstream Limit/Cross Section: \_\_\_\_\_  
Upstream Limit/Cross Section: \_\_\_\_\_

**NOTE: FOR MORE STRUCTURES, ATTACH ADDITIONAL PAGES AS NEEDED.**



**D. DAM/BASIN**Flooding Source: Raymac ArroyoName of Structure: Raymac Dam1. This request is for (check one): ☒ Existing Dam/Basin ☐ New Dam/Basin ☐ Modification of existing Dam/Basin2. The Dam/Basin was designed by (check one): ☐ Federal Agency ☐ State Agency ☒ Private Organization☐ Local Government Agency Name of the Agency or Organization: Scanlon & Associates3. The Dam was permitted as (check one): ☐ Federal Dam ☐ State Dam

Provide the permit or identification number (ID) for the dam and the appropriate permitting agency or organization

Permit or ID number NM00479 Permitting Agency or Organization New Mexico Dam Safetya. ☒ Local Government Dam ☐ Private Dam

Provided related drawings, specification and supporting design information.

4. Does the project involve revised hydrology? ☒ Yes ☐ No

If Yes, complete the Riverine Hydrology &amp; Hydraulics Form (Form 2).

Was the dam/basin designed using critical duration storm? (must account for the maximum volume of runoff)

☒ Yes, provide supporting documentation with your completed Form 2.☐ No, provide a written explanation and justification for not using the critical duration storm.5. Does the submittal include debris/sediment yield analysis? ☐ Yes ☒ No

If Yes, then fill out Section F (Sediment Transport). If No, then attach your explanation for why debris/sediment analysis was not considered?

6. Does the Base Flood Elevation behind the dam/basin or downstream of the dam/basin change? ☒ Yes ☐ No

If Yes, complete the Riverine Hydrology &amp; Hydraulics Form (Form 2) and complete the table below.

Stillwater Elevation Behind the Dam/Basin

FREQUENCY (% annual chance)	FIS	REVISED
10-year (10%)	N/A	N/A
50-year (2%)	N/A	N/A
100-year (1%)	4964	4959.6
500-year (0.2%)	N/A	N/A
Normal Pool Elevation	N/A	N/A

7. Please attach a copy of the formal Operation and Maintenance Plan

**E. LEVEE/FLOODWALL**1. System Elements

a. This Levee/Floodwall analysis is based on (check one):

<input type="checkbox"/> Upgrading of an existing levee/floodwall system	<input type="checkbox"/> A newly constructed levee/floodwall system	<input type="checkbox"/> Reanalysis of an existing levee/floodwall system
--	---	---

b. Levee elements and locations are (check one):

☐ Earthen embankment, dike, berm, etc

Stationed \_\_\_\_\_ to \_\_\_\_\_

☐ Structured floodwall

Stationed \_\_\_\_\_ to \_\_\_\_\_

☐ Other (describe): \_\_\_\_\_

Stationed \_\_\_\_\_ to \_\_\_\_\_



## Digital Attachments - Hydraulics

### Hydraulics

- 1991 Quadrangle Topographic Data Contours for Terrain Revisions and NOAA Reports
- CN grid supporting data
- Storage-Elevation curves for each pond
- HEC-RAS model
- Rainfall distribution spreadsheet
- Field survey data from High Mesa

## Digital Attachments – Support Information

### As-Built Information

- Record drawings for all phases of the Three-Dam Outlet Project
- Dam Information
  - Record Drawings for Don Felipe, Raymac, and McCoy Dam
  - AMAFCA OMI Manual and McCoy Dam Permit and Certificate of Construction
- South Valley Solar Field As-Built

### Drainage Analysis Report

- Black Mesa Draft Drainage Analysis Report and As-Built Update
- WaterCAD Model

### Drainage Management Plans

- Drainage Management Plans for the Don Felipe, Raymac, and McCoy dams
- AHYMO Model Data

### Fee Exemption Support

- Financial Documentation
- Cost Share Letter
- USACE Letter

### Floodplain Mapping

- Revised 1% annual chance floodplain
- Complete 1% annual chance depth grid
- Effective FEMA floodplains within the project area
- Support layers including the raw full depth boundary, drainage area conversion boundary, and LOMR revision area boundary





## ESP Corporate Office

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Mailing Address: PO Box 7030 Charlotte, NC 28241  
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