Lee Ranch Mine
Use Attainability Analysis

May 2018

Contents

Contents (cont.)

1 Introduction

The Lee Ranch Mine (LRM) is a surface coal mine located in McKinley County New Mexico (Figure 1), and operates under Surface Mining Permit No. 19-2P issued by the New Mexico Mining and Minerals Division (MMD). Streams in the vicinity of Lee Ranch Mine are Mulatto Canyon, Arroyo Tinaja, San Isidro Arroyo, Doctor Arroyo, and tributaries thereof. These streams are not included in a classified Water Quality Standards segment (§20.6.4.101-899 NMAC) and consequently are unclassified waters of the State (§20.6.4.98 NMAC). Water quality standards for unclassified streams in New Mexico are based upon stream hydrology. By determining the correct hydrologic nature of the stream (i.e., perennial, intermittent, or ephemeral) LRM, New Mexico Environment Department (NMED), and the United States Environmental Protection Agency (USEPA) can ensure that the appropriate designated uses and water quality standards are applied to each drainage.

In 2011, the NMED completed field work using the NMED Surface Water Quality Bureau (SWQB) Hydrology Protocol (HP) on the Mulatto Canyon drainage (Figure 1) within the LRM permit boundary. This action was part of a study of 18 unclassified non-perennial stream segments associated with several facilities that hold NPDES permits in New Mexico. The results of the study were incorporated into a Use Attainability Analysis (UAA) developed in June 2012, and clearly indicated Mulatto Canyon and a portion of the San Isidro Arroyo are ephemeral (NMED 2012).

Despite the NMED assessment uncertainty remained about the potential use for the tributary drainages within and adjacent to the LRM permit boundary. To address this uncertainty LRM has completed a UAA for these drainages. The tributaries were analyzed using the NMED SWQB HP which utilizes hydrologic, geomorphic, and biologic indicators to determine the persistence of water within a stream reach.

LRM prepared and submitted the draft Lee Ranch Mine Use Attainability Analysis Sampling Plan in September 2015 which described the hydrologic, biological, and geomorphic data that would be collected to classify the drainages within and adjacent to the LRM permit area. The draft plan was reviewed by NMED SWQB and USEPA Region 6 and the final plan submitted on June 6, 2017 was formally approved by NMED on January 12, 2018. Field work conducted at the LRM in accordance with the sampling plan was performed from June 19 to June 21, 2017.

2 Purpose and Objectives

This report describes the results of LRM's application of the NMED HP to San Isidro Arroyo and tributaries thereof. The information obtained in this evaluation is intended to support the UAA determination for the surface waters of this segment of the San Isidro Arroyo and its tributaries. The two objectives of this study are: 1) determine the proper hydrologic regime for surface waters that are tributary to San Isidro Arroyo based on the HP; and 2) support the development and submittal of a UAA that classifies the streams appropriately.

3 Site Setting

The LRM is located within the southeastern portion of McKinley County, New Mexico, east of the Continental Divide within the southern Chaco Slope structural province of the San Juan Basin (Kelley, 1963). Approximately 8470 acres (13.2 mi^2) of land within the 15,656 acre (24.5 mi^2) LRM permit boundary has been disturbed by surface coal mining (pits) and mining related activities (e.g., coal processing facilities). The LRM is located within the central portion of the 51,006 acre (79.7 mi^2) San Isidro Arroyo watershed. This watershed is bound by the San Mateo Mesa located south-southwest of the LRM permit area and drains to the northeast towards the Arroyo Chico approximately 4.8 miles downstream of the LRM permit area. Elevations within the watershed range from approximately 8,200 ft msl in the headwaters near the San Mateo Mesa to approximately 6,440 ft msl at the San Isidro Arroyo confluence with Arroyo Chico. The headwaters originate in steep, deeply incised canyons which rapidly drop in elevation in the central and lower portion of the watershed which is characterized by rolling hills and broad, flat channels. The western portion of the watershed is drained by Arroyo Tinaja and Mulatto Canyon and the eastern portion is drained by San Isidro Arroyo and Doctor Arroyo. Arroyo Tinaja, Mulatto Canyon, San Isidro Arroyo, and Doctor Arroyo originate upgradient of the LRM, and flow across the mine permit boundary. Dikes and diversions have been used to route upgradient drainage around the active areas of the mine.

The mine is located in a semiarid region of southwestern New Mexico, with a climate that is characterized by low humidity and wide ranges in daily and annual temperatures. The average annual precipitation measured at the LRM is 10.5 inches (1985 – 2017). This is similar to the 10.96 inches of average annual precipitation measured at the Gallup Municipal Airport from 1973 – 2017 (NOAA, 2018a). Most of the rainfall occurs during the mid-summer to mid-fall monsoon season (July – October) as brief, but often intense, thunderstorms. Approximately one third to nearly one half of the annual precipitation occurs in the summer with the mid-winter and early spring months (January – April) typically being the driest months of the year. High evapotranspiration rates characterize this region. Annual potential evapotranspiration at the mine site was estimated to be approximately 32 inches (SMCRA Permit 19-2P). Assuming an average annual precipitation of 11 inches the annual moisture deficit is in excess of 21 inches.

3.1 Surface Water

There are no perennial streams within the southeastern portion of McKinley County, New Mexico (Cooper and John, 1968). The drainage channels within the San Isidro Arroyo watershed exhibit characteristics in line with discontinuous ephemeral streams. Discontinuous ephemeral streams are common in the arid and semiarid west and are characterized by alternating erosional and depositional reaches (Bull, 1997; Tooth, 2000; Field and Lichvar, 2007). These systems follow the scour-transport-fill landform sequence, where gullies form the scour zone, the arroyo channel is the primary zone of transport, and sediment and water are transported across the channel fan or floodout zone where water spreads out across the surface as sheetflow (Bull, 1997; Tooth, 1999; Wakelin-King and Webb, 2007). These features develop from differences in the channel and valley floor slopes. Aggradation

occurs in areas where the channel slope intersects the valley-floor slope and sheetflow spreads across the floodout zone or channel fan (Bull, 1997; Field and Lichvar, 2007). Sediment continues to be deposited until the increased slope at the toe of the channel fan promotes incision, initiating the next downstream scour-transport-fill sequence (Bull, 1997; Field and Lichvar, 2007).

Surface water runoff (flow) within the drainage channels of the San Isidro Arroyo watershed occurs irregularly and is in direct response to precipitation events such as summer thunderstorms, or less frequently, snow-melt runoff. Summer thunderstorms often occur over partial areas within a given watershed depending on the movement, duration and intensity of the storm. Groundwater was not encountered within the unconsolidated material in the pre-mine exploratory borings or during the mining process and the drainage channel bottoms in the in the vicinity of the LRM sit above the local water table (MMD Permit 19-2P). Flow events are flashy in nature characterized by rapid peaks and relatively short durations resulting in limited sustained flow rates. Flow depths for the 10-yr, 24-hr event (1.7 – 1.8 in) estimated using the unit hydrograph procedures adopted by the Soil Conservation Service (USDA-SCS, 1971) were generally less than two feet (MMD Permit 19-2P). Because of the remote location of the stream monitoring points and limited duration of flow events, single stage, non-automated sediment samplers, were installed at each monitoring station (see Figure 1 for SWM locations). The samplers were modeled after similar non-automated devices developed by the USGS to monitor ephemeral streams in New Mexico. The stream sample points locations are checked monthly or following sizeable rain events. Rainfall does not occur ubiquitously across the site and surface water monitoring conducted within the Mulatto Canyon, Arroyo Tinaja, and San Isidro Arroyo at the LRM indicates that the occurrence of flow events that produce sufficient volumes of water for sample collection using the single stage samplers varies from 1 -10 times per year (mean: 4 events per year). The vast majority of these events occur during the summer monsoon season.

USGS Gaging Station 08340500 located on the Arroyo Chico approximately 35 miles downstream of the project area is the closest available gaging station to the project area. Stream discharge data is available from October 1943 through September 1986 and October 2005 through present. Monitoring at the gaging station was discontinued by the USGS between October 1986 and September 2005. The drainage area reporting to this location is approximately 880,210 acres (1375 mi^2); with the San Isidro Arroyo watershed (51,006 acres; 79.7 mi^2) representing less than six percent of its drainage area. Figure 2 presents a hydrograph of the available daily mean discharge data for station 0834500. The discharge record for this station indicates extensive periods of no flow, with the arroyo averaging 198 days (range: 44 – 366 days) of measured flow on an annual basis over the 54 years during which a complete flow record was available.

The highest mean daily flows typically occur between July and September and are likely the result of intense local precipitation in the basin. Prior to 1973 the Arroyo Chico exhibited a lower frequency of flow events per year (mean: 152 events per year) but had a higher frequency of mean daily flow above 1000 cubic feet per second (cfs), with 49 events exceeding this threshold between October 1, 1943 and December 31, 1972. Since that time the frequency of flow events has increased (mean: 250 events per year) but the mean daily flow has only exceeded 1000 cfs twice during the period of available record. The LRM did not begin operating until late 1984, over a decade after the reduction in the mean daily

flow began. Even at its current maximum the LRM's disturbance area (8470 acres (13.2 mi^2)) represents less than one percent of the drainage area reporting to gaging station 0834500. Although discharge rarely occurs from the numerous sediment ponds that have been constructed to provide treatment of disturbed area runoff from the LRM (see NPDES Permit No. NM0029581) they do not capture and store significant volumes of water due to the infrequent nature of runoff events in the area. All runoff that originates in watersheds upstream of the LRM is routed around or through the LRM mine area using diversions. Therefore it is not expected that the LRM has had a significant impact on the volume of water observed at the gaging station.

There was no measured flow during June 2017 at the Arroyo Chico gaging station. This is not uncommon as 23 of the 54 years of record do not have a measured flow during June.

3.2 Groundwater

The LRM is located in the southern portion of the San Juan Basin within the Chaco Slope structural province (Kelley, 1963). Geologic structure and lithology influence the movement and occurrence of groundwater in the area. The local dip of the bedrock has been influenced by the San Mateo dome and the San Miguel Creek dome located south and northeast of the permit area, respectively. The strata in the vicinity of the San Mateo dome dip in a northeasterly direction at approximately 2^o. A northwesterly dip of approximately 2^o is associated with the strata in the eastern portion of the permit area near the San Miguel Creek Dome. Faulting is not extensive on the Chaco Slope, but does influence the groundwater flow regime within the permit area. Groundwater near the LRM is present in some of the sandstones and coal units within the Cleary Coal Member of the Menefee Formation, the Point Lookout Sandstone, the Crevasse Canyon Formation, and the Gallup Sandstone.

The Cleary Coal Member of the Menefee Formation consists of sandstone, siltstone, mudstone, shale and coal of Upper Cretaceous age. The sandstone units and coal seams are generally lenticular and tend to lack lateral continuity. The water bearing units in the formation are likely unconfined in the south due to the thinner and more highly fractured nature of the units near the San Mateo dome. However to the north, in the downgradient direction, relatively impermeable shales overlie these units, limiting vertical migration, resulting in confined conditions. The Menefee formation is used sparingly as a source of livestock water in the area due to the poor quality and low yields of the formations. Measured hydraulic conductivity of the Menefee at the LRM ranges from $9.43x10^{-6}$ to $4.53x10^{-5}$ cm/sec (mean: $2.14x10^{-5}$ cm/sec). Static water levels measured in temporary Menefee wells MW-2 and MW-3 in 1982 ranged from approximately 67.53 – 70.11 ft below ground surface (bgs).

The Point Lookout Sandstone is laterally continuous and contains groundwater under confined conditions throughout the area. The Point Lookout Sandstone is separated from the water bearing sandstones and coal units of the Menefee Formation by low permeable shale that is located at the base of the Menefee formation. The Point Lookout Sandstone is a massive, tan and yellowish-gray, fine- to medium-grained sandstone with approximately 30% silt and clay (Brod and Stone, 1981). The high proportion of silt and clay within the Point Lookout are likely the cause of the low hydraulic conductivity

which is on the order of $1x10^{-5}$ cm/sec (range: $9.43x10^{-5}$ – $1.79x10^{-5}$ cm/sec). The Point Lookout Sandstone is used primarily for stock water. Static water levels measured in Point Lookout Sandstone wells MW-1 and MW-5 in 1982 ranged from approximately 63.39 – 64.49 ft bgs. Water levels in the Point Lookout Sandstone in 2017 ranged from approximately 52-75 ft bgs at PLD-2, PLD-3, and PLD-4 on the east side of the permit and approximately 140 ft bgs at PLD-5 on the west side of the permit.

The Crevasse Canyon Formation and Gallup Sandstone lie beneath the Point Lookout Sandstone and are hydrologically isolated from the mining activities by several hundred feet of low permeable bedrock. The LRM has two water supply wells that are completed in the Dilco Coal Member of the Crevasse Canyon Formation and the Gallup Sandstone. Both wells (W-7, W-22) were drilled in the early 1980's are completed to a total depth of greater than 1500 ft bgs (TD: 1524 - 1553 ft bgs). The Crevasse Canyon Formation consists of (in descending order) the Gibson Coal Member, the Dalton Sandstone, and Dilco Coal. The Dilco Coal Member consists of interbedded gray shale and claystone, carbonaceous shale, coal, siltstone, and lenticular channel sandstone (Craigg, 2000). The Gallup Sandstone is moderately well sorted fine to medium grained sandstone and is a major source of water for the town of Gallup (Craigg, 2000; Stone, 1981). The depth to water measured at the two production wells at the time of installation was 150 ft bgs at W7 (October 1982) and 180 ft bgs at W-22 (July 1983).

Quaternary deposits include alluvium, colluvium, and eolian deposits. Exploration drilling indicates the unconsolidated materials range from approximately 0 – 80 ft in thickness. Groundwater was not encountered in the unconsolidated material within the permit area. In 1982, monitoring well MW-4 was completed to a depth of 52 ft below ground surface within the unconsolidated material overlying the Menefee formation, but failed to produce water (Figure 3). Detectable groundwater was not identified in the unconsolidated materials above the shallowest coal seam during the exploratory drilling of the site for SMCRA Permit 19-2P. This is consistent with the observations made by Cooper and John, 1968 (NMSE Technical Report 35) who noted that only minor amounts of water were present in the alluvium in southeastern McKinley County, with dug wells identified near San Mateo Creek, the Azul Creek Valley, and San Antonio Spring. All of those locations are outside of the San Isidro Arroyo watershed.

Groundwater flow within the bedrock is dependent on the structural dip of the lithologic units and is modified locally by the type and degree of fracturing. Groundwater flow is partially controlled by the San Mateo and San Miguel Creek domes located to the south and northeast of the study area. The strata in the vicinity of the San Mateo dome dips at approximately 2° in a northeasterly direction. The strata in the eastern portion of the study area near the San Miguel Creek Dome dips to the northwest at approximately 2°. Groundwater flow in the vicinity of the LRM permit is in a north-northeasterly direction (MMD Permit 19-2P). Recharge of the shallower Menefee Formation and Point Lookout Sandstone occurs in and around the sandstone outcrops located to the south and southeast of the permit area where fractures allow for more rapid percolation of precipitation. To the north impermeable shales limit vertical groundwater flow resulting in confined conditions which prevents appreciable connectivity with the base of the drainage channels. Natural groundwater discharge is limited to a small handful of low discharge rate springs predominately found in the eastern portion of the study area. Discharge also occurs from wells used for livestock water. Water emanating from the

springs and livestock wells is typically diffuse, limited in quantity and evaporates or soaks into the ground within very short distances due to the semi-arid climatic conditions.

The low hydraulic conductivity of the Menefee Formation and Point Lookout Sandstone limits the quantity of groundwater that flows into the mine pits and the radius of influence of water level drawdowns beyond the permit area. Significant groundwater inflows into the LRM mine pits have not been encountered during mining. The mine maintains water rights under Permit # RG35275 for the use of up to 1500 ac-ft of water per year. As of 2017 a total of 5 points of groundwater diversion (wells) remain active under Permit RG35275. Three of these wells (W22-212, W22-213, W22-211) are located within the Menefee Formation (TD: 215 ft bgs), and two mine production wells (W-7, W-22) are screened at much deeper depths within the Crevasse Canyon Formation and Gallup Sandstone (TD: 1524 - 1553 ft bgs). The combined yearly average withdrawal of the Menefee formation wells during the period of available record (2000-2017) has been approximately 8.5 ac-ft/yr. The combined yearly withdrawal from the Menefee wells has remained below 1 ac-ft/yr since 2009. The combined annual average withdrawal from the two mine production wells since 2000 has been 111.8 ac-ft/yr. The production wells did not operate from 2004 – 2007 and yearly withdrawals have been lowered from a mean annual average 292 ac-ft/yr from 2000- 2003 to 84.4 ac-ft/yr from 2008 – 2017. The two production wells are hydrologically isolated from the surface by several hundred feet of low permeable bedrock units. Accordingly, withdrawals from the production wells did not impact the surface water flow regimes of the stream channels studied during the 2017 HP Assessment.

Twenty additional points of diversion (wells) are held by private landowners within the study area (New Mexico Office of State Engineer's Water Rights Database (http://www.ose.state.nm.us/). Five of the 12 diversion permits identified within the LRM permit boundary are no longer active or have been mined through (Figure 1). The remaining 15 wells are used primarily for livestock purposes and have permitted withdrawals of 3 ac-ft/yr. The semi-arid climate limits vegetation in this region resulting in the need for livestock herds to graze several hundred acres per year to accommodate their dietary needs. Therefore these wells are typically only used on an as needed basis when the herd is grazing in the immediate area. These withdrawals are insignificant and have negligible effects on the surface water flow regimes of the stream channels evaluated during the 2017 HP Assessment.

3.3 Springs

Thirteen springs were identified within and around the LRM permit boundary as part of MMD Permit 19-2P. Eight of these springs were identified within the Doctor Arroyo drainage area(S-2 through S-9) and two within the San Isidro Arroyo drainage area (S-1 and S-10). The remaining three (S-11 – S-13) were identified within the San Miguel Creek drainage area outside of the LRM MMD permit boundary and the UAA study area. Two of the ten springs (S-2 and S-10) identified within the study area are located outside of the LRM MMD permit boundary. Water quality and quantity (where measurable) was monitored at the springs expected to be removed by mining, which included Burro (S-7), D/600 (S-6), Montano (S-4), Ojo Redondo (S-5), and Doctor Springs (S-3), which is now located within the mining

exclusion area as approved in the MMD Permit (No. 19-2P). Impacts from mining to these springs, or any adjacent ones, are addressed through the Army Corp of Engineers Clean Water Act Section 404 permitting and mitigation process. These six springs, which were all generally located in the eastern part of the permit area, were identified as having a sodium bicarbonate water type (Appendix A). This is the same water type determined for groundwater monitored in the Menefee Formation and Point Lookout Sandstone in the eastern part of the MMD permit area. Direct measurements of the quantity of water produced by most of these springs could not be completed due to the absence of an identifiable source, lack of a defined flow, and the intermittent nature of the springs. Water emanating from the springs tends to evaporate or soak into the ground within short distances or be retained by small impoundments as a source of water for livestock.

4 Survey and Analysis (HP Application)

The NMED Hydrologic Protocol was used to determine the hydrologic flow regime in order to evaluate whether aquatic life and recreational uses can be supported within the San Isidro Arroyo watershed. All work was conducted in accordance with the approved work plan and followed the NMED Hydrologic Protocol guidance (NMED 2011). The Level 1 Evaluation was conducted June 19 -21, 2017. A watershed approach was utilized to establish similar types of drainages that would further enhance the applicability of the HP analysis locations in determining the hydrologic regime of the San Isidro Arroyo and its 3 principal tributaries; Arroyo Tinaja, Mulatto Canyon, and Doctor Arroyo. Representative reaches were identified near the downstream end of each subwatershed to ensure all upstream runoff processes were included. The hydrologic protocol allows for the early determination of the flow regime after evaluation of the first six or nine indicators if scores are meeting specified thresholds. However, to further enhance the hydrologic determinations a complete Level 1 Evaluation, which included an assessment of all 14 Level 1 indicators, was completed at each of the assessment points. A numeric score was provided for each of the 14 attributes using the four-tiered, weighted scale as described in the NMED Hydrologic Protocol Guidance (NMED 2011). The indicators evaluated included: Water in Channel, Fish, Benthic Macroinvertebrates, Filamentous Algae and Periphyton, Difference in Vegetation, and Absence of Rooted Upland Plants in the Streambed, Sinuosity, Floodplain and Channel Dimensions, In Channel Structures, Stream Substrate Size and Sorting, Hydric Soils, Presence of Sediment on Plants and/or Debris, Seeps and Springs, and Iron Oxidizing Bacteria/Fungi.

4.1 Watershed Approach

The drainages within the San Isidro Arroyo were categorized into three tiers. The first tier consists of lower order headwater streams (watersheds 1A, 1B, 1C, 1D). Two of these watersheds exist in the uppermost headwaters characterized by steep canyons and terrain (1A and 1B), while the other two are headwater watersheds within the lower portion of the watershed characterized by rolling topography (1C and 1D). The second watershed tier (watershed 2ABC) is located on San Isidro Arroyo further downstream and encompasses the Tier 1 watersheds of Arroyo Tinaja, Mulatto Canyon, and San Isidro Arroyo. This is an intermediate tier that collects drainage from both the upper canyon area and the

lower plains area. The third watershed tier (watershed 3ABCD) is located the furthest downstream on San Isidro Arroyo prior to its confluence with Arroyo Chico and encompasses all subwatersheds analyzed. These arroyos and tributaries thereof are located within USGS 12-digit Hydrologic Unit Codes (HUC) 130202050205 and 130202050206 (Figure 1). Use of a tiered approach ensures that all hydrologic regime types are characterized within the San Isidro watershed. It also allows the characterization of the boundary between the Level IV Ecoregions, with watersheds 1A and 1B being located within the Semiarid Tablelands Level IV Ecoregion and all other watersheds being located within the San Juan/Chaco Tablelands and Mesas Level IV Ecoregion. Furthermore, all tributaries to San Isidro Arroyo are accounted for by sampling points or photograph points within the tributary itself or by those further downstream in the larger channels.

4.2 Sample Site Locations

Field reconnaissance was conducted during September 2 – 3, 2015 to establish sampling locations that would allow for accurate characterization of the stream reaches / assessment units (AU). USGS and topographic maps, aerial photography, and knowledge of the primary drainages across the site were used to select the sample locations. Additional information taken into account when selecting sampling locations included geology, surrounding topography, stream morphology, vegetation, incoming tributaries, and any other feature that may affect the hydrology of the system. Following the field reconnaissance and collection of additional information, individual sites were established in locations that gave an accurate representation of the stream reaches in question. Representative reaches were identified near the downstream end of each subwatershed to ensure all upstream runoff processes were included. Additional information about the selection of the representative stream reaches is included in the Work Plan previously submitted on June 6, 2017 and formally approved on January 12, 2018.

The HP was applied to the following locations: one sampling site in Arroyo Tinaja within subwatershed 1A (HP11), two sampling sites in Mulatto Canyon within subwatershed 1B (HP13, HP14), three sampling sites in Doctor Arroyo within subwatershed 1D (HP16, HP17, HP18), and three sampling sites within the San Isidro Arroyo (HP15 in subwatershed 1C, HP21 in subwatershed 2ABC, HP31 in watershed 3ABCD). The approved sampling plan also included a second location within the Arroyo Tinaja (HP12). This point was dropped due to a lack of channel structure or evidence of past flow events and subsequently changed to photograph point PP12A. Table 1 summarizes the selected sampling locations, their corresponding stream reach, subwatershed, and spatial relationship to current NPDES outfalls. The locations of all sampling sites are shown on Figure 1. Table 2 summarizes the additional photograph locations used to supplement the HP sampling location throughout the watershed.

4.3 Weather

4.3.1 Drought Conditions

Local weather conditions were evaluated prior to performing the field work to ensure severe drought conditions were not occurring during the HP field event. Figure 4 includes the Palmer Drought Severity Index (PDSI), Standardized Precipitation Index (SPI) and the Palmer Z index for June 2017. The 12-month Standardized Precipitation Index (SPI) was obtained through the High Plains Regional Climate Center (HPRCC) Climate Maps website (HPRCC 2018). The SPI measures drought based on the probability of precipitation. The HPRCC map shows that McKinley County, New Mexico had a 12-month SPI value between 0 and -1 for the eastern half of the study area and an SPI value between 1 and 0 for the western half of the study area during June of 2017. The SPI at this time scale is representative of longer-term precipitation patterns. A value between 0 and -1 is indicative of below-average precipitation conditions and a value between 0 and 1 is indicative of above-average precipitation conditions. The Palmer Z-index was obtained through the National Oceanic and Atmospheric Administration (NOAA) website (NOAA, 2018b). The Palmer Z-Index measures short term drought on a monthly scale. Northwestern New Mexico is shown as a range of -1.24 and +0.99 in June 2017, which is indicative of normal conditions. The PDSI was obtained from the NOAA website (NOAA, 2018c). The PDSI is used to measure the duration and intensity of long-term drought patterns. The June 2017 PDSI map shows that northwestern New Mexico is within the PDSI range of -1.99 to +1.99, again indicative of normal conditions.

4.3.2 Precipitation

Prior to conducting the field evaluations during June 19 through 21, 2017, precipitation records collected at the LRM were reviewed for evidence of recent precipitation. Precipitation at LRM had not occurred within the last 48-hours, and the most recent recorded rain event occurred between May 18 and May 19, 2017 (0.13 in).

4.4 Quality Assurance and Control

The LRM team of evaluators consisted of both onsite and regional technical staff with a combined 58 years of experience in hydrology, hydrogeology and geology including experience in the arid southwest United States. Field replicates were completed at Mulatto Canyon assessment points WP-23/ WP-24 and WP-25, all of which had previously been evaluated as a part the UAA NMED in 2012 (NMED, 2012). The NMED Hydrologic Protocol allows for the stream reaches to be characterized as ephemeral after completing the evaluation of the first six indicators if the score does not exceed a combined value of two. However to further support the HP findings the LRM conducted an evaluation of all 14 HP Level 1 indicators, regardless of whether the preliminary score indicated the evaluation could be stopped earlier. Since the results of the 2012 NMED Level 1 Evaluation did not necessitate the analysis of more than the first six indicators, the final scores of the LRM and NMED evaluations are not directly comparable. Despite this, both Level 1 Evaluations indicated that these reaches of Mulatto Canyon are ephemeral.

Table 1: This table shows the HP sample sites, corresponding stream reaches and subwatersheds, and rationale. Sites are arranged by subwatershed, from Tier 1 to Tier 3.

Site ID	Stream Reach	Sub-Watershed	NPDES Outfalls Upstream	NPDES Outfalls Downstream	Rationale
HP11	Arroyo Tinaja	1A	--	Temp: 049, 050, 090, 091, 092, 093	Headwater watershed representative of steep canyon terrain. Site located at base of canyons near ecoregional boundary.
HP13	Mulatto Canyon	1B	--	Temp: 002, 003, 004, 006, 044, 101 Temp Prop: 103 Perm: 102	Headwater watershed representative of steep canyon terrain. Site located at base of canyons near ecoregional boundary. In approximate location of 2011 NMED UAA site.
HP14	Mulatto Canyon	1B	--	Temp: 002, 003, 004, 006, 044, 101 Temp Prop: 103 Perm: 102	Headwater watershed representative of steep canyon terrain. Site located within canyons.
HP15	San Isidro Arroyo	1C	--	Temp: 061, 062, 067, 085, 087, 094, 096	Headwater watershed representative of rolling hills.
HP16	Doctor Arroyo	1D	Temp Prop: 097	Temp: 080, 095 Temp Prop: 098, 099	Headwater watershed representative of rolling hills. Upstream of Doctor Springs.
HP17	Doctor Arroyo	1D	Temp: 095 Temp Prop: 097	Temp: 080 Temp Prop: 098, 099	Headwater watershed representative of rolling hills. Downstream of Doctor Springs.
HP18	Doctor Arroyo	1D	Temp: 080, 095 Temp Prop: 097, 098, 099	--	Headwater watershed representative of rolling hills. Downstream of Doctor Springs.
HP21	San Isidro Arroyo	2ABC	Temp: 002, 003, 004, 006, 044, 049, 050, 061, 062, 067, 085, 087, 090, 091, 092, 093, 094, 096, 101 Temp Prop: 103 Perm: 102	--	Tier 2 watershed downstream of confluence of Arroyo Tinaja, Mulatto Canyon, and San Isidro Arroyo. In approximate location of 2011 NMED UAA site.
HP31	San Isidro Arroyo	3ABCD	Temp: 002, 003, 004, 006, 044, 049, 050, 061, 062, 067, 080, 085, 087, 090, 091, 092, 093, 094, 095, 096, 101 Temp Prop: 097, 098, 099 103 Perm: 102	--	Tier 3 watershed downstream of confluence of Arroyo Tinaja, Mulatto Canyon, San Isidro Arroyo, and Doctor Arroyo. This site encompasses the San Isidro Arroyo watershed in its entirety. Located just upstream of its confluence with Arroyo Chico.

Note:
Location HP12, formerly included in the site Sampling Plan, was dropped as an HP site due to a lack of evidence of past flow events.
Perm: Permanent Outfall
Temp: Temporary Outfall
Temp Prop.: Proposed Temporary Outfall

Table 2: This table identifies both the HP and photography locations. Sites are grouped by stream reach and are generally ordered from upstream to downstream.

Site ID	Easting	Northing	Location Type 1 (HP / Photo)	Location Type 2 (Stream / NPDES Confluence)	Associated NPDES Confluence	Stream Reach
PP151	-107.720	35.499	Photo Only	Stream	--	Arroyo Tinaja
HP11	-107.706	35.503	HP and Photo	Stream	--	Arroyo Tinaja
PP12B	**-107.709**	**35.497**	Photo Only	Stream	--	Arroyo Tinaja Tributary
PP12A	-107.697	35.500	Photo Only	Stream	--	Arroyo Tinaja Tributary
PP169	-107.652	35.522	Photo Only	Stream	--	Arroyo Tinaja
PP283	-107.604	35.527	Photo Only	Stream & NPDES Confluence	091	Arroyo Tinaja
PP284	-107.594	35.530	Photo Only	Stream & NPDES Confluence	049, 050, 090, 092	Arroyo Tinaja
PP285	-107.591	35.536	Photo Only	Stream & NPDES Confluence	093	Arroyo Tinaja
HP14	-107.691	35.476	HP and Photo	Stream	--	Mulatto Canyon
HP13	-107.680	35.483	HP and Photo	Stream	--	Mulatto Canyon
PP281	-107.669	35.492	Photo Only	Stream & NPDES Confluence	002, 003, 004, 006, 044, 101	Mulatto Canyon
PP282	-107.656	35.519	Photo Only	Stream & NPDES Confluence	102, 103 (proposed)	Mulatto Canyon
PP157	-107.636	35.462	Photo Only	Stream	--	San Isidro Arroyo
PP158	-107.602	35.493	Photo Only	Stream	--	San Isidro Arroyo
HP15	-107.597	35.500	HP and Photo	Stream	--	San Isidro Arroyo
PP152	-107.660	35.482	Photo Only	Stream	--	San Isidro Arroyo Tributary
PP153	-107.654	35.476	Photo Only	Stream	--	San Isidro Arroyo Tributary
PP154	-107.647	35.473	Photo Only	Stream	--	San Isidro Arroyo Tributary
PP155	-107.639	35.471	Photo Only	Stream	--	San Isidro Arroyo Tributary
PP156	-107.640	35.468	Photo Only	Stream	--	San Isidro Arroyo Tributary
PP170	-107.614	35.500	Photo Only	Stream	--	San Isidro Arroyo Tributary
PP286	-107.592	35.510	Photo Only	Stream & NPDES Confluence	096	San Isidro Arroyo
PP287	-107.589	35.518	Photo Only	Stream & NPDES Confluence	085, 087, 094	San Isidro Arroyo
PP288	-107.586	35.525	Photo Only	Stream & NPDES Confluence	061, 062, 067	San Isidro Arroyo
HP21	-107.573	35.539	HP and Photo	Stream	--	San Isidro Arroyo
HP31	-107.519	35.580	HP and Photo	Stream	--	San Isidro Arroyo

Site ID	Easting	Northing	Location Type 1 (HP / Photo)	Location Type 2 (Stream / NPDES Confluence)	Associated NPDES Confluence	Stream Reach
PP159	-107.566	35.498	Photo Only	Stream	--	Doctor Arroyo
PP289	-107.559	35.505	Photo Only	Stream & NPDES Confluence	097 (proposed)	Doctor Arroyo
HP16	-107.556	35.515	HP and Photo	Stream	--	Doctor Arroyo
PP160	-107.554	35.519	Photo Only	Stream	--	Doctor Arroyo
PP161	-107.551	35.525	Photo Only	Stream	--	Doctor Arroyo Tributary
PP290	-107.550	35.528	Photo Only	Stream & NPDES Confluence	095	Doctor Arroyo Tributary
HP17	-107.550	35.528	HP and Photo	Stream & NPDES Confluence	098 (proposed)	Doctor Arroyo
PP291	-107.548	35.535	Photo Only	Stream & NPDES Confluence	099 (proposed)	Doctor Arroyo
PP167	-107.576	35.513	Photo Only	Stream	--	Doctor Arroyo Tributary
PP168	-107.555	35.534	Photo Only	Stream	--	Doctor Arroyo Tributary
PP292	-107.549	35.538	Photo Only	Stream & NPDES Confluence	080	Doctor Arroyo Tributary
PP163	-107.531	35.528	Photo Only	Stream	--	Doctor Arroyo Tributary
PP164	-107.527	35.533	Photo Only	Stream	--	Doctor Arroyo Tributary
PP166	-107.545	35.542	Photo Only	Stream	--	Doctor Arroyo Tributary
HP18	-107.539	35.552	HP and Photo	Stream	--	Doctor Arroyo

Note:
Location HP12, formerly included in the site Sampling Plan, was dropped as an HP site due to a lack of evidence of past flow events. Location PP162 and PP165 were also dropped from the list of photopoints due to lack of access or no evidence of past hydrology. PP12A and PP12B were added to list of photopoints. PP12A is at the same location as the formerly proposed HP12. PP12B is located upstream of PP12A at the confluence of two canyon drainage channels.

Prior to conducting the field work at LRM, NMED representatives requested permission to visit LRM during the planned implementation of the field investigations to provide additional HP training and support. To further ensure the proper application of the HP methodologies, LRM staff requested that NMED representatives complete simultaneous HP evaluations at two locations during the assessment. Accordingly, NMED staff was on-site on June 20, 2017 and completed independent assessments of HP-11 and HP-21. In both instances the LRM and NMED scores were within 1 point of each other. Copies of the NMED field sheets are included in Appendix B.

4.5 Level 1 Evaluation Results

The results of the Level 1 Evaluation for each Assessment Unit, or subwatershed, are located in Appendix B. This includes the Cover Sheet for each Assessment Unit followed by the Level 1 Hydrologic Determination Field Sheets for each HP point located within the Assessment Unit. The Cover Sheet documents the hydroclimatic conditions and any observed hydrologic modifications such as constructed diversions, NPDES outfalls, or groundwater pumping that was present/ occurring during the evaluation. The Level 1 Hydrologic Determination Field Sheets document the score for each Level 1 Indicator and include field notes and photos from the assessment points. A photo log for each of the drainage channels is located in Appendix B. This includes upstream and downstream photos collected at each of the photo (PP) and HP assessment points and generally follows the progression of each drainage channel from its upper headwaters to its outlet. A site map depicting all HP and PP locations is found in Figure 1. Table 3 includes a summary of the Level 1 Evaluation score for all 14 indicators at each assessment point. Figures 5 -8 depict the drainage profile for the primary drainage channels within the study area. A discussion of the Level 1 Evaluation results for the Tier 1 – 3 watersheds are provided in section 4.5.1 – 4.5.3.

4.5.1 Tier 1 Subwatersheds

Subwatersheds 1A and 1B

The Tier 1 Subwatersheds consists of lower order headwater streams. Subwatershed 1A and 1B exist in the uppermost headwaters of Mulatto Canyon and Arroyo Tinaja and are characterized by steep canyons and terrain. Both of these subwatersheds are located within the Semiarid Tablelands Level IV Ecoregion (22j) which consists of mesas, plateaus, valleys, and canyons formed mostly from flat to gently dipping sedimentary rocks with quaternary aged colluvium with large areas of bedrock outcrops and colluvium with valley-fill alluvium. Grass, shrubs, and woodlands cover the tablelands (Griffith et al., 2006). Rough basal terrain and steep cliffs along the eroded margins of the drainage channels limited access into the canyons. Assessment point HP14 was established in the headwater canyons within the largest drainage channel in Subwatershed 1B. The assessment point is located near the eastern, downstream, edge of the canyons where the channel slope begins to decline prior to entering the rolling topography of the lower plain (Figure 6). This assessment point is within the highest order drainage channel of the upper canyon headwaters and is representative of the stream reach within the canyons with the greatest potential to support a non-ephemeral flow regime. The assessed flow regime at this

Table 3: Level 1 Hydrology Protocol Evaluation Scores.

Site ID	Stream Reach	Sub-Watershed	Water in Channel	Fish	Benthic Macroinvert.	Filamentous Algae/ Periphyton	Differences in Vegetation	Absence of Rooted Upland Plants in Streambed	Sinuosity*	Floodplain and Channel Dimensions	In-Channel Structure: Riffle-Pool Sequence	Particle Size or Stream Substrate Sorting	Hydric Soils	Sediment on Plants and Debris	Seeps and Springs	Iron Oxidizing Bacteria/ Fungi	Total
HP11	Arroyo Tinaja	1A	0	0	0	0	0	2	1 (1)	1.5	0	0	0	0.5	0	0	5
HP13	Mulatto Canyon	1B	0	0	0	0	0	3	1 (0.5)	1.5	0	1.5	0	0.5	0	0	7.5
HP14	Mulatto Canyon	1B	0	0	0	0	0	2	1 (1)	1.5	0	1.5	0	0.5	0	0	6.5
HP15	San Isidro Arroyo	1C	0	0	0	0	2	2	1 (1)	3	0	0	0	0.5	0	0	8.5
HP16	Doctor Arroyo	1D	0	0	0	0	1	1	1 (1)	3	0	0	0	0.5	0	0	6.5
HP17	Doctor Arroyo	1D	0	0	0	0	2	1	2 (1)	3	0	0	0	0.5	0	0	8.5
HP18	Doctor Arroyo	1D	0	0	0	0	0	1	2 (-)	1.5	0	1.5	0	0	0	0	6
HP21	San Isidro Arroyo	2ABC	0	0	0	0	2	2	1 (2)	1.5	0	0	0	0.5	0	0	8
HP31	San Isidro Arroyo	3ABCD	0	0	0	0	2	2	1 (0.5)	1.5	0	0	0	0.5	0	0	7

Note

*Sinuosity was determined both in the field (value in parentheses) and from the National Hydrography Dataset. The larger of the two numbers was used in the final score.

location provides a conservative estimate of the flow regime of the lower order headwater canyon drainage channels which feature less developed channel characteristics and smaller contributing drainage areas. See Appendix C photopoint PP151 located within the largest canyon headwater drainage within Subwatershed 1A where the channel is less developed, more steeply incised, and is less vegetated along banks of the channel. The Level 1 Evaluation score at HP14 is 6.5, which supports a determination of an ephemeral flow regime.

Two additional HP assessments were completed for these subwatersheds. HP11 was established near the Level IV Ecoregion boundary and outlet of Subwatershed 1A, and HP13 was established at the outlet of Subwatershed 1B. Location HP12, formerly included in the site Sampling Plan within Subwatershed 1A, was dropped as an HP site and changed to a photopoint (PP12A) due to an absence of a defined drainage channel. This location may be representative of a depositional segment of the discontinuous ephemeral flow system where the drainage channel vanishes and sheetflow permeates across the channel fan or floodout zone. PP12B was also added in this drainage and is located upstream of PP12A at the confluence of two canyons. See Appendix C for photos of these locations. An HP assessment was not completed at the outlet of Subwatershed 1A because a defined channel was not present in this location either. Both HP11 and HP13 are located northeast of the canyons where the landforms transition to the rolling topography of the lower plain seen throughout the rest of the study area (Figure 5, Figure 6). These locations were established at, or very close to, the subwatershed outlet in the channels with the largest contributing drainage area. These points are located within the stream reach, with the greatest potential to support non-ephemeral flow and therefore provide a conservative estimation of the flow regimes of the lower order tributaries within their respective subwatersheds. When applicable photopoints were established in the lower order portions of the disconnected drainages to provide evidence that their flow regime and channel structures are similar in nature to the assessment point locations (see PP12A and PP12B in Subwatershed 1A). There have been no modifications to the drainage channels or their contributing areas within these subwatersheds. As previously noted, groundwater withdrawals from the LRM production wells are from the Gallup Aquifer located approximately 1000 ft bgs. The aquifer is confined and is not in direct connection with any of the drainages within the study area and could not have impacted the results of this evaluation. The Level 1 score for both HP11 (5) and HP13 (7.5) support a determination that these headwater drainages are ephemeral.

Subwatersheds 1C and 1D

Subwatershed 1C and 1D consist of the headwaters of San Isidro Arroyo and Doctor Arroyo and are primarily characterized by the rolling topography of the lower plain. The subwatersheds are located predominately within the San Juan/ Chaco Tablelands and Mesas (22i) Level IV Ecoregion described as plateaus, valleys, and canyons with a mix of desert shrub, semi-desert-shrub-steppe, and semi-desert grasslands. The area is composed of gently dipping Tertiary and Cretaceous sedimentary rocks with quaternary aged colluvium, colluvium with valley fill alluvium, and discontinuous eolian deposits (Griffith et al., 2006). Approximately 11 percent (584.7 acres; 0.91 mi^2) of Subwatershed 1C (5413.9 acres; 8.46 mi^2) is located within the Semiarid Tablelands Level IV Ecoregion (22j).

Assessment point HP15 was determined to be representative of Subwatershed 1C as the vast majority of the watershed falls within the rolling plain topography. The lower order tributaries in the upper canyon headwaters and within the transitional zone between the canyon and rolling hill topography (see PP157) exhibit similar stream channel characteristics as found at assessment points HP14 and HP13 within Subwatershed 1B. Therefore an HP assessment point was not completed in the headwaters of Subwatershed 1C. HP15 was established at the subwatershed outlet within the highest order drainage channel (Figure 7). It is located at the lowest elevation within the subwatershed and receives the entirety of the subwatersheds drainage. This location is representative of the stream reach with the greatest potential to support non-ephemeral flow and therefore provides a conservative estimation of the flow regime of the upstream, lower order, tributaries within the subwatershed. HP15 had the greatest channel and floodplain width of the locations observed within the watershed (see Appendix C PP156, PP157, and PP158). Stream beds within the subwatershed consisted of fine to medium grained sand and silt and poor substrate sorting was found throughout. Upland vegetation was present within the channel at PP156 and PP158 but did not encroach on the channel at HP15. No modification to the drainage channels or their contributing drainage area has occurred in Subwatershed 1C. The result of the Level 1 Evaluation at HP15 (HP Score: 8.5) supports the determination of ephemeral flow for the drainage channels within subwatershed 1C.

Subwatershed 1D includes nearly the entirety of Doctor Arroyo from its upper headwaters to approximately 3000 ft upstream of its confluence with San Isidro Arroyo. The subwatershed covers the eastern end of the MMD permit boundary. A mining exclusion area was also established in the vicinity of Doctor Springs (S-3). There have been no modifications to the trunk of the Doctor Arroyo channel however mining along the western end of the subwatershed has removed a portion of an unnamed tributary (approximately between PP167 and PP168) that previously reported to Doctor Arroyo near the northern permit boundary. This drainage will be reconstructed during mine reclamation using appropriate geomorphic and engineering design principles. NPDES outfall 080 was also built for treating disturbed area runoff from mining activities downstream of PP168 in this unnamed tributary. A dike was built along the western end of the exclusion area which diverts runoff from mining related disturbance to NPDES outfall 095. Both of these outfalls are temporary and, based on their relatively small drainage areas (292 acres; ~4.75% of the Doctor Arroyo Watershed), have resulted in negligible reductions in the quantity of surface runoff to Doctor Arroyo. A diversion was also built in the southwestern headwaters of Doctor Arroyo to redirect drainage away from the mining area to the north. This has resulted in a change in the drainage break and directed more water towards the San Isidro Arroyo. The area affected by this diversion is also small (149 acres; ~ 2.43% of the Doctor Arroyo Watershed) and the amount of water that has been redirected should have had negligible impact on the Doctor Arroyo flow regime or channel morphology.

Three assessment points were established within Subwatershed 1D: HP16 immediately upstream of the mining exclusion area, HP17 immediately downstream of the mining exclusion area, and HP18 at the outlet of the Doctor Arroyo 1D subwatershed. During the field investigation point HP18 was moved upstream approximately 1500 ft south from its proposed location due to limited accessibility. Water was identified in the channel near Doctor Spring (S-3) within the mine exclusion area at photopoint

PP160 (Appendix C). The spring reports to a livestock tank that produces minor contributions of overflow to the channel. In 2013 LRM installed a water supply tank, which is supplied by wells W22-211, W22-212, and W22-213, and three livestock drinkers to supplement the needs of the rancher and supply additional water to the small wetland feature in the area. The combined annual withdrawal from these three wells since 2013 has ranged from 0.1 – 0.4 ac-ft per year (mean: 0.2 ac-ft per year). Overflow from the Doctor Spring area evaporates or soaks into the ground within a short distance (< 900 ft within Doctor Arroyo). Assessment points HP16 and HP17 were established at the upstream and downstream portion of the mining exclusion area to evaluate potential changes to the Doctor Arroyo channel flow regime at the LRM MMD permit boundary. HP18 was located as close to the Doctor Arroyo watershed outlet as possible to represent the channel reach with the lowest elevation, largest contributing drainage area, and most developed hydrologic flow regime. This location provides a strong indication of the flow regime of the upstream lower order tributaries, absent direct connection with springs, which drain to it. Appendix C includes the photo log of the Doctor Arroyo watershed and Figure 8 shows the drainage profile within the Doctor Arroyo channel. Photopoints were established in the tributary headwaters and at their confluence with the trunk of Doctor Arroyo. PP167 and PP168 were established at the upstream and downstream unaffected portions of the tributary that has been partially mined through. The drainage channel in these areas exhibit similar characteristics to stream reaches found at similar elevations within the subwatershed. PP290 and PP291 are located downstream of temporary NPDES outfalls 080 and 095 where discharge water from these outfalls would enter the receiving stream. The drainage area reporting to these two outfalls represents less than five percent of the Doctor Arroyo watershed and the construction of these structures should not have altered the Doctor Arroyo flow regime. The photo documentation of the drainages within the watershed indicates that the three assessment points should be representative of the entirety of the subwatershed except for the 900 ft of saturated channel adjacent to Doctor Springs. Scores from the Level 1 Evaluation at the three assessment points range from 6 – 8.5 and support the determination that the remainder of Subwatershed 1D is ephemeral.

4.5.2 Tier 2 Subwatershed

Subwatershed 2ABC is located within the San Isidro Arroyo and encompasses the Tier 1 watersheds of Arroyo Tinaja (1A), Mulatto Canyon (1B), and San Isidro Arroyo (1C). This area collects drainage from both the upper canyons and lower plains. This watershed encompasses the majority of the LRM and includes several diversions built to direct runoff from upstream watersheds that have not been affected by mining away from areas disturbed by mining activities. Arroyo Tinaja and Mulatto Canyon were both diverted to the north and now wrap around the northern perimeter of the mining area before reconnecting with the native Arroyo Tinaja channel near photopoint PP284. The Arroyo Tinaja flows to the north where the channel courses into a broad grassy valley with a very shallow valley slope of 0.3% (see Figure 5 and Appendix C photopoint PP285). This location is considered representative of the channel fan or floodout zone where sediment aggrades within the discontinuous ephemeral flow system. Some mudcracks were seen in this area but there was no evidence of concentrated flow. Several temporary NPDES outfalls have also been built adjacent to the Arroyo Tinaja channel near PP283 and PP284. The modified portion of the Arroyo Tinaja channel (see PP169, PP283, PP284) exhibits swale-like

characteristics with a broad shallow channel that is densely vegetated. The bed material consists of silt and fine sand and there are no riffle-pool structures. These channel characteristics are not uncommon within the watershed and are seen at similar elevations (~6600 – 6700 ft msl) within the native reaches of the San Isidro Arroyo (see PP286, PP287, PP288). Mulatto Canyon was mined through during the early history of mining at LRM as approved under MMD Permit 19-2P, and drainage from upstream watersheds 1B has been diverted to the north through the existing course of the re-constructed Mulatto Canyon channel. The channel now extends from approximately HP-13 at the outlet of Subwatershed 1B to photopoint PP169 where it connects with the Arroyo Tinaja (see Figure 1). Several temporary NPDES outfalls have been constructed along this reach of the re-constructed channel of Mulatto Canyon. The drainage channel near PP281 has features similar of the native drainages just downstream of the mesa canyons where the landforms transition to a rolling topography (see HP11). The remainder of the channel (see PP282) has characteristics similar to the Arroyo Tinaja diversion.

The drainage from several small unnamed tributaries in the headwaters of the San Isidro Arroyo has been diverted to the east around the southern perimeter of the mine. A small dike was also constructed in the reach between HP15 and PP286 to direct water towards NPDES outfall 096. Several temporary outfalls were constructed in vicinity of PP286 and further to the north near PP288. As described above, the San Isidro Arroyo Channel broadens and the density of the upland vegetation increases within the channel as the channel slope lessens (see Appendix C San Isidro Arroyo photos and Figure 7). Assessment point HP21 was established at the outlet of Subwatershed 2ABC after the confluence of Arroyo Tinaja and Mulatto Canyon and is representative of the hydrologic process of the entire subwatershed. HP21 is located in the stream reach with the greatest potential to support non-ephemeral flow within the 2ABC subwatershed and therefore provides a conservative estimation of the flow regime of the upstream, lower order, tributaries that drain to it. The Level 1 Evaluation score for assessment point HP21 was 8.0 and supports the determination that the flow is ephemeral. This is in agreement with the results documented by NMED in the 2012 Use Attainability Analysis (UAA), which indicated this reach of the San Isidro Arroyo is ephemeral (NMED 2012). The HP21 Level 1 Evaluation score is very similar to the HP15 score (8.5) recorded at the outlet of Subwatershed 1C, which is also located within the lower plains. The Level 1 Evaluation scores observed at assessment points HP-11 (5) and HP13 (7.5), located upstream near the outlets of Subwatersheds 1A and 1B at the base of the mesa canyons, and HP14 (6.5) also located upstream within the mesa canyons, further indicate that the flow regime within Subwatershed 2ABC is ephemeral. Photos throughout the 2ABC sub-watershed provide additional evidence that the flow regime remains consistent (see Appendix C).

4.5.3 Tier 3 Subwatershed

Watershed 3ABCD includes the lower reach of the San Isidro Arroyo just before its confluence with Arroyo Chico and encompasses all of the Tier 1 and Tier 2 subwatersheds analyzed. There have been no alterations to the stream channel or mine related construction within the drainage area downstream of Subwatersheds 2ABC and 1D. Hydrologic assessment point HP31 was established within the San Isidro Arroyo just above its confluence with the Arroyo Chico approximately 4.8 miles downstream of the mining boundary. HP31 is located in the stream reach with the greatest potential to support non-ephemeral flow within the San Isidro Arroyo watershed because it is located at the lowest elevation and

receives runoff from all of the subwatersheds. Therefore the hydrologic regime observed at HP31 provides a conservative estimation of the flow regime of the upstream lower order tributaries that drain to it. The Level 1 Evaluation score for assessment point HP-31 was 7.0, which provides further evidence that the flow in the San Isidro Arroyo is only in response to precipitation and snow melt events. This is similar to the scores observed at HP18 (6) and HP21 (8) which are also located in the lower topographic portion of the drainage basin (~ 6450 – 6550 ft msl). The Level 1 Evaluation scores observed at assessment points HP-11 (5) and HP13 (7.5), located near the outlets of Subwatersheds 1A and 1B at the base of the mesa canyons, and HP14 (6.5), located within the mesa canyons indicate that the flow regime in the upstream, lower order reaches, of the drainage basin are also ephemeral.

Water was identified in one reach of Doctor Arroyo (PP160). This reach is located within the mining exclusion area and receives overflow from bedrock wells that supplement the water available to the rancher's cattle and to the wetland in the Doctor Springs (S-3) area. The drainage channel has a sand bottom and the water in the channel evaporates or soaks into the ground within a short distance (< 900 ft). Assessment points HP16 and HP17 were established at the upstream and downstream portion of the mining exclusion area, with HP17 located approximately 4000 ft downstream of Doctor Springs. Level 1 Evaluation scores at HP-16 and HP-17 were 6.5 and 8.5 indicating that the flow regime of Doctor Arroyo immediately above and below the exclusion area is ephemeral and that the saturated reach adjacent to Doctor Springs is not representative of the normal conditions within the Doctor Arroyo channel.

Nine Level 1 HP Evaluations were completed at representative points throughout the San Isidro Arroyo watershed (3ABCD). The assessment points were located in a range of topographic and geomorphic features within the basin including two Ecoregions. The scores from all nine evaluations indicate that the flow regime of the drainage channels within the San Isidro Arroyo watershed are ephemeral and support the determination made by NMED in their 2012 Use Attainability Analysis for the San Isidro Arroyo and Mulatto Canyon (NMED 2012). These results are in agreement with past observations that significant quantities of groundwater are not present in the alluvium in this area and that none of the streams exhibit perennial flow (Cooper and John, 1968). This was further supported by information provided in the LRM MMD Permit 19-2P by pre-mine drilling events which found no appreciable groundwater within the unconsolidated overburden above the most shallow coal seam and along alluvial channels. Monitoring of stream flow as part of MMD Permit 19-2P substantiates that the drainage channels only flow in direct response to storm events and have channel bottoms that are above the local water table. In limited locations, groundwater discharges naturally to several springs and artificially by privately owned livestock water wells within and adjacent to the LRM MMD permit area. Water emanating from these features is limited in quantity, typically evaporating or soaking into the ground within short distances, and is not of sufficient volume to alter the flow regime of adjacent drainage channels. Many of these features were approved to be mined through and potential impacts to those located outside of the disturbance area are limited by the low hydraulic conductivity of the water bearing bedrock units which minimize potential water level drawdowns. Impacts to these features are addressed through the Army Corp of Engineers Clean Water Act 404 permitting and mitigation process. The LRM's water supply wells are completed in the Gallup Aquifer greater than 1000 ft bgs. This aquifer is hydrologically isolated from the mining activities, upper bedrock units, and drainage channels by

several hundred feet of low permeable bedrock. Several of the drainage channels within the watershed have been modified to direct upland runoff around the perimeter of the mining area and some of the contributing drainage areas have been temporarily modified with the construction of sediment basins to capture and treat disturbed area runoff from mine areas. Evidence collected during the 2017 field application of the HP clearly indicates all stream channels within the San Isidro Arroyo watershed are ephemeral, and remain ephemeral just as they were prior to mining.

5 Conclusion

The Level 1 HP Evaluations (9) completed at hydrologically representative locations throughout the San Isidro Arroyo watershed indicate the drainages throughout the watershed are ephemeral. This reaffirms data collected for the LRM MMD Permit 19-2P prior to mining which indicated that the drainage channels within and adjacent to the mining area only flow in response to storm events and that channel bottoms are above the local water table. Groundwater is not present in the shallow overburden or channel alluvium, bedrock groundwater is typically confined at appreciable depths below the bottoms of stream channels. The few springs that are located within and adjacent to the LRM permit area within the watershed feature limited and diffuse discharge that typically evaporates or soaks into the ground within short distances. Hydrologic alterations including the diversion of upland runoff around the perimeter of the mining area and construction of temporary sediment basins to provide sediment control for affected area drainage have not impacted the natural hydrologic regime of these drainages as they remain the same as they were prior to mining. Based on the results of the Level 1 Hydrology Protocol evaluations, supporting regional hydrologic studies, and mine-specific hydrologic information as provided in the MMD permit, the LRM believes there is sufficient information to warrant an ephemeral hydrologic classification for all stream segments within the San Isidro Arroyo watershed. The LRM does not believe it is feasible for these drainages to attain the designated use of marginal warm water aquatic life and primary contact because of the factor defined at 40 CFR 131.10(g)(2): natural, ephemeral, or intermittent or low flow conditions or water levels prevent the attainment of the use. Therefore the LRM intends to pursue the classification of these drainages under §20.6.4.97 NMAC for ephemeral waters with the appropriate limited aquatic life use and secondary contact designation.

6 References

Bull, W.B., 1997. Discontinuous ephemeral streams. Geomorphology 19, 227–276.

Cooper, J. B. and John, E. G., 1968. Geology and Ground Water Occurrences in Southeastern McKinley County, New Mexico. NMSE Technical Report 35, p. 119

Craigg, S.D., 2000, Geologic framework of the San Juan structural basin of New Mexico, Colorado, Arizona, and Utah with emphasis on Triassic through Tertiary rocks: U.S. Geological Survey Professional Paper 1420, 70 p.

Field, J.J. and Lichvar, R.W. 2007, Review and Synopsis of Natural and Human Controls on Fluvial Channel Processes in the Arid West. ERDC/CRREL TR-07-16. Hanover, NH: U.S. Army Engineer Research and Development Center.

Griffith, G.E., Omernik, J.M., McGraw, M.M., Jacobi, G.Z., Canavan, C.M., Schrader, T.S., Mercer, D., Hill, R., and Moran, B.C., 2006, Ecoregions of New Mexico (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,400,000).

High Plains Regional Climate Center (HPRCC) Climate Maps, 2018. 12-Month Standardized Precipitation Index. http://hprcc.unl.edu/maps.php?map=ACISClimateMaps

Kelley, V.C. 1963. Tectonic Setting. In: Geology and Technology of the Grants Uranium Region. NMBMMR Mem. 15.

Energy Minerals and Natural Resources Department, New Mexico Mining and Minerals Division (MMD). Life of mine surface mining permit No. 19-2P.

National Oceanic and Atmospheric Administration (NOAA) Online Weather Data, 2018a. Monthly Precipitation Data for Gallup Municipal AP, NM. Web. 20 Feb 2018. http://w2.weather.gov/-climate /xmacis.php?wfo=abq

National Oceanic and Atmospheric Administration (NOAA), 2018b. Historical Palmer Drought Indices, Z-Index. http://www.ncdc.noaa.gov/temp-and-precip/drought/historical-palmers/zin/201510-201609

National Oceanic and Atmospheric Administration (NOAA), 2018c. Historical Palmer Drought Indices, Palmer Drought Severity Index. http://www.ncdc.noaa.gov/temp-and-precip/drought/historical-palmers/psi/201510-201609

New Mexico Administrative Code (NMAC) Title 20 Environmental Protection Chapter 6 Water Quality, November 2016. http://164.64.110.239/nmac/parts/title20/20.006.0004.pdf

New Mexico Environmental Department (NMED), 2011. Statewide Water Quality Management Plan and Continuing Planning Process, Appendix C: Hydrology Protocol for the Determination of Uses Supported By Ephemeral, Intermittent, and Perennial Waters. Surface Water Quality Bureau. May 2011. https://www.env.nm.gov/swqb/Hydrology/

New Mexico Environment Department (NMED), 2012. Use Attainability Analysis for Unclassified Non-Perennial Watercourses with NPDES Permitted Facilities. Surface Water Quality Bureau. June 2012. https://www.env.nm.gov/swqb/UAA/HP/index.html

Stone, W.L., 1981, Hydrogeology of the Gallup Sandstone. San Juan Basin, northwest New Mexico: Groundwater, v. 19, no. 1, p. 4-11.

Tooth, S., 1999. Floodouts in central Australia. In: Miller, A.J., Gupta, A. (Eds.), Varieties of Fluvial Form. John Wiley & Sons, Chichester, pp. 219–247.

Tooth, S., 2000. Process, form and change in dryland rivers; a review of recent research. Earth-Science Reviews 51, 67–107.

USDA-SCS. April 1971. National Engineering Handbook, Section 3, Sedimentation, Chapter 6, Sediment Sources, Yields and Delivery Ratios.

USDA-SCS. 1971. National Engineering Handbook, Chapter 4, Hydrology.

Wakelin-King, G.A. and Webb, J.A., 2007. Threshold-dominated fluvial styles in an arid-zone mud-aggregate river: The uploads of Fowlers Creek, Australia. Geomorphology 85, 114-127

Figures

Lee Ranch Mine Use Attainability Analysis
UAA Sampling Locations
HP Site
Photopoint Site
UAA Watersheds
Tier 3
Tier 2
Tier 1
NPDES Outfalls
Existing, Permanent
Existing, Temporary
Proposed, Temporary
Diversions / Dikes
Dike
Diversion
Lee Ranch Permit Boundary
Level IV Ecoregions
2014 Disturbance Boundary
LR Monitoring Wells
LR Historic Monitoring Wells
LR Production Wells
NMSOE Current Production Wells
NMSOE Inactive Production Wells
Spring Locations
Surface Water Monitoring Locations
Elevation
7894 - 8240
7648 - 7894
7451 - 7648
7295 - 7451
7164 - 7295
7044 - 7164
6936 - 7044
6839 - 6936
6756 - 6839
6683 - 6756
6601 - 6683
6440 - 6601
Reference Scale: 1:24,000
Drawn By: JB
Updated 04/23/2018
Service Layer Credits: USGS The National Map: National Boundaries Dataset, National Elevation Dataset, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation
0 0.5 1 2 3 Miles
22j: Semiarid Tablelands
22i: San Juan/Chaco Tablelands and Mesas
23e: Conifer Woodlands and Savannas
Watershed 3ABCD
Watershed 2ABC
Watershed 1A
Watershed 1B
Watershed 1C
Watershed 1D
HP31
HP21
HP18
HP17
HP16
HP15
HP14
HP13
HP11
PP12A
PP128
PP151
PP152
PP153
PP154
PP155
PP156
PP157
PP158
PP159
PP160
PP161
PP163
PP164
PP166
PP167
PP168
PP169
PP170
PP281
PP282
PP283
PP284
PP285
PP286
PP287
PP288
PP289
PP290
PP291
PP292
Mulatto Canyon
Arroyo Tinaja
San Isidro Arroyo

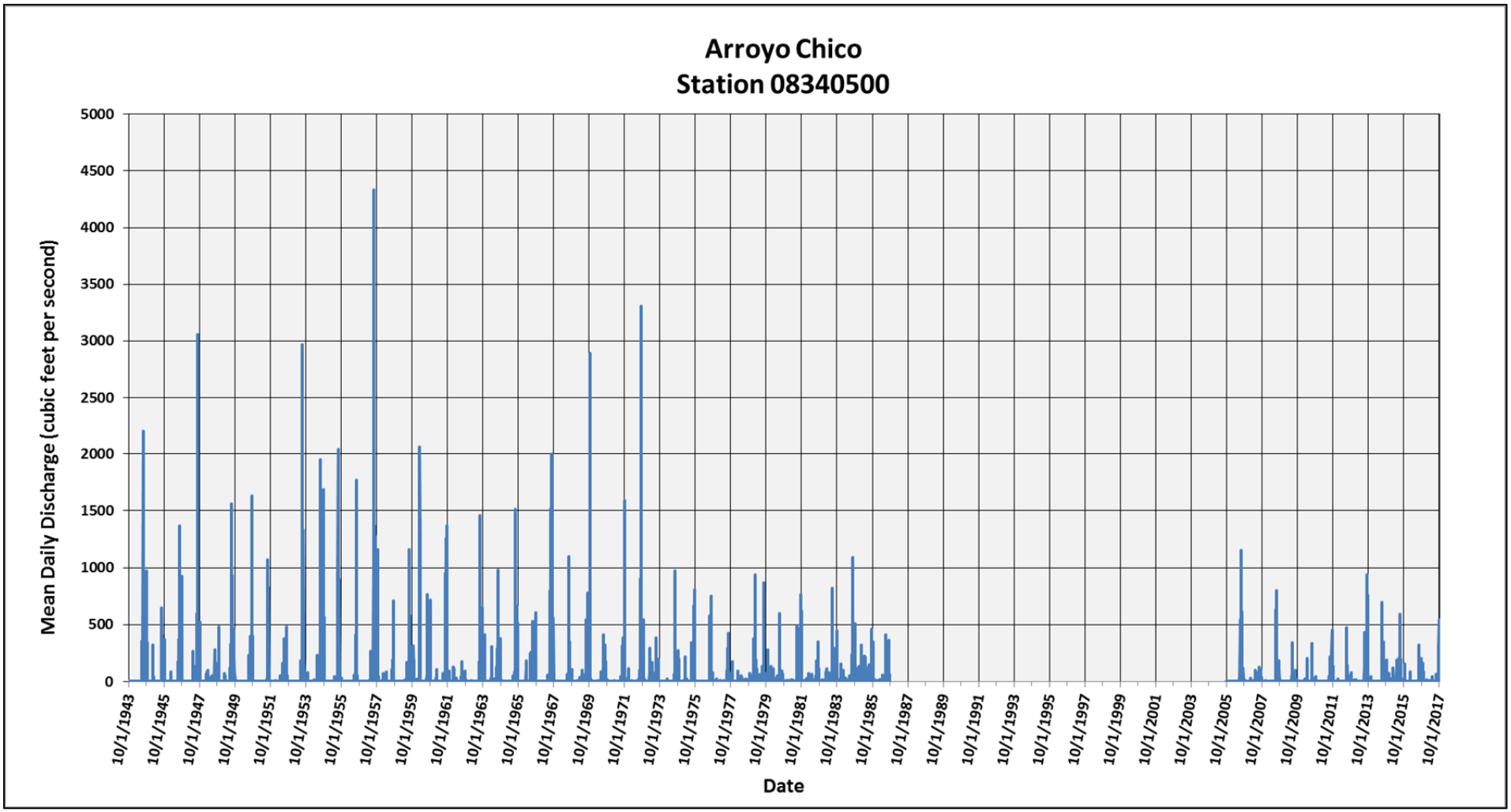


Figure 2. Mean daily discharge (cubic feet per second) at the USGS Arroyo Chico Gaging Station (08340500) located downstream of the San Isidro drainage basin.

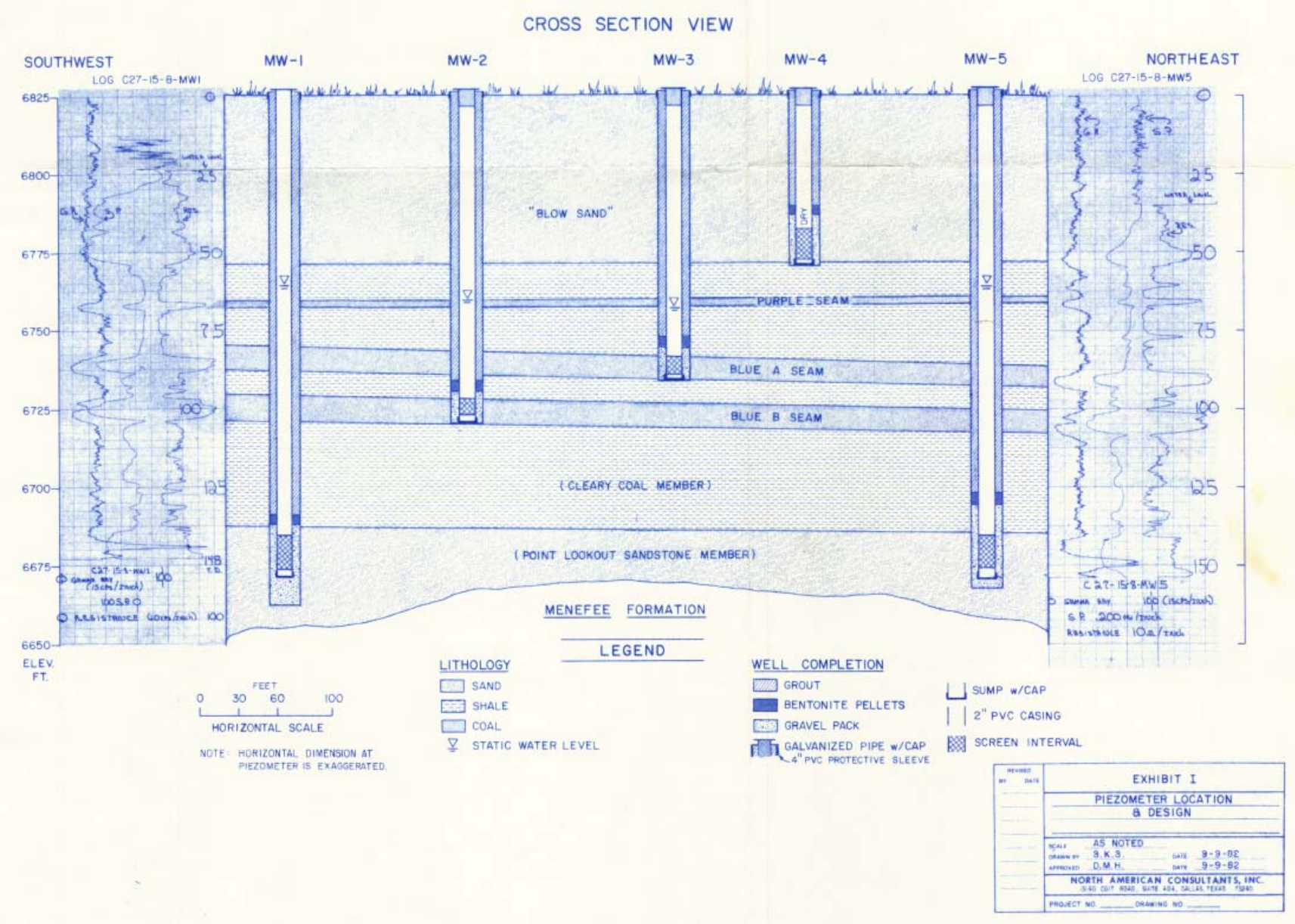
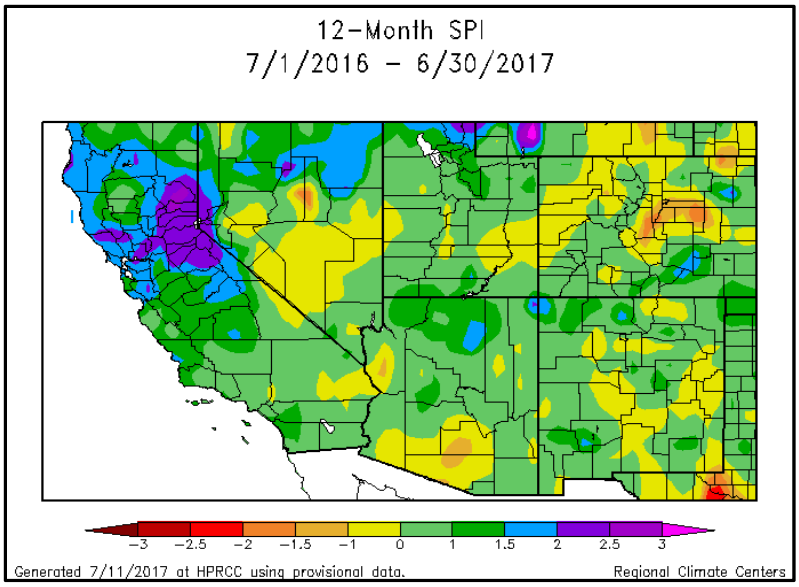
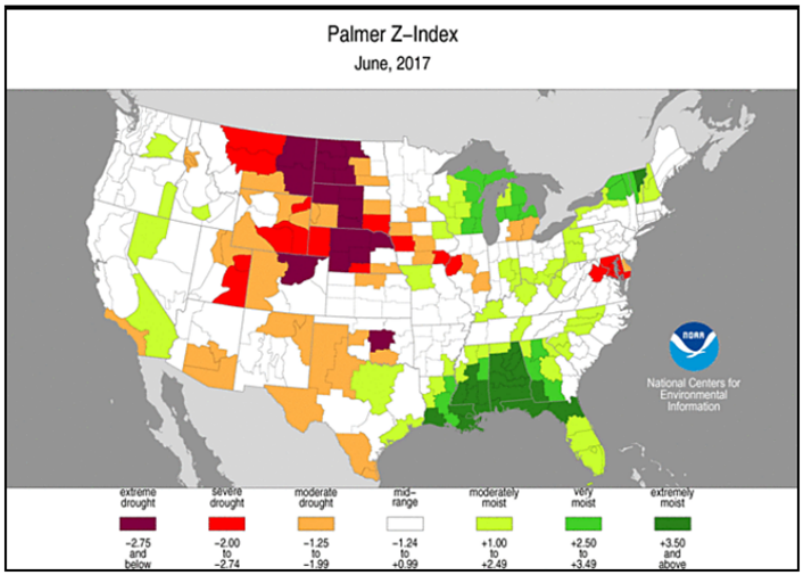


Figure 3. Monitoring well construction diagram for temporary wells MW-1 through MW-5 installed in 1982. Note that unconsolidated well MW-4 is dry.





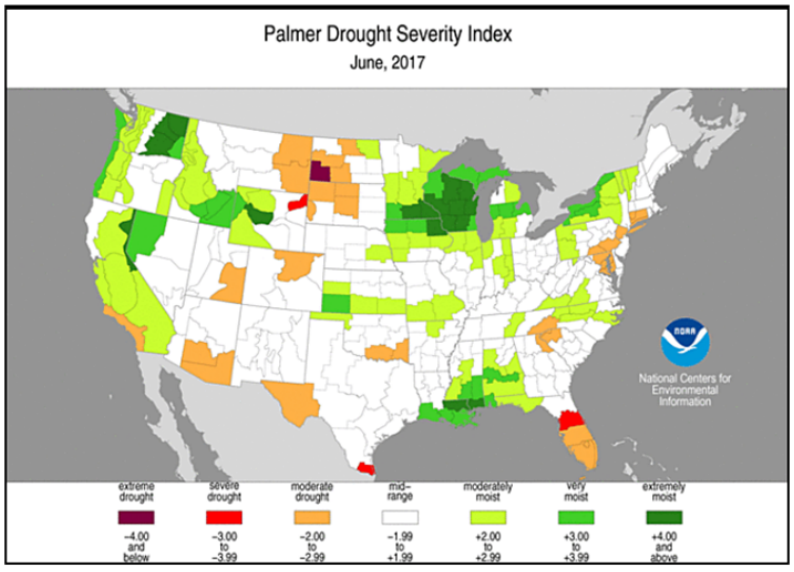


Figure 4. 12-Month Standardized Precipitation Index, Palmer Z-Index, and Palmer Drought Severity Index, for June 2017.

Figure 5. Arroyo Tinaja drainage profile.

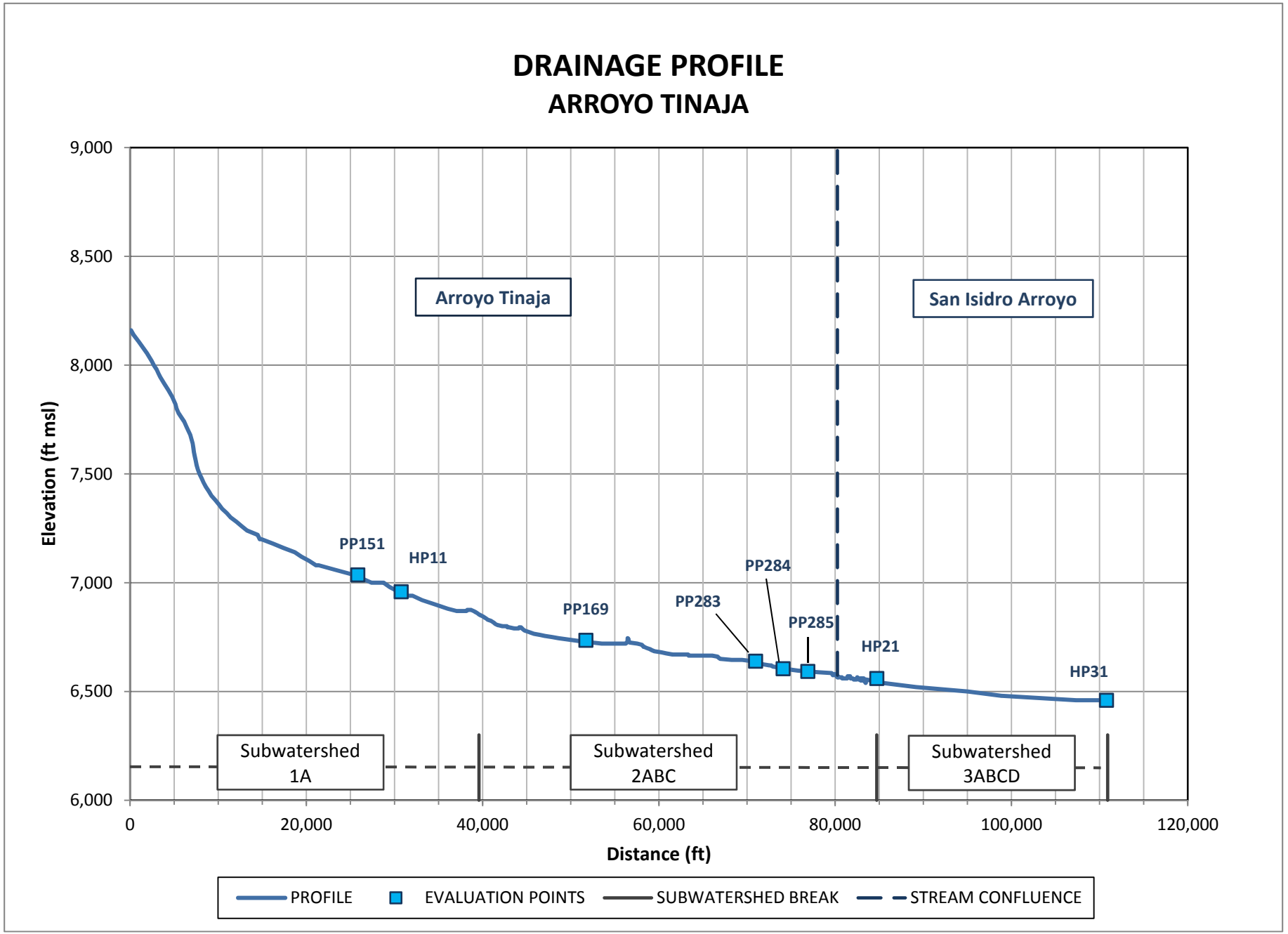


Figure 6. Mulatto Canyon drainage profile.

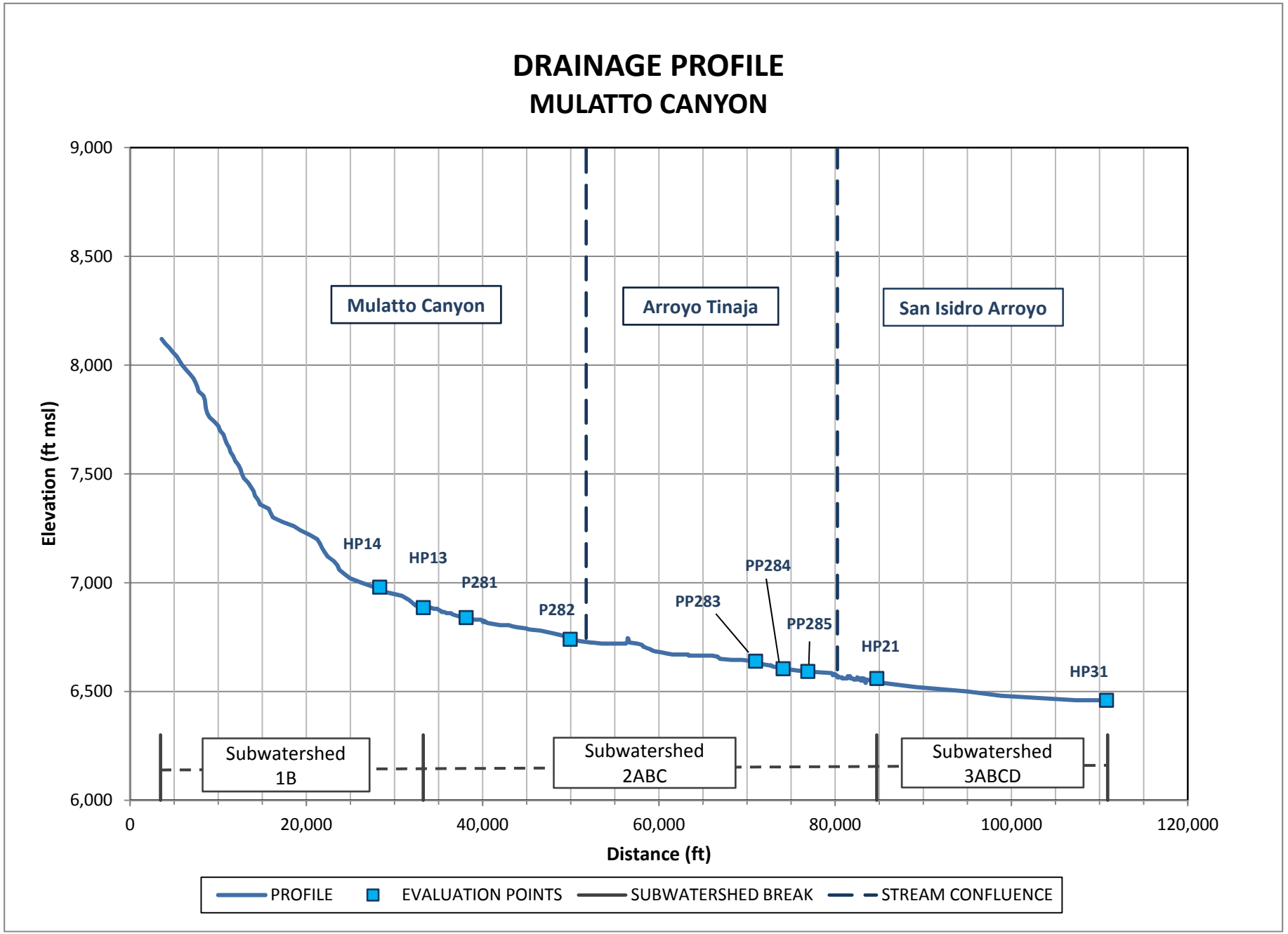


Figure 7. San Isidro Arroyo drainage profile.

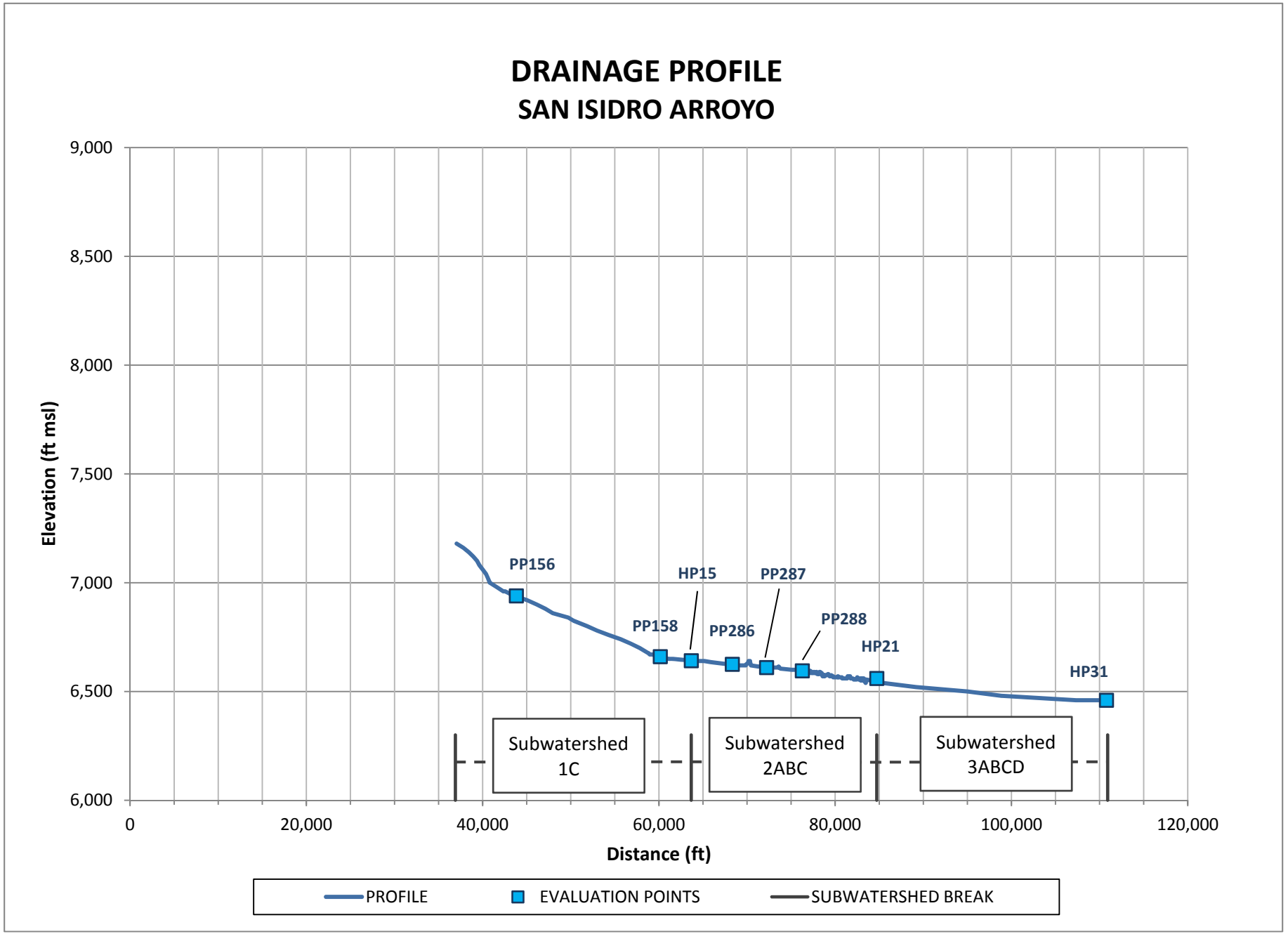
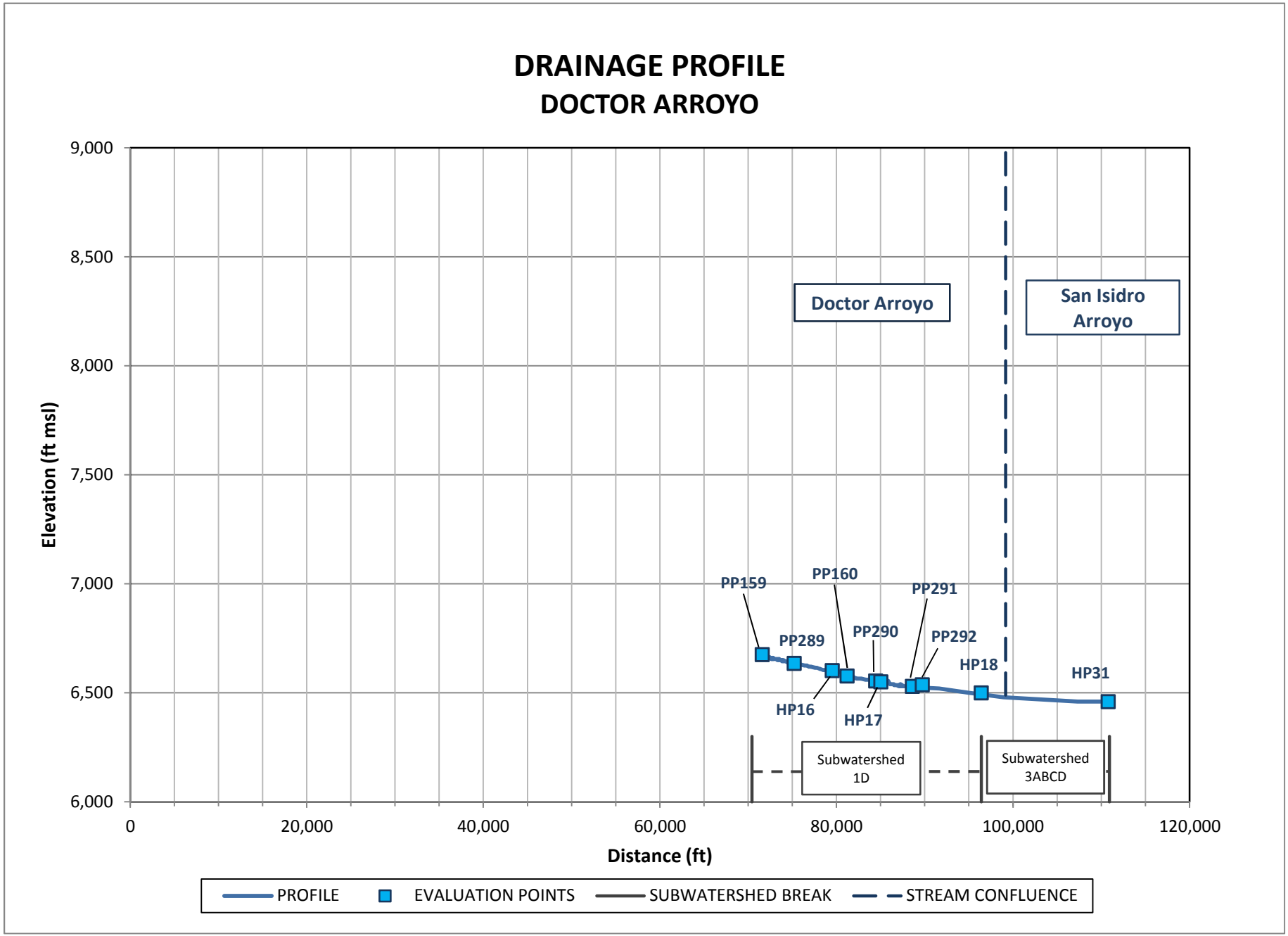
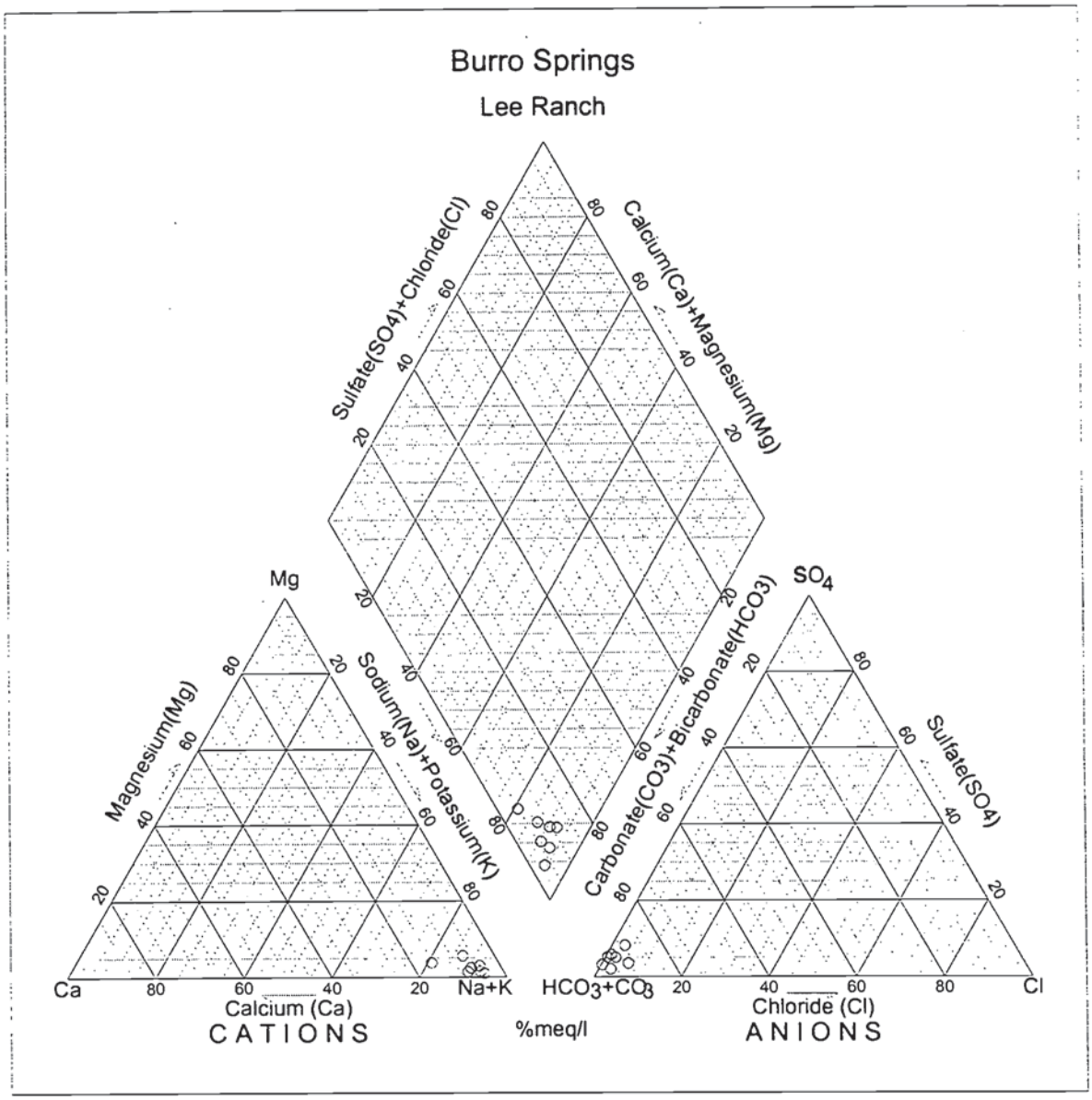


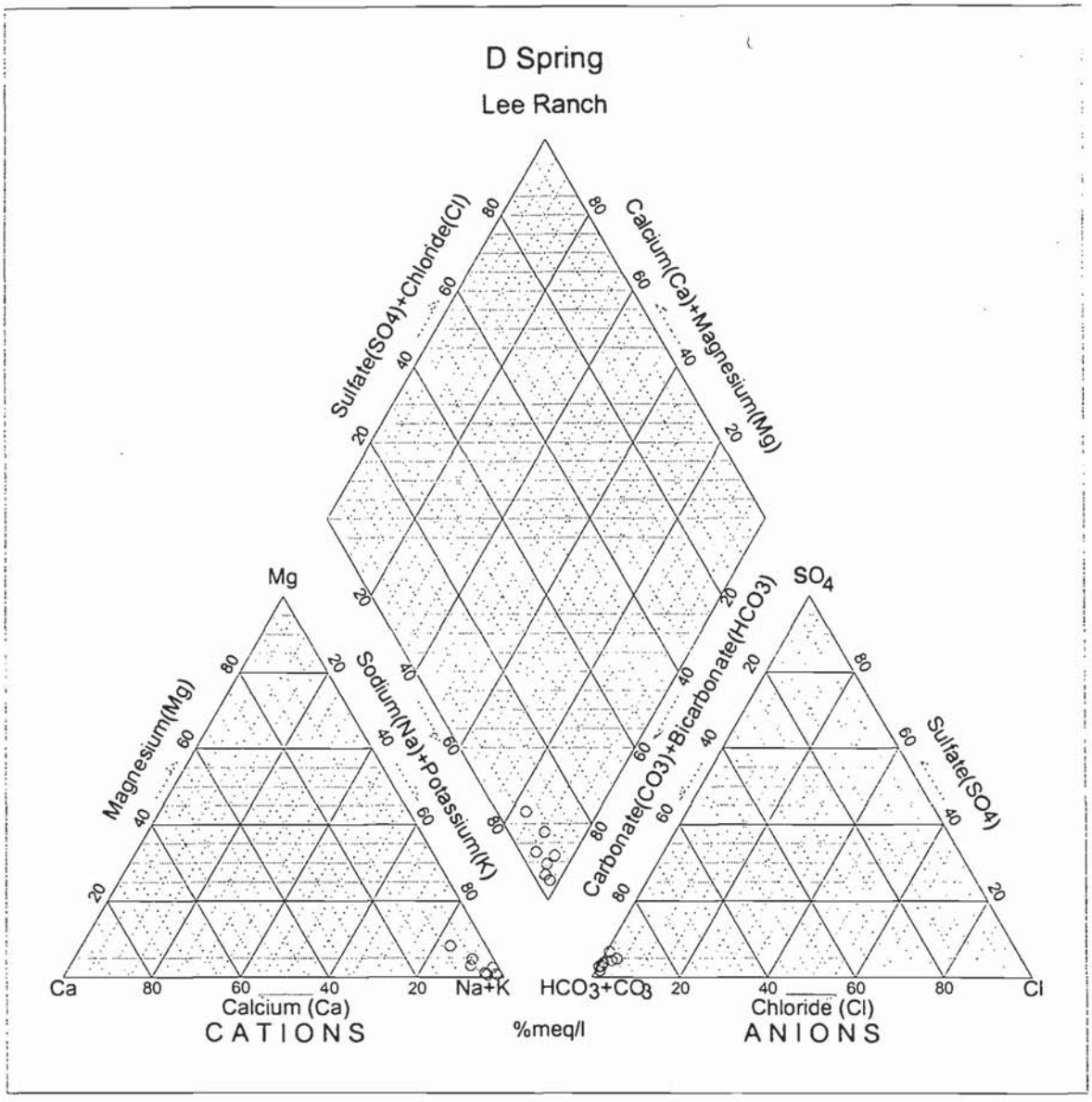
Figure 8. Doctor Arroyo drainage profile.

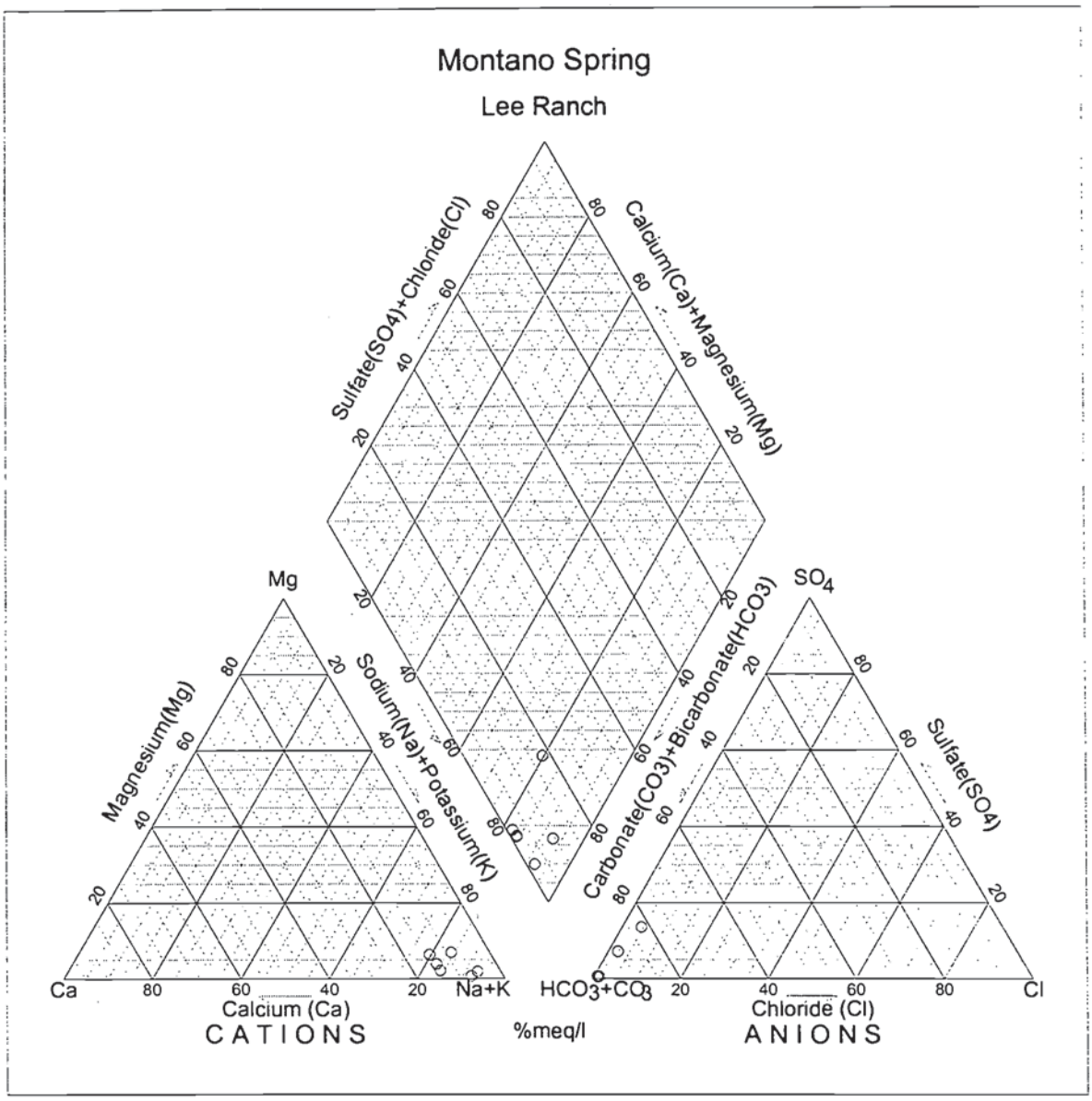


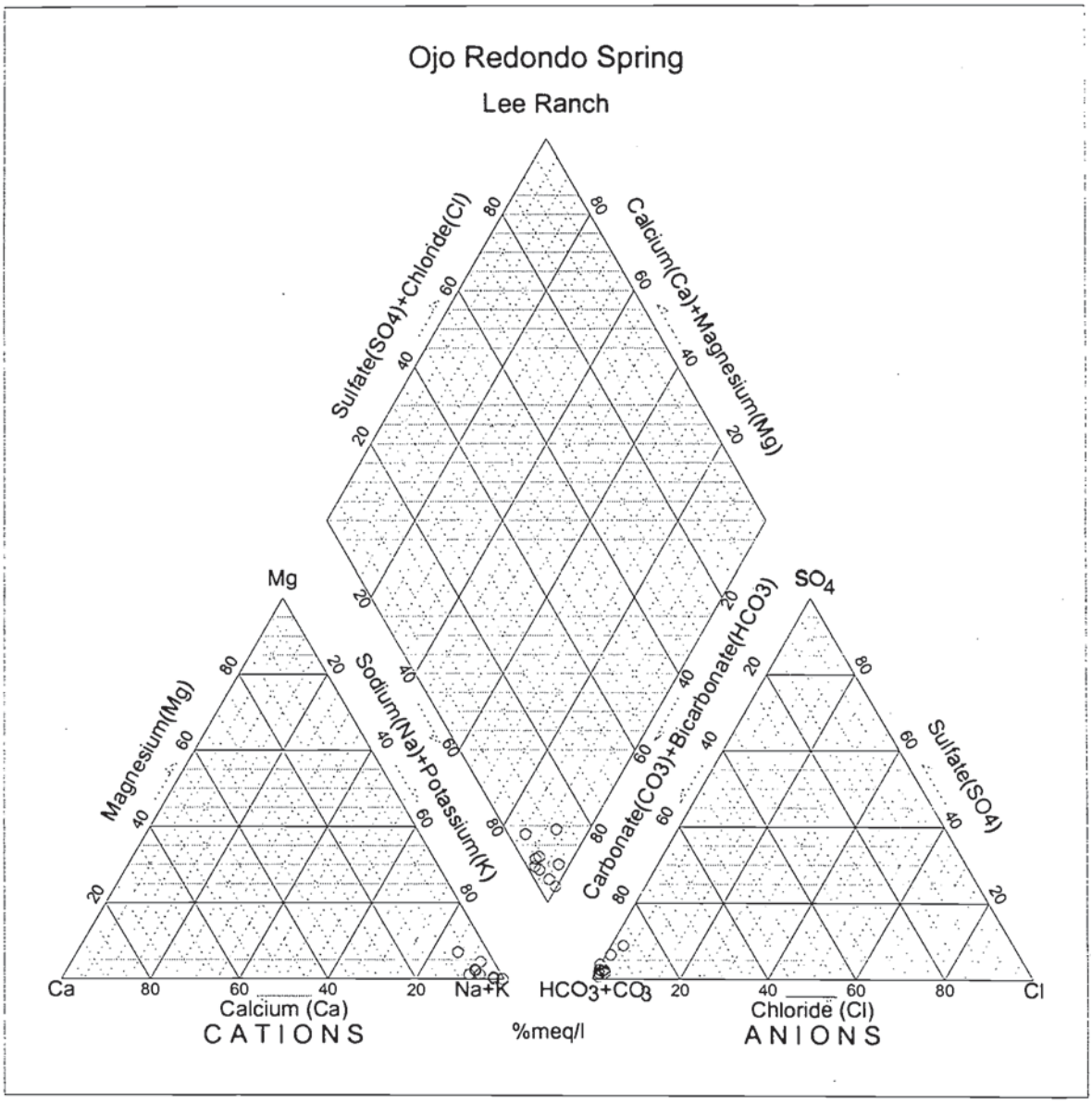
Appendix A

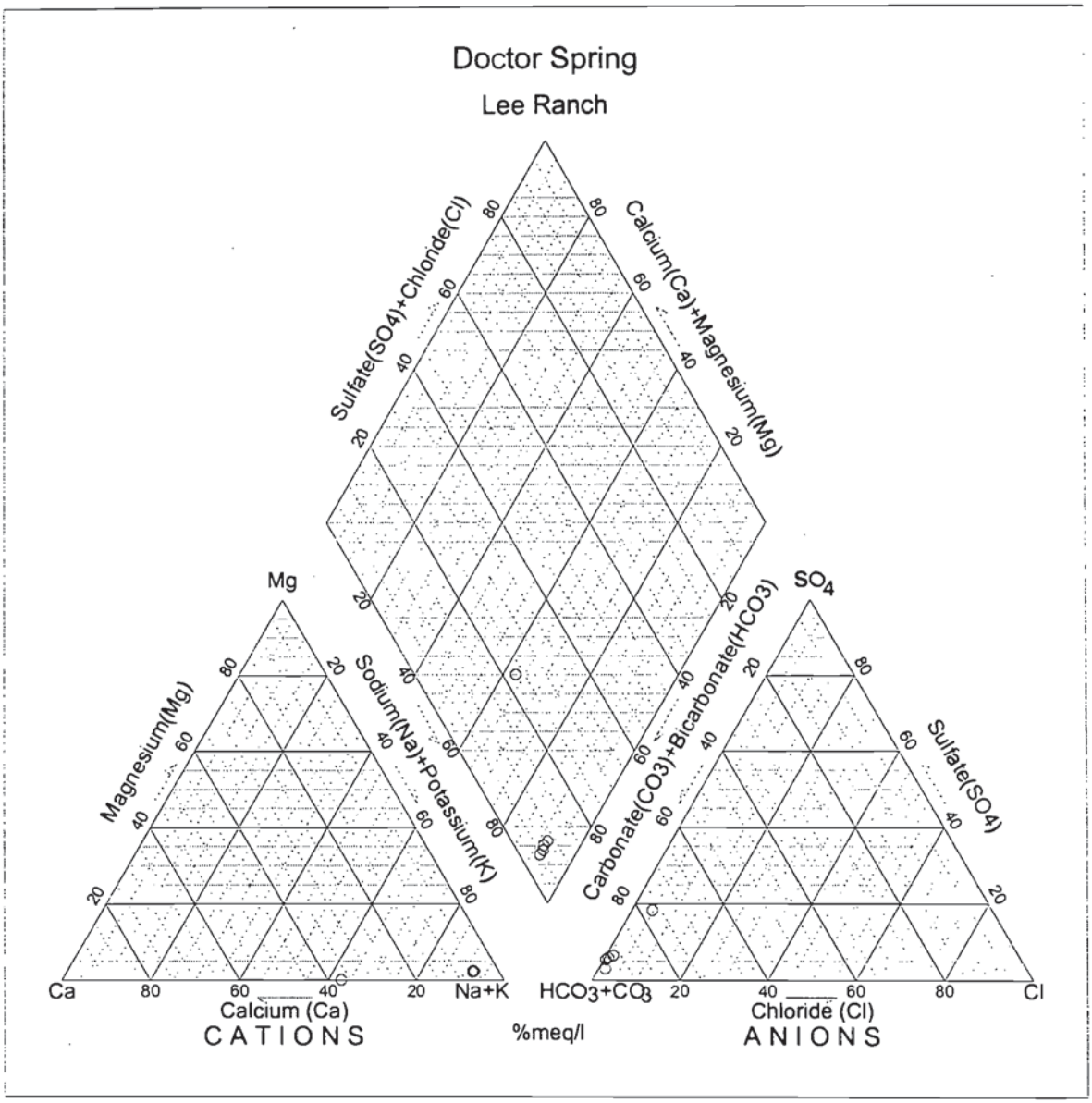
Trilinear Diagrams

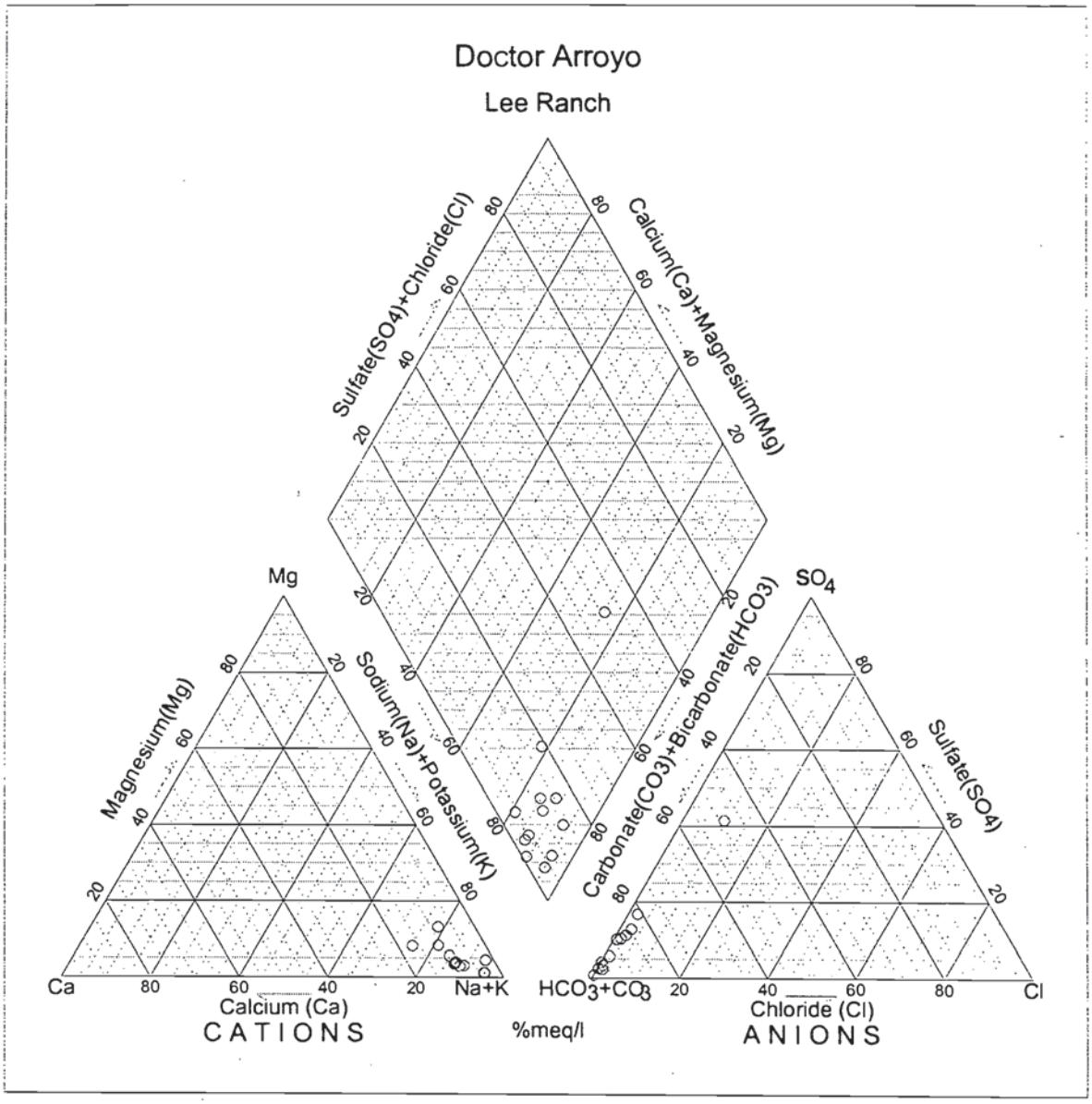

Burro Springs
Lee Ranch
Sulfate(SO4)+Chloride(Cl)
Calcium(Ca)+Magnesium(Mg)
Carbonate(CO3)+Bicarbonate(HCO3)
Mg
Magnesium(Mg)
Sodium(Na)+Potassium(K)
Ca
Na+K
Calcium (Ca)
CATIONS
%meq/l
SO4
Sulfate(SO4)
HCO3+CO3
Cl
Chloride (Cl)
ANIONS

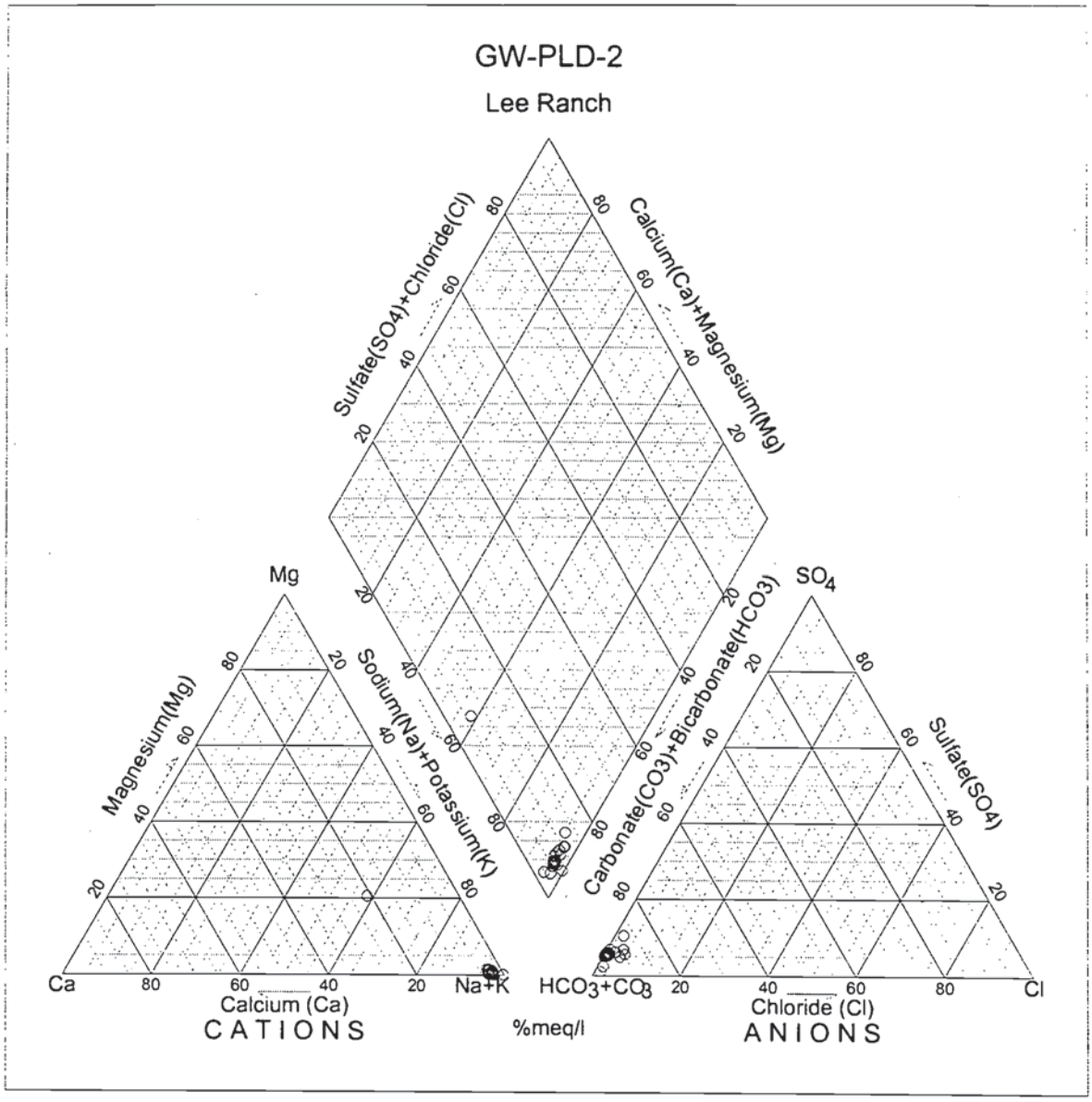

D Spring
Lee Ranch
Sulfate(SO4)+Chloride(Cl)
Calcium(Ca)+Magnesium(Mg)
Carbonate(CO3)+Bicarbonate(HCO3)
Mg
Magnesium(Mg)
Sodium(Na)+Potassium(K)
SO4
Sulfate(SO4)
Ca
Na+K
HCO3+CO3
Cl
Calcium (Ca)
CATIONS
%meq/l
Chloride (Cl)
ANIONS

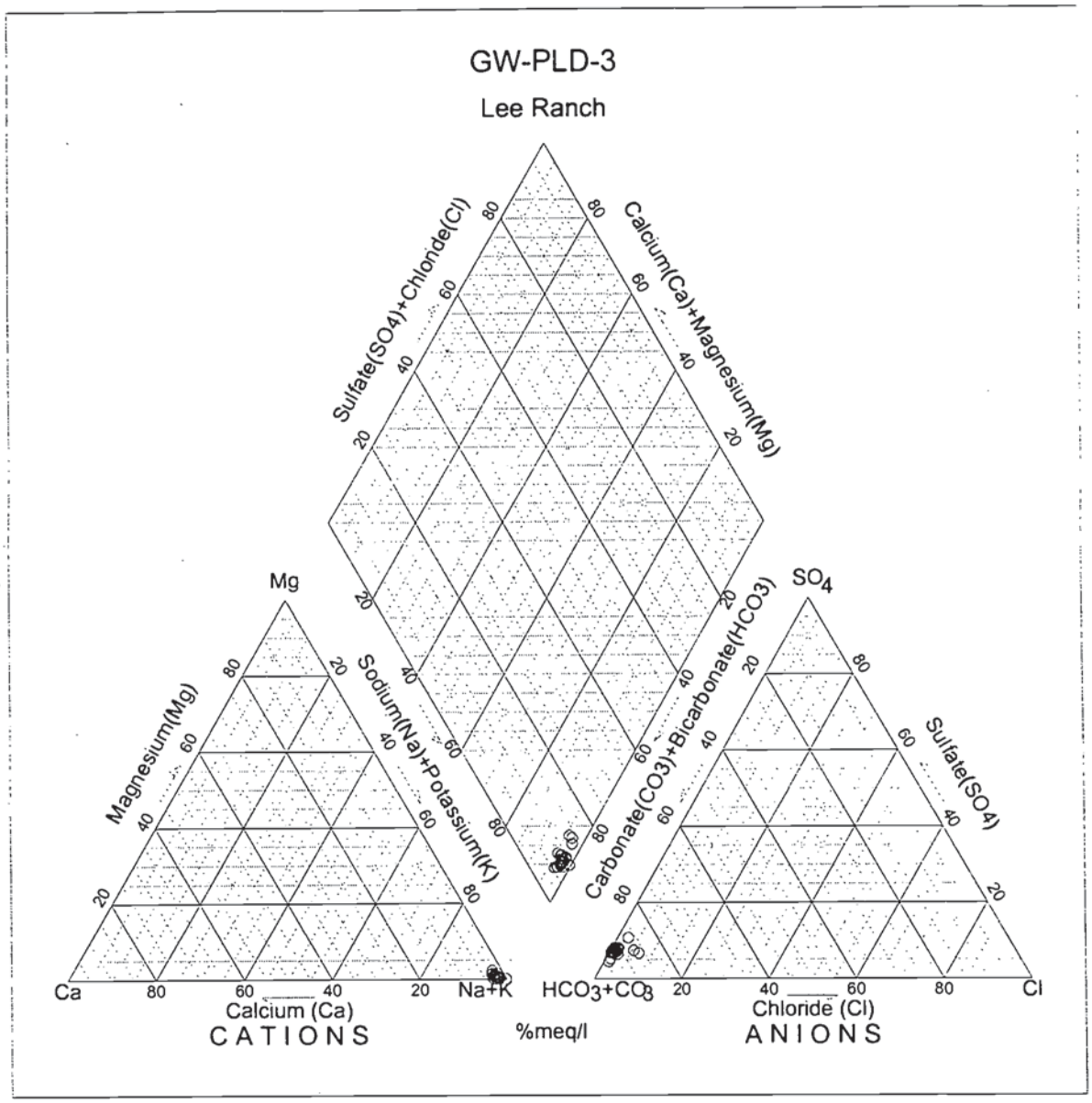

Montano Spring
Lee Ranch
Sulfate(SO4)+Chloride(Cl)
Calcium(Ca)+Magnesium(Mg)
Carbonate(CO3)+Bicarbonate(HCO3)
Sodium(Na)+Potassium(K)
Mg
Magnesium(Mg)
Ca
Na+K
Calcium (Ca)
CATIONS
%meq/l
SO4
Sulfate(SO4)
HCO3+CO3
Cl
Chloride (Cl)
ANIONS


Ojo Redondo Spring
Lee Ranch
Sulfate(SO4)+Chloride(Cl)
Calcium(Ca)+Magnesium(Mg)
Carbonate(CO3)+Bicarbonate(HCO3)
Sodium(Na)+Potassium(K)
Mg
Magnesium(Mg)
Ca
Calcium (Ca)
CATIONS
Na+K
SO4
Sulfate(SO4)
HCO3+CO3
Chloride (Cl)
ANIONS
Cl
%meq/l
80
60
40
20


Doctor Spring
Lee Ranch
Sulfate(SO4)+Chloride(Cl)
Calcium(Ca)+Magnesium(Mg)
Carbonate(CO3)+Bicarbonate(HCO3)
Sodium(Na)+Potassium(K)
Mg
Magnesium(Mg)
Ca
Calcium (Ca)
CATIONS
Na+K
SO4
Sulfate(SO4)
HCO3+CO3
Chloride (Cl)
ANIONS
Cl
%meq/l
80
60
40
20


Doctor Arroyo
Lee Ranch
Sulfate(SO4)+Chloride(Cl)
Calcium(Ca)+Magnesium(Mg)
Mg
Magnesium(Mg)
Sodium(Na)+Potassium(K)
Ca
Na+K
Calcium (Ca)
CATIONS
%meq/l
SO4
Carbonate(CO3)+Bicarbonate(HCO3)
Sulfate(SO4)
HCO3+CO3
Cl
Chloride (Cl)
ANIONS


GW-PLD-2
Lee Ranch
Sulfate(SO4)+Chloride(Cl)
Calcium(Ca)+Magnesium(Mg)
Carbonate(CO3)+Bicarbonate(HCO3)
Sodium(Na)+Potassium(K)
Mg
Magnesium(Mg)
Ca
Calcium (Ca)
CATIONS
Na+K
SO4
Sulfate(SO4)
HCO3+CO3
Chloride (Cl)
ANIONS
Cl
%meq/l
20
40
60
80


GW-PLD-3
Lee Ranch
Sulfate(SO4)+Chloride(Cl)
Calcium(Ca)+Magnesium(Mg)
Carbonate(CO3)+Bicarbonate(HCO3)
Sodium(Na)+Potassium(K)
Mg
Magnesium(Mg)
Ca
Na+K
Calcium (Ca)
CATIONS
%meq/l
SO4
Sulfate(SO4)
HCO3+CO3
Cl
Chloride (Cl)
ANIONS

Appendix B

Level 1 Hydrology Protocol Results

Cover Sheet
Hydrology Protocol Use Attainability Analysis for an Ephemeral Stream[1]

Stream Name:	Basin:	8-digit HUC:
Arroyo Tinaja (Subwatershed 1A)	Rio Grande	13020205
Reach Description:	**Upstream lat/long:**	**Downstream lat/long:**
Unlined, unclassified, ephemeral arroyo	35.461/-107.778	35.503/-107.706
Current WQS		**Assessment Unit ID:**
☒ Unclassified 20.6.4.98 or 99 NMAC ☐ Classified 20.6.4. _____ NMAC		Lee Ranch Mine

Reach Evaluation (How homogeneity of reach hydrology was verified)	
Methods Used:	(ex. aerial photos, "ground truthing", Google™ Earth, etc.) ground truthing, aerial photos
Reasoning:	Why is the stream homogeneous? Similar geology, sinuosity, and vegetation

Hydrology Protocol Results		**Notes**
Location 1 (lat/long): 35.503/-107.722	☒ eph ☐ int ☐ per	HP-11, watershed 1A assessment
Location 2 (lat/long):	☐ eph ☐ int ☐ per	
Location 3 (lat/long):	☐ eph ☐ int ☐ per	
☐ Additional location results attached.		

Hydroclimatic Conditions		**If "yes" please describe.**
Drought (SPI Value < - 1.5)	☐ yes ☒ no	-1 to 0 Eastern half of study area (June 2017, NOAA) 0 to 1 Western half of study area (June 2017, NOAA)
Recent Rainfall (within 48 hours)	☐ yes ☒ no	
Gauge data available?	☐ yes ☒ no	
If yes for any of above, please explain why these conditions do not impact the UAA conclusion that *natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use*:		

Hydrologic and Other Modifications		**If "yes" please describe.**
Dam/diversion	☐ yes ☒ no	
Channelization/roads	☐ yes ☒ no	
Groundwater pumping	☒ yes ☐ no	See explanation at the end of the modification section
Agricultural return flows	☐ yes ☒ no	
Existing point source discharge	☐ yes ☒ no	

[1] This form is designed for the UAA process for ephemeral waters described in Subsection C of 20.6.4.15 NMAC.

Appendix B - Level 1 Hydrology Protocol Results

Hydrologic and Other Modifications		If "yes" please describe.
Planned point source discharge	☐ yes ☒ no	
Other modifications e.g., land use practices	☐ yes ☒ no	*Please explain hydrologic impact*

If yes for any of above, please explain why these modifications do not alter the uses supported by the natural flow regime:

Subwatershed 1A is located upstream of the LRM and has not been impacted by mining activity. Subwatershed 1A consists of the uppermost headwaters of Arroyo Tinaja and is predominantly characterized by steep canyons and terrain. Closer to the subwatershed outlet the landforms begin to transition into the rolling topography of the lower plain seen throughout the rest of the UAA study area. The two production wells at the Lee Ranch Mine are located several miles away from this portion of the watershed and are hydrologically isolated from the arroyo by several hundred feet of low permeable bedrock. The wells are screened within the Gallup aquifer > 1000 ft bgs. The Gallup aquifer is confined and the static water level is approximately 150 - 180 ft bgs. There are no livestock wells located within this subwatershed.

Current Uses Observed		If "yes" please describe.
Macroinvertebrates	☐ yes ☒ no	
Fish	☐ yes ☒ no	
Recreation (contact use)	☐ yes ☒ no	

If yes for any of the above, please explain why these observed uses are consistent with the UAA conclusion that 101(a)(2) aquatic life and recreational uses are not feasible:

Additional Comments:

HP11 was established as the representative assessment point within Subwatershed 1A. HP-11 is located at the base of the Arroyo Tinaja headwater canyons where the landforms begin to transition into the rolling topography of the lower plain. Due to the rough terrain and limited accessibility of the canyons an assessment point was not established within the mesa canyons within Subwatershed 1A. Assessment point HP14 within Subwatershed 1B was established within the highest order headwater canyon reach within the UAA study area and is considered representative of the flow regime present within the lower order canyon drainage channels of Subwatersheds 1A, 1B, and 1C. See Appendix B Mulatto Canyon and Part 4.5.1 of the LRM UAA report for additional information for assessment point HP14. See photo point PP151 within Appendix C for an example of the channel just inside the outer rim of the canyon, PP12B for the adjacent tributary and PP12A for the channel immediately below the confluence of the two channels near the outlet of watershed 1A. A defined channel could not be located at the outlet of Watershed 1A. HP11 is located in the closest reach to the watershed outlet with a defined channel and represents the reach within Subwatershed 1A with the greatest potential for sustained flow and channel development. This location is representative of the stream reach with the greatest potential to support non-ephemeral flow within the subwatershed and therefore provides a conservative estimation of the flow regime of the lower order tributaries within the subwatershed. The Level 1 Evaluation score for HP11 is a 5 and supports a determination that the headwater drainages in Subwatershed 1A are ephemeral.

ATTACHMENTS:

☒ Map and Photos (required)
☒ Hydrology Protocol Field Sheets for all locations (required)
☐ Level 2 Analysis (optional)
☒ Additional sites and/or documentation (optional)

CONCLUSION:

Appendix B - Level 1 Hydrology Protocol Results

This UAA concludes that the stream reach identified above is ephemeral and that Clean Water Act Section 101(a)(2) aquatic life and recreational uses are neither existing nor attainable due to the factor identified in 40 CFR 131.10(g)(2): *natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent*. Based on this conclusion, we recommend that the designated uses and criteria identified in 20.6.4.97 NMAC be applied to this stream reach in accordance with the UAA process set forth in Subsection C of 20.6.4.15 NMAC.

Submitted by: James Boswell

Signed: _____ Date: 5/7/2018

Surface Water Quality Bureau concurs with recommendation. ☐ Yes ☐ No

If no, see attached reasons.

Signed: _____ Date: _____

EPA Region 6 technical approval granted. ☐ Yes ☐ No

If no, see attached reasons.

Signed: _____ Date: _____

Appendix B - Level 1 Hydrology Protocol Results

NMED Surface Water Quality Bureau – LEVEL 1 Hydrology Determination Field Sheet

Date: 06/20/2017	**Stream Name: Arroyo Tinaja**	**Latitude: 35° 30' 10.78"**
Evaluator(s): CG JC JB JJ	**Site ID: Lee Ranch Mine**	**Longitude: 107° 42' 20.78"**
TOTAL POINTS: 7.5 *Stream is at least intermittent if ≥ 12*	**Assessment Unit: HP11**	**Drought Index (12-mo. SPI Value): 0 - -1**

WEATHER CONDITIONS	**NOW:** ___ storm (heavy rain) ___ rain (steady rain) ___ showers (intermittent) _5_ %cloud cover _X_ clear/sunny	**PAST 48 HOURS:** ___ storm (heavy rain) ___ rain (steady rain) ___ showers (intermittent) ___ %cloud cover _X_ clear/sunny	**Has there been a heavy rain in the last 48 hours?** ___ YES _X_ NO **Field evaluations should be performed at least 48 hours after the last known major rainfall event. **OTHER:** **Stream Modifications** ___ YES _X_ NO **Diversions** ___ YES _X_ NO **Discharges** ___ YES _X_ NO **Explain in further detail in NOTES section

LEVEL 1 INDICATORS	STREAM CONDITION			
	Strong	**Moderate**	**Weak**	**Poor**
1.1. Water in Channel	Flow is evident throughout the reach. Moving water is seen in riffle areas but may not be as evident throughout the runs.	Water is present in the channel but flow is barely discernable in areas of greatest gradient change (i.e. riffles) or floating object is necessary to observe flow.	Dry channel with standing pools. There is some evidence of base flows (i.e. riparian vegetation growing along channel, saturated or moist sediment under rocks, etc)	Dry channel. No evidence of base flows was found.
	6	**4**	**2**	**0**
1.2. Fish	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Fish are not present.
	3	**2**	**1**	**0**
1.3. Benthic Macroinvertebrates	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Macroinvertebrates are not present.
	3	**2**	**1**	**0**
1.4. Filamentous Algae/Periphyton	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Filamentous algae and/or periphyton are not present.
	3	**2**	**1**	**0**
1.5. Differences in Vegetation	Dramatic compositional differences in vegetation are present between the stream banks and the adjacent uplands. A distict riparian vegetation corridor exists along the entire reach – riparian, aquatic, or wetland species dominate the length of the reach.	A distinct riparian vegetation corridor exists along part of the reach. Riparian vegetation is interspersed with upland vegetation along the length of the reach.	Vegetation growing along the reach may occur in greater densities or grow more vigorously than vegetation in the adjacent uplands, but there are no dramatic compositional differences between the two.	No compositional or density differences in vegetation are present between the streambanks and the adjacent uplands.
	3	**2**	**1**	**0**
1.6. Absence of Rooted Upland Plants in Streambed	Rooted upland plants are absent within the streambed/thalweg.	There are a few rooted upland plants present within the streambed/thalweg.	Rooted upland plants are consistently dispersed throughout the streambed/thalweg	Rooted upland plants are prevalent within the streambed/thalweg.
	3	**2**	**1**	**0**
			SUBTOTAL (#1.1 – #1.6)	**2**

If the stream being evaluated has a subtotal ≤ 2 at this juncture, the stream is determined to be EPHEMERAL.
If the stream being evaluated has a subtotal ≥ 18 at this point, the stream is determined to be PERENNIAL.
YOU MAY STOP THE EVALUATION AT THIS POINT. If the stream has a subtotal between 2 and 18 continue the Level 1 Evaluation.

Appendix B - Level 1 Hydrology Protocol Results

LEVEL 1 INDICATORS	STREAM CONDITION			
	Strong	Moderate	Weak	Poor
1.7. Sinuosity	**Ratio > 1.4.** Stream has numerous, closely-spaced bends, few straight sections.	**Ratio < 1.4.** Stream has good sinuosity with some straight sections.	**Ratio < 1.2.** Stream has very few bends and mostly straight sections.	**Ratio = 1.0.** Stream is completely straight with no bends.
	3	2	1	0
1.8. Floodplain and Channel Dimensions	**Ratio > 2.5.** Stream is minimally confined with a wide, active floodplain.	**Ratio between 1.2 and 2.5.** Stream is moderately confined. Floodplain is present, but may only be active during larger floods.	**Ratio < 1.2.** Stream is incised with a noticeably confined channel. Floodplain is narrow or absent and typically disconnected from the channel.	
	3	1.5	0	
1.9. In-Channel Structure: Riffle-Pool Sequence	Demonstrated by a frequent number of riffles followed by pools along the entire reach. There is an obvious transition between riffles and pools.	Represented by a less frequent number of riffles and pools. Distinguishing the transition between riffles and pools is difficult.	Stream shows some flow but mostly has areas of pools or of riffles.	There is no sequence exhibited.
	3	2	1	0
SUBTOTAL (#1.1 – #1.9)				4.5

If the stream being evaluated has a subtotal ≤ 5 at this juncture, the stream is determined to be EPHEMERAL.
If the stream being evaluated has a subtotal ≥ 21 at this point, the stream is determined to be PERENNIAL.
YOU MAY STOP THE EVALUATION AT THIS POINT. If the stream has a subtotal between 5 and 21 continue the Level 1 Evaluation.

1.10. Particle Size or Stream Substrate Sorting	Particle sizes in the channel are noticeably different from particle sizes in areas close to but not in the channel. There is a clear distribution of various sized substrates in the stream channel with finer particles accumulating in the pools, and larger particles accumulating in the riffles/runs.	Particle sizes in the channel are moderately similar to particle sizes in areas close to but not in the channel. Various sized substrates are present in the stream channel and are represented by a higher ratio of larger particles (gravel/cobble).	Particle sizes in the channel are similar or comparable to particle sizes in areas close to but not in the channel. Substrate sorting is not readily observed in the stream channel.
	3	1.5	0
1.11. Hydric Soils	Hydric soils are found within the study reach.		Hydric soils are not found within the study reach.
	Present = 3		Absent = 0
1.11. Sediment on Plants and Debris	Sediment found readily on plants and debris within the stream channel, on the streambank, and within the floodplain throughout the length of the stream.	Sediment found on plants or debris within the stream channel although it is not prevalent along the stream. Mostly accumulating in pools.	Sediment is isolated in small amounts along the stream.	No sediment is present on plants or debris.
	1.5	1	0.5	0
TOTAL POINTS (#1.1 – #1.12)				5.0

SUPPLEMENTAL INDICATORS: **The following indicators do not occur consistently throughout New Mexico but may be useful in the determination of perenniality. If the indicator is present record score below and tally with previous score to compute TOTAL.**		
1.13. Seeps and Springs	Seeps and springs are found within the study reach.	Seeps and springs are not found within the study reach.
	Present = 1.5	Absent = 0
1.14. Iron Oxidizing Bacteria/Fungi	Iron-oxidizing bacteria and/or fungi are found within the study reach.	Iron-oxidizing bacteria and/or fungi are not found within the study reach.
	Present = 1.5	Absent = 0
TOTAL *plus* SUPPLEMENTAL POINTS (#1.1 – #1.14)		5.0

NMED Surface Water Quality Bureau – LEVEL 1 Hydrology Determination Field Sheet

Photo Descriptions and NOTES

Photo #	Description (US, DS, LB, RB, etc.)	Notes
1	HP11 upstream	
2	HP11 downstream	
3	HP11 rooted plants and cobble in the channel.	

NOTES:

Channel: Active channel relatively straight. Approximately 5 feet wide. Nearly 20 feet tall and 30 feet across to upper terrace. Evidence of bank erosion on sides.

Substrate: Very fine sand and silt. Some subangular pebbles and occasional cobbles.

Vegetation: Some upland vegetation in channel. Vegetation prevalent on banks. Composition similar to surrounding upland area.

Soils: Very weak redox features and more than 18" deep.

Assessment Length: HP recommends use of either 40 times the channel width or 150 meters, whichever is larger, as the assessment length. Channel width is up to 8 feet. 40 times the channel width is less than 150 meters. Therefore, an assessment length of at least 150 meters was used.

Various: Sinuosity low a(ratio: ~ 1.15). Shelly Lemon and Brian Dahl with NMED were present during HP11 Assessment.

LEVEL 1 Field Measurements

INDICATOR #1.10 Particle Size or Stream Substrate Sorting

Used Sand Gauge (©1984 by W.F. McCollough)

INDICATOR #1.8 (*Floodplain and Channel Dimensions*) – MEASUREMENTS & CALCULATIONS**

Max Depth (#1)	Bankfull Stage (#2)	Maximum Depth Value (#3)	2x Maximum Depth Value (#3)	Flood-Prone Area Location (#4)	Flood-Prone Area Width (#5)	Bankfull Width (#6)	Floodplain to Active Channel Ratio (FPA Width / Bankfull Width)
5.06’	4.76’	0.30’	0.60’	4.46’	9.83’	7.67’	1.28

****REFER to Figure 3 on page 19 for clarification**

Lee Ranch Mine Photos

1 - HP11 upstream

2 - HP11 downstream

3 - HP11 rooted plants and cobble in the channel

Lee Ranch HP UAA 6-20-17

HYDROLOGY DETERMINATION
FIELD SHEETS

Available at the SWQB Hydrology Protocol website:
(http://www.nmenv.state.nm.us/swqb/Hydrology/index.html)

Appendix B - Level 1 Hydrology Protocol Results

NMED Surface Water Quality Bureau – LEVEL 1 Hydrology Determination Field Sheet

Date: 6-20-17	**Stream Name:** Tinaja	**Latitude:** 35.50286
Evaluator(s): SL, BD	**Site ID:** HP11	**Longitude:** 107.70572
TOTAL POINTS: *Stream is at least intermittent if ≥ 12*	**Assessment Unit:**	**Drought Index (12-mo. SPI Value):**

	NOW:	**PAST 48 HOURS:**	**Has there been a heavy rain in the last 48 hours?**
WEATHER CONDITIONS	___ storm (heavy rain) ___ rain (steady rain) ___ showers (intermittent) ___ %cloud cover X clear/sunny	___ storm (heavy rain) ___ rain (steady rain) ___ showers (intermittent) ___ %cloud cover X clear/sunny	___ YES X NO **Field evaluations should be performed at least 48 hours after the last known major rainfall event. **OTHER:** **Stream Modifications** ___ YES X NO **Diversions** ___ YES X NO **Discharges** ___ YES X NO **Explain in further detail in NOTES section

LEVEL 1 INDICATORS	STREAM CONDITION			
	Strong	Moderate	Weak	Poor
1.1. Water in Channel	Flow is evident throughout the reach. Moving water is seen in riffle areas but may not be as evident throughout the runs.	Water is present in the channel but flow is barely discernable in areas of greatest gradient change (i.e. riffles) or floating object is necessary to observe flow.	Dry channel with standing pools. There is some evidence of base flows (i.e. riparian vegetation growing along channel, saturated or moist sediment under rocks, etc)	Dry channel. No evidence of base flows was found.
	6	4	2	0
1.2. Fish	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Fish are not present.
	3	2	1	0
1.3. Benthic Macroinvertebrates	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Macroinvertebrates are not present.
	3	2	1	0
1.4. Filamentous Algae/Periphyton	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Filamentous algae and/or periphyton are not present.
	3	2	1	0
1.5. Differences in Vegetation	Dramatic compositional differences in vegetation are present between the stream banks and the adjacent uplands. A distict riparian vegetation corridor exists along the entire reach – riparian, aquatic, or wetland species dominate the length of the reach.	A distinct riparian vegetation corridor exists along part of the reach. Riparian vegetation is interspersed with upland vegetation along the length of the reach.	Vegetation growing along the reach may occur in greater densities or grow more vigorously than vegetation in the adjacent uplands, but there are no dramatic compositional differences between the two.	No compositional or density differences in vegetation are present between the streambanks and the adjacent uplands.
	3	2	1	0
1.6. Absence of Rooted Upland Plants in Streambed	Rooted upland plants are absent within the streambed/thalweg.	There are a few rooted upland plants present within the streambed/thalweg.	Rooted upland plants are consistently dispersed throughout the streambed/thalweg	Rooted upland plants are prevalent within the streambed/thalweg.
	3	2	1	0
			SUBTOTAL (#1.1 – #1.6)	2

If the stream being evaluated has a subtotal ≤ 2 at this juncture, the stream is determined to be EPHEMERAL.
If the stream being evaluated has a subtotal ≥ 18 at this point, the stream is determined to be PERENNIAL.
YOU MAY STOP THE EVALUATION AT THIS POINT. If the stream has a subtotal between 2 and 18 continue the Level 1 Evaluation.

Appendix B - Level 1 Hydrology Protocol Results

LEVEL 1 INDICATORS	STREAM CONDITION			
	Strong	Moderate	Weak	Poor
1.7. Sinuosity	**Ratio > 1.4.** Stream has numerous, closely-spaced bends, few straight sections.	**Ratio < 1.4.** Stream has good sinuosity with some straight sections.	**Ratio < 1.2.** Stream has very few bends and mostly straight sections.	**Ratio = 1.0.** Stream is completely straight with no bends.
	3	2	1	0
1.8. Floodplain and Channel Dimensions	**Ratio > 2.5.** Stream is minimally confined with a wide, active floodplain.	**Ratio between 1.2 and 2.5.** Stream is moderately confined. Floodplain is present, but may only be active during larger floods.	**Ratio < 1.2.** Stream is incised with a noticeably confined channel. Floodplain is narrow or absent and typically disconnected from the channel.	
	3	1.5	0	
1.9. In-Channel Structure: Riffle-Pool Sequence	Demonstrated by a frequent number of riffles followed by pools along the entire reach. There is an obvious transition between riffles and pools.	Represented by a less frequent number of riffles and pools. Distinguishing the transition between riffles and pools is difficult.	Stream shows some flow but mostly has areas of pools or of riffles.	There is no sequence exhibited.
	3	2	1	0
SUBTOTAL (#1.1 – #1.9)				4.5

If the stream being evaluated has a subtotal ≤ 5 at this juncture, the stream is determined to be EPHEMERAL.
If the stream being evaluated has a subtotal ≥ 21 at this point, the stream is determined to be PERENNIAL.
YOU MAY STOP THE EVALUATION AT THIS POINT. If the stream has a subtotal between 5 and 21 continue the Level 1 Evaluation.

1.10. Particle Size or Stream Substrate Sorting	Particle sizes in the channel are noticeably different from particle sizes in areas close to but not in the channel. There is a clear distribution of various sized substrates in the stream channel with finer particles accumulating in the pools, and larger particles accumulating in the riffles/runs.	Particle sizes in the channel are moderately similar to particle sizes in areas close to but not in the channel. Various sized substrates are present in the stream channel and are represented by a higher ratio of larger particles (gravel/cobble).	Particle sizes in the channel are similar or comparable to particle sizes in areas close to but not in the channel. Substrate sorting is not readily observed in the stream channel.	
	3	1.5	0	
1.11. Hydric Soils	Hydric soils are found within the study reach.		Hydric soils are not found within the study reach.	
	Present = 3		Absent = 0	
1.12. Sediment on Plants and Debris	Sediment found readily on plants and debris within the stream channel, on the streambank, and within the floodplain throughout the length of the stream.	Sediment found on plants or debris within the stream channel although it is not prevalent along the stream. Mostly accumulating in pools.	Sediment is isolated in small amounts along the stream.	No sediment is present on plants or debris.
	1.5	1	0.5	0
TOTAL POINTS (#1.1 – #1.12)				6.0

SUPPLEMENTAL INDICATORS: The following indicators do not occur consistently throughout New Mexico but may be useful in the determination of perenniality. If the indicator is present record score below and tally with previous score to compute TOTAL.		
1.13. Seeps and Springs	Seeps and springs are found within the study reach.	Seeps and springs are not found within the study reach.
	Present = 1.5	Absent = 0
1.14. Iron Oxidizing Bacteria/Fungi	Iron-oxidizing bacteria and/or fungi are found within the study reach.	Iron-oxidizing bacteria and/or fungi are not found within the study reach.
	Present = 1.5	Absent = 0
TOTAL *plus* SUPPLEMENTAL POINTS (#1.1 – #1.14)		6.0

NMED Surface Water Quality Bureau – LEVEL 1 Hydrology Determination Field Sheet

Photo Descriptions and NOTES

Photo #	Description (US, DS, LB, RB, etc.)	Notes

5.06
4.76
.30

Max Depth = 0.3
2X Max = 0.6

NOTES:

5.06 4.76 (BF)

Very fine sand w/ silt
some pebbles w/ very few cobbles

7ft 8in = 7.67 ft Bankfull ~~Width~~ Width

4.46ft (stage) 9ft 10in = 9.83 Flood Prone Area Width

Ratio = 1.28

Cover Sheet
Hydrology Protocol Use Attainability Analysis for an Ephemeral Stream[1]

Stream Name:	Basin:	8-digit HUC:
Mulatto Canyon (Subwatershed 1B)	Rio Grande	13020205
Reach Description:	**Upstream lat/long:**	**Downstream lat/long:**
Unlined, unclassified, ephemeral arroyo	35.427/-107.745	35.483/-107.680
Current WQS		**Assessment Unit ID:**
☒ Unclassified 20.6.4.98 or 99 NMAC ☐ Classified 20.6.4. _____ NMAC		Lee Ranch Mine

Reach Evaluation (How homogeneity of reach hydrology was verified)	
Methods Used:	(ex. aerial photos, "ground truthing", Google™ Earth, etc.) ground truthing, aerial photos
Reasoning:	Why is the stream homogeneous? Similar geology, sinuosity, and vegetation

Hydrology Protocol Results		Notes
Location 1 (lat/long): 35.474/-107.69	☒ eph ☐ int ☐ per	HP-14, watershed 1B Assessment within canyons
Location 2 (lat/long): 35.485/-107.68	☒ eph ☐ int ☐ per	HP-13, watershed 1B Assessment at base of canyons
Location 3 (lat/long):	☐ eph ☐ int ☐ per	
☐ Additional location results attached.		

Hydroclimatic Conditions		If "yes" please describe.
Drought (SPI Value < - 1.5)	☐ yes ☒ no	-1 to 0 Eastern half of study area (June 2017, NOAA) 0 to 1 Western half of study area (June 2017, NOAA)
Recent Rainfall (within 48 hours)	☐ yes ☒ no	
Gauge data available?	☐ yes ☒ no	
If yes for any of above, please explain why these conditions do not impact the UAA conclusion that *natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use*:		

Hydrologic and Other Modifications		If "yes" please describe.
Dam/diversion	☐ yes ☒ no	
Channelization/roads	☐ yes ☒ no	
Groundwater pumping	☒ yes ☐ no	See explanation at the end of the modification section
Agricultural return flows	☐ yes ☒ no	
Existing point source discharge	☐ yes ☒ no	

[1] This form is designed for the UAA process for ephemeral waters described in Subsection C of 20.6.4.15 NMAC.

Appendix B - Level 1 Hydrology Protocol Results

Hydrologic and Other Modifications		If "yes" please describe.
Planned point source discharge	☐ yes ☒ no	
Other modifications e.g., land use practices	☐ yes ☒ no	*Please explain hydrologic impact*

If yes for any of above, please explain why these modifications do not alter the uses supported by the natural flow regime:

Subwatershed 1B is located upstream of the LRM and has not been impacted by mining activity. Assessment point HP-14 is located within the headwater canyons and assessment point HP-13 is located at the base of the headwater canyons. The two production wells at the Lee Ranch Mine are hydrologically isolated from Mulatto Canyon by several hundred feet of low permeable bedrock. The wells are screened within the Gallup aquifer > 1000 ft bgs. The Gallup aquifer is confined and is not in direct hydrologic connection with any of the subwatersheds drainage channels. The static water level of the Gallup aquifer in this area is approximately 150 - 180 ft bgs. In addition there is 1 livestock well located within this subwatershed that has a permitted withdrawal of 3 ac-ft per year (see Figure 1). Livestock wells are used on an as needed basis when the herd is grazing in the immediate area. Therefore for the purpose of this assessment this withdrawal is considered to be insignificant.

Current Uses Observed		If "yes" please describe.
Macroinvertebrates	☐ yes ☒ no	
Fish	☐ yes ☒ no	
Recreation (contact use)	☐ yes ☒ no	

If yes for any of the above, please explain why these observed uses are consistent with the UAA conclusion that 101(a)(2) aquatic life and recreational uses are not feasible:

Additional Comments:

Two assessment points were established within Subwatershed 1B. Assessment point HP14 is located within the Mulatto Canyon headwaters. There are no roads and access into the canyons is limited due the rough terrain. HP14 is located within the highest order stream in the mesa canyon terrain and should allow for a conservative representation of the flow regime for the smaller tributaries within the upper canyon headwater area. Assessment point HP13 is located just downstream of the canyons where the landforms transition to the rolling topography of the lower plain to the north and throughout a majority of the study area. This location was established downstream of HP14 along the well-defined drainage channel and represents the reach with the largest drainage area. This location is representative of the stream reach with the greatest potential to support non-ephemeral flow within the subwatershed and therefore provides a conservative estimation of the flow regime of the lower order drainage channels throughout the subwatershed. No modifications from mining have occurred within Subwatershed 1B. The Level 1 Evaluation score for both HP14 (6.5) and HP13 (7.5) support a determination that the headwater drainages within Subwatershed 1B are ephemeral.

ATTACHMENTS:

☒ Map and Photos (required)
☒ Hydrology Protocol Field Sheets for all locations (required)
☐ Level 2 Analysis (optional)
☒ Additional sites and/or documentation (optional)

CONCLUSION:

This UAA concludes that the stream reach identified above is ephemeral and that Clean Water Act Section 101(a)(2) aquatic life and recreational uses are neither existing nor attainable due to the factor identified in 40 CFR 131.10(g)(2): *natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment*

of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent. Based on this conclusion, we recommend that the designated uses and criteria identified in 20.6.4.97 NMAC be applied to this stream reach in accordance with the UAA process set forth in Subsection C of 20.6.4.15 NMAC.

Submitted by: James Boswell Signed:  Date: 5/7/2018
Surface Water Quality Bureau concurs with recommendation. ☐ Yes ☐ No *If no, see attached reasons.* Signed: _____ Date: _____
EPA Region 6 technical approval granted. ☐ Yes ☐ No *If no, see attached reasons.* Signed: _____ Date: _____

Appendix B - Level 1 Hydrology Protocol Results

NMED Surface Water Quality Bureau – LEVEL 1 Hydrology Determination Field Sheet

Date: 06/20/17	**Stream Name: Mulatto Canyon**	**Latitude: 35° 29' 05.18**
Evaluator(s): CG JC JB JJ	**Site ID: Lee Ranch Mine**	**Longitude: 107° 40' 48.04"**
TOTAL POINTS: 7 *Stream is at least intermittent if ≥ 12*	**Assessment Unit: HP13**	**Drought Index (12-mo. SPI Value): 0 - -1**

WEATHER CONDITIONS	**NOW:** ___ storm (heavy rain) ___ rain (steady rain) ___ showers (intermittent) _5_ %cloud cover _X_ clear/sunny	**PAST 48 HOURS:** ___ storm (heavy rain) ___ rain (steady rain) ___ showers (intermittent) ___ %cloud cover _X_ clear/sunny	**Has there been a heavy rain in the last 48 hours?** ___ YES _X_ NO **Field evaluations should be performed at least 48 hours after the last known major rainfall event. **OTHER:** **Stream Modifications** ___ YES _X_ NO **Diversions** ___ YES _X_ NO **Discharges** ___ YES _X_ NO **Explain in further detail in NOTES section

LEVEL 1 INDICATORS	STREAM CONDITION			
	Strong	**Moderate**	**Weak**	**Poor**
1.1. Water in Channel	Flow is evident throughout the reach. Moving water is seen in riffle areas but may not be as evident throughout the runs.	Water is present in the channel but flow is barely discernable in areas of greatest gradient change (i.e. riffles) or floating object is necessary to observe flow.	Dry channel with standing pools. There is some evidence of base flows (i.e. riparian vegetation growing along channel, saturated or moist sediment under rocks, etc)	Dry channel. No evidence of base flows was found.
	6	**4**	**2**	**0**
1.2. Fish	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Fish are not present.
	3	**2**	**1**	**0**
1.3. Benthic Macroinvertebrates	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Macroinvertebrates are not present.
	3	**2**	**1**	**0**
1.4. Filamentous Algae/Periphyton	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Filamentous algae and/or periphyton are not present.
	3	**2**	**1**	**0**
1.5. Differences in Vegetation	Dramatic compositional differences in vegetation are present between the stream banks and the adjacent uplands. A distict riparian vegetation corridor exists along the entire reach – riparian, aquatic, or wetland species dominate the length of the reach.	A distinct riparian vegetation corridor exists along part of the reach. Riparian vegetation is interspersed with upland vegetation along the length of the reach.	Vegetation growing along the reach may occur in greater densities or grow more vigorously than vegetation in the adjacent uplands, but there are no dramatic compositional differences between the two.	No compositional or density differences in vegetation are present between the streambanks and the adjacent uplands.
	3	**2**	**1**	**0**
1.6. Absence of Rooted Upland Plants in Streambed	Rooted upland plants are absent within the streambed/thalweg.	There are a few rooted upland plants present within the streambed/thalweg.	Rooted upland plants are consistently dispersed throughout the streambed/thalweg	Rooted upland plants are prevalent within the streambed/thalweg.
	3	**2**	**1**	**0**
			SUBTOTAL (#1.1 – #1.6)	**3**

If the stream being evaluated has a subtotal ≤ 2 at this juncture, the stream is determined to be EPHEMERAL.
If the stream being evaluated has a subtotal ≥ 18 at this point, the stream is determined to be PERENNIAL.
YOU MAY STOP THE EVALUATION AT THIS POINT. If the stream has a subtotal between 2 and 18 continue the Level 1 Evaluation.

Appendix B - Level 1 Hydrology Protocol Results

LEVEL 1 INDICATORS	STREAM CONDITION			
	Strong	Moderate	Weak	Poor
1.7. Sinuosity	**Ratio > 1.4.** Stream has numerous, closely-spaced bends, few straight sections.	**Ratio < 1.4.** Stream has good sinuosity with some straight sections.	**Ratio < 1.2.** Stream has very few bends and mostly straight sections.	**Ratio = 1.0.** Stream is completely straight with no bends.
	3	2	1	0.5 / 0
1.8. Floodplain and Channel Dimensions	**Ratio > 2.5.** Stream is minimally confined with a wide, active floodplain.	**Ratio between 1.2 and 2.5.** Stream is moderately confined. Floodplain is present, but may only be active during larger floods.	**Ratio < 1.2.** Stream is incised with a noticeably confined channel. Floodplain is narrow or absent and typically disconnected from the channel.	
	3	1.5	0	
1.9. In-Channel Structure: Riffle-Pool Sequence	Demonstrated by a frequent number of riffles followed by pools along the entire reach. There is an obvious transition between riffles and pools.	Represented by a less frequent number of riffles and pools. Distinguishing the transition between riffles and pools is difficult.	Stream shows some flow but mostly has areas of pools or of riffles.	There is no sequence exhibited.
	3	2	1	0
SUBTOTAL (#1.1 – #1.9)				5

If the stream being evaluated has a subtotal ≤ 5 at this juncture, the stream is determined to be EPHEMERAL.
If the stream being evaluated has a subtotal ≥ 21 at this point, the stream is determined to be PERENNIAL.
YOU MAY STOP THE EVALUATION AT THIS POINT. If the stream has a subtotal between 5 and 21 continue the Level 1 Evaluation.

1.10. Particle Size or Stream Substrate Sorting	Particle sizes in the channel are noticeably different from particle sizes in areas close to but not in the channel. There is a clear distribution of various sized substrates in the stream channel with finer particles accumulating in the pools, and larger particles accumulating in the riffles/runs.	Particle sizes in the channel are moderately similar to particle sizes in areas close to but not in the channel. Various sized substrates are present in the stream channel and are represented by a higher ratio of larger particles (gravel/cobble).	Particle sizes in the channel are similar or comparable to particle sizes in areas close to but not in the channel. Substrate sorting is not readily observed in the stream channel.
	3	1.5	0
1.11. Hydric Soils	Hydric soils are found within the study reach.		Hydric soils are not found within the study reach.
	Present = 3		Absent = 0
1.12. Sediment on Plants and Debris	Sediment found readily on plants and debris within the stream channel, on the streambank, and within the floodplain throughout the length of the stream.	Sediment found on plants or debris within the stream channel although it is not prevalent along the stream. Mostly accumulating in pools.	Sediment is isolated in small amounts along the stream.	No sediment is present on plants or debris.
	1.5	1	0.5	0
TOTAL POINTS (#1.1 – #1.12)				7

SUPPLEMENTAL INDICATORS: **The following indicators do not occur consistently throughout New Mexico but may be useful in the determination of perenniality. If the indicator is present record score below and tally with previous score to compute TOTAL.**

1.13. Seeps and Springs	Seeps and springs are found within the study reach.	Seeps and springs are not found within the study reach.
	Present = 1.5	Absent = 0
1.14. Iron Oxidizing Bacteria/Fungi	Iron-oxidizing bacteria and/or fungi are found within the study reach.	Iron-oxidizing bacteria and/or fungi are not found within the study reach.
	Present = 1.5	Absent = 0
TOTAL *plus* SUPPLEMENTAL POINTS (#1.1 – #1.14)		7

NMED Surface Water Quality Bureau – LEVEL 1 Hydrology Determination Field Sheet

Photo Descriptions and NOTES

Photo #	Description (US, DS, LB, RB, etc.)	Notes
4	HP13 upstream	
5	HP13 downstream	
6	HP13 stream bankfull width	
7	HP13 stream channel	
8	HP13 side slope with vegetative debris	
9	HP13 soil profile (1)	
10	HP13 soil profile (2)	

NOTES:

Channel: Active channel approximately 6 feet wide (extremely channelized), upper terrace approximately 7 feet above channel bottom. Bankfull height difficult to identify in channelized section with vertical banks to upland area therefore it was estimated at the break at the lower side slope (see P6). Side slopes were covered in debris from vegetation above and sloughing from upper walls indicating that there had not been recent flows (see P8).

Substrate: Medium sand with some silt and some pebbles at base of stream channel. Upland terrace consists of fine to very fine sand.

Vegetation: Very little vegetation within the stream channel. Bank vegetation identical to upland terraces.

Soils: Sandy and dry down to 18". Uniform vertically throughout profile.

Assessment Length: HP recommends use of either 40 times the channel width or 150 meters, whichever is larger, as the assessment length. Channel width is up to 6 feet. 40 times the channel width is less than 150 meters. Therefore, an assessment length of at least 150 meters was used.

Various: Very straight channel with occasional bending (sinuosity ratio: ~1.05).

LEVEL 1 Field Measurements

INDICATOR #1.10 Particle Size or Stream Substrate Sorting

Used Sand Gauge (©1984 by W.F. McCollough)

INDICATOR #1.8 (*Floodplain and Channel Dimensions*) – MEASUREMENTS & CALCULATIONS**

Max Depth (#1)	Bankfull Stage (#2)	Maximum Depth Value (#3)	2x Maximum Depth Value (#3)	Flood-Prone Area Location (#4)	Flood-Prone Area Width (#5)	Bankfull Width (#6)	Floodplain to Active Channel Ratio (FPA Width / Bankfull Width)
4.98’	4.7’	0.28’	0.56’	4.42’	6.0’	4.5’	1.33

****REFER to Figure 3 on page 19 for clarification**

Lee Ranch Mine Photos

4 - HP13 upstream

5 - HP13 downstream

6 - HP13 bankfull width

Lee Ranch Mine Photos

7 - HP13 stream channel

8 - HP13 side slope with vegetative debris

9 - HP13 soil profile (1)

Lee Ranch Mine Photos

10 - HP13 soil profile (2)

Appendix B - Level 1 Hydrology Protocol Results

NMED Surface Water Quality Bureau – LEVEL 1 Hydrology Determination Field Sheet

Date: 06/20/17	**Stream Name: Mulatto Canyon**	**Latitude: 35° 28' 35.22"**
Evaluator(s): CG JC JB JJ	**Site ID: Lee Ranch Mine**	**Longitude: 107° 41' 26.94"**
TOTAL POINTS: 6.5 *Stream is at least intermittent if ≥ 12*	**Assessment Unit: HP14**	**Drought Index (12-mo. SPI Value): 0 - -1**

WEATHER CONDITIONS	**NOW:** ___ storm (heavy rain) ___ rain (steady rain) ___ showers (intermittent) ___ %cloud cover _X_ clear/sunny	**PAST 48 HOURS:** ___ storm (heavy rain) ___ rain (steady rain) ___ showers (intermittent) ___ %cloud cover _X_ clear/sunny	**Has there been a heavy rain in the last 48 hours?** ___ YES _X_ NO **Field evaluations should be performed at least 48 hours after the last known major rainfall event. **OTHER:** **Stream Modifications** ___ YES _X_ NO **Diversions** ___ YES _X_ NO **Discharges** ___ YES _X_ NO **Explain in further detail in NOTES section

LEVEL 1 INDICATORS	STREAM CONDITION			
	Strong	**Moderate**	**Weak**	**Poor**
1.1. Water in Channel	Flow is evident throughout the reach. Moving water is seen in riffle areas but may not be as evident throughout the runs.	Water is present in the channel but flow is barely discernable in areas of greatest gradient change (i.e. riffles) or floating object is necessary to observe flow.	Dry channel with standing pools. There is some evidence of base flows (i.e. riparian vegetation growing along channel, saturated or moist sediment under rocks, etc)	Dry channel. No evidence of base flows was found.
	6	**4**	**2**	**0**
1.2. Fish	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Fish are not present.
	3	**2**	**1**	**0**
1.3. Benthic Macroinvertebrates	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Macroinvertebrates are not present.
	3	**2**	**1**	**0**
1.4. Filamentous Algae/Periphyton	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Filamentous algae and/or periphyton are not present.
	3	**2**	**1**	**0**
1.5. Differences in Vegetation	Dramatic compositional differences in vegetation are present between the stream banks and the adjacent uplands. A distict riparian vegetation corridor exists along the entire reach – riparian, aquatic, or wetland species dominate the length of the reach.	A distinct riparian vegetation corridor exists along part of the reach. Riparian vegetation is interspersed with upland vegetation along the length of the reach.	Vegetation growing along the reach may occur in greater densities or grow more vigorously than vegetation in the adjacent uplands, but there are no dramatic compositional differences between the two.	No compositional or density differences in vegetation are present between the streambanks and the adjacent uplands.
	3	**2**	**1**	**0**
1.6. Absence of Rooted Upland Plants in Streambed	Rooted upland plants are absent within the streambed/thalweg.	There are a few rooted upland plants present within the streambed/thalweg.	Rooted upland plants are consistently dispersed throughout the streambed/thalweg	Rooted upland plants are prevalent within the streambed/thalweg.
	3	**2**	**1**	**0**
			SUBTOTAL (#1.1 – #1.6)	**2**

If the stream being evaluated has a subtotal ≤ 2 at this juncture, the stream is determined to be EPHEMERAL.
If the stream being evaluated has a subtotal ≥ 18 at this point, the stream is determined to be PERENNIAL.
YOU MAY STOP THE EVALUATION AT THIS POINT. If the stream has a subtotal between 2 and 18 continue the Level 1 Evaluation.

Appendix B - Level 1 Hydrology Protocol Results

LEVEL 1 INDICATORS	STREAM CONDITION			
	Strong	Moderate	Weak	Poor
1.7. Sinuosity	**Ratio > 1.4.** Stream has numerous, closely-spaced bends, few straight sections.	**Ratio < 1.4.** Stream has good sinuosity with some straight sections.	**Ratio < 1.2.** Stream has very few bends and mostly straight sections.	**Ratio = 1.0.** Stream is completely straight with no bends.
	3	2	1	0
1.8. Floodplain and Channel Dimensions	**Ratio > 2.5.** Stream is minimally confined with a wide, active floodplain.	**Ratio between 1.2 and 2.5.** Stream is moderately confined. Floodplain is present, but may only be active during larger floods.	**Ratio < 1.2.** Stream is incised with a noticeably confined channel. Floodplain is narrow or absent and typically disconnected from the channel.	
	3	1.5	0	
1.9. In-Channel Structure: Riffle-Pool Sequence	Demonstrated by a frequent number of riffles followed by pools along the entire reach. There is an obvious transition between riffles and pools.	Represented by a less frequent number of riffles and pools. Distinguishing the transition between riffles and pools is difficult.	Stream shows some flow but mostly has areas of pools or of riffles.	There is no sequence exhibited.
	3	2	1	0
SUBTOTAL (#1.1 – #1.9)				**4.5**
If the stream being evaluated has a subtotal ≤ 5 at this juncture, the stream is determined to be EPHEMERAL. If the stream being evaluated has a subtotal ≥ 21 at this point, the stream is determined to be PERENNIAL. YOU MAY STOP THE EVALUATION AT THIS POINT. If the stream has a subtotal between 5 and 21 continue the Level 1 Evaluation.				
1.10. Particle Size or Stream Substrate Sorting	Particle sizes in the channel are noticeably different from particle sizes in areas close to but not in the channel. There is a clear distribution of various sized substrates in the stream channel with finer particles accumulating in the pools, and larger particles accumulating in the riffles/runs.	Particle sizes in the channel are moderately similar to particle sizes in areas close to but not in the channel. Various sized substrates are present in the stream channel and are represented by a higher ratio of larger particles (gravel/cobble).	Particle sizes in the channel are similar or comparable to particle sizes in areas close to but not in the channel. Substrate sorting is not readily observed in the stream channel.	
	3	1.5	0	
1.11. Hydric Soils	Hydric soils are found within the study reach.		Hydric soils are not found within the study reach.	
	Present = 3		Absent = 0	
1.12. Sediment on Plants and Debris	Sediment found readily on plants and debris within the stream channel, on the streambank, and within the floodplain throughout the length of the stream.	Sediment found on plants or debris within the stream channel although it is not prevalent along the stream. Mostly accumulating in pools.	Sediment is isolated in small amounts along the stream.	No sediment is present on plants or debris.
	1.5	1	0.5	0
TOTAL POINTS (#1.1 – #1.12)				**6.5**

SUPPLEMENTAL INDICATORS: **The following indicators do not occur consistently throughout New Mexico but may be useful in the determination of perenniality. If the indicator is present record score below and tally with previous score to compute TOTAL.**		
1.13. Seeps and Springs	Seeps and springs are found within the study reach.	Seeps and springs are not found within the study reach.
	Present = 1.5	Absent = 0
1.14. Iron Oxidizing Bacteria/Fungi	Iron-oxidizing bacteria and/or fungi are found within the study reach.	Iron-oxidizing bacteria and/or fungi are not found within the study reach.
	Present = 1.5	Absent = 0
TOTAL *plus* SUPPLEMENTAL POINTS (#1.1 – #1.14)		**6.5**

NMED Surface Water Quality Bureau – LEVEL 1 Hydrology Determination Field Sheet

Photo Descriptions and NOTES

Photo #	Description (US, DS, LB, RB, etc.)	Notes
11	**HP14 upstream**	
12	**HP14 downstream**	
13	**HP14 bankfull position**	**Marked with flags**
14	**HP14 cobble at the bottom of channel**	
15	**HP14 example of debris at base of stream channel**	
16	**Measuring HP14 flood plain width**	**Marked with flags**

NOTES:

Site was moved downstream due to accessibility. New location is considered representative of upper canyon sites. Stream remains uniform upstream.

Channel: Bankfull indicators of pine needle deposition (no conifers at site). Debris located at break in slope and vegetation change. Sloughing / mass wasting of bank materials. At least one historical terrace in channel. Calculation of flood prone area matched up with this terrace.

Substrate: Fine sand with some subrounded pebbles and some subangular cobbles.

Vegetation: Few rooted plants in active channel. Banks stabilized with upland vegetation. Bank vegetation is the same in composition as surrounding areas.

Assessment Length: HP recommends use of either 40 times the channel width or 150 meters, whichever is larger, as the assessment length. Channel width is up to 7 feet. 40 times the channel width is less than 150 meters. Therefore, an assessment length of at least 150 meters was used.

Various: Debris found along vegetation in channel. Sinuosity approximately 1.15 ratio.

LEVEL 1 Field Measurements

INDICATOR #1.10 Particle Size or Stream Substrate Sorting

Used Sand Gauge (©1984 by W.F. McCollough)

INDICATOR #1.8 (*Floodplain and Channel Dimensions*) – MEASUREMENTS & CALCULATIONS**

Max Depth (#1)	Bankfull Stage (#2)	Maximum Depth Value (#3)	2x Maximum Depth Value (#3)	Flood-Prone Area Location (#4)	Flood-Prone Area Width (#5)	Bankfull Width (#6)	Floodplain to Active Channel Ratio (FPA Width / Bankfull Width)
4.94’	3.68’	1.26’	2.52’	2.42’	13.25’	6.58’	2.01

****REFER to Figure 3 on page 19 for clarification**

Lee Ranch Mine Photos

11 - HP14 upstream

12 - HP14 downstream

13 - HP14 bankfull position

Lee Ranch Mine Photos

14 - HP14 cobble at base of channel

15 - HP14 example of debris at base of channel

16 – measuring HP14 flood plain width

Cover Sheet
Hydrology Protocol Use Attainability Analysis for an Ephemeral Stream[1]

Stream Name:	Basin:	8-digit HUC:
San Isidro Arroyo (Subwatershed 1C)	Rio Grande	13020205
Reach Description:	**Upstream lat/long:**	**Downstream lat/long:**
Unlined, unclassified, ephemeral arroyo	35.463/-107.663	35.500/-107.597
Current WQS		**Assessment Unit ID:**
☒ Unclassified 20.6.4.98 or 99 NMAC ☐ Classified 20.6.4. _____ NMAC		Lee Ranch Mine

Reach Evaluation (How homogeneity of reach hydrology was verified)	
Methods Used:	(ex. aerial photos, "ground truthing", Google™ Earth, etc.) ground truthing, aerial photos
Reasoning:	Why is the stream homogeneous? Similar geology, sinuosity, and vegetation

Hydrology Protocol Results		**Notes**
Location 1 (lat/long): 35.474/-107.69	☒ eph ☐ int ☐ per	HP-15, watershed 1C Assessment
Location 2 (lat/long):	☐ eph ☐ int ☐ per	
Location 3 (lat/long):	☐ eph ☐ int ☐ per	
☐ Additional location results attached.		

Hydroclimatic Conditions		**If "yes" please describe.**
Drought (SPI Value < - 1.5)	☐ yes ☒ no	-1 to 0 Eastern half of study area (June 2017, NOAA) 0 to 1 Western half of study area (June 2017, NOAA)
Recent Rainfall (within 48 hours)	☐ yes ☒ no	
Gauge data available?	☐ yes ☒ no	
If yes for any of above, please explain why these conditions do not impact the UAA conclusion that *natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use*:		

Hydrologic and Other Modifications		**If "yes" please describe.**
Dam/diversion	☐ yes ☒ no	
Channelization/roads	☐ yes ☒ no	
Groundwater pumping	☒ yes ☐ no	See explanation at the end of the modification section
Agricultural return flows	☐ yes ☒ no	
Existing point source discharge	☐ yes ☒ no	

[1] This form is designed for the UAA process for ephemeral waters described in Subsection C of 20.6.4.15 NMAC.

Hydrologic and Other Modifications		If "yes" please describe.
Planned point source discharge	☐ yes ☒ no	
Other modifications e.g., land use practices	☐ yes ☒ no	*Please explain hydrologic impact*

If yes for any of above, please explain why these modifications do not alter the uses supported by the natural flow regime:

Subwatershed 1C is located upstream, to the east-southeast, of the LRM and has been unaffected by mining activities. The drainage channels in this subwatershed are located several miles from the two mine production wells which are screened within the Gallup Aquifer (> 1000 ft bgs). The Gallup Aquifer is confined and hydrologically isolated from the base of the San Isidro Arroyo by several hundred feet of low permeable bedrock. The static water level of the Gallup aquifer is approximately 150 -180 ft bgs. In addition there is 1 livestock well located within this subwatershed that has a permitted withdrawal of 3 ac-ft per year (see Figure 1). For purpose of this assessment this withdrawal is considered to be insignificant.

Current Uses Observed		If "yes" please describe.
Macroinvertebrates	☐ yes ☒ no	
Fish	☐ yes ☒ no	
Recreation (contact use)	☐ yes ☒ no	

If yes for any of the above, please explain why these observed uses are consistent with the UAA conclusion that 101(a)(2) aquatic life and recreational uses are not feasible:

Additional Comments:

Subwatershed 1C includes the headwaters of the San Isidro Arroyo. The subwatershed predominately consists of the rolling hill topography with only a small portion of the drainage area (584 acres) located within the upper canyon headwaters. A single assessment point (HP15) was deemed representative for this area because the majority of the subwatershed is located within the rolling hill topography. Furthermore the drainage channels in the upper canyon headwaters and within the transitional zone between the canyon and rolling hill topography (see PP157) are expected to be analogous to assessment points HP14 and HP13 within Subwatershed 1B. HP-15 is located at the outlet of the Subwatershed 1C and represents the stream reach with the greatest potential to support non-ephemeral flow. This location receives drainage from all lower order tributaries within the subwatershed and provides a conservative estimation of the flow regime of the upstream tributaries within the subwatershed. See photo point PP156 and PP157 within Appendix C for additional images of the channel near the base of the canyons and PP158 for the reach of channel in the vicinity of spring S-1. As previously noted there are no surface water diversions within this subwatershed and the channel has not been modified by mining activities. The result of the Level 1 Evaluation at HP15 (HP Score: 8.5) supports the determination of ephemeral flow for the drainage channels within subwatershed 1C.

ATTACHMENTS:

☒ Map and Photos (required)
☒ Hydrology Protocol Field Sheets for all locations (required)
☐ Level 2 Analysis (optional)
☒ Additional sites and/or documentation (optional)

CONCLUSION:

This UAA concludes that the stream reach identified above is ephemeral and that Clean Water Act Section 101(a)(2) aquatic life and recreational uses are neither existing nor attainable due to the factor identified in 40 CFR 131.10(g)(2): *natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent.*

Based on this conclusion, we recommend that the designated uses and criteria identified in 20.6.4.97 NMAC be applied to this stream reach in accordance with the UAA process set forth in Subsection C of 20.6.4.15 NMAC.

Submitted by: James Boswell Signed:  Date: 5/7/2018
Surface Water Quality Bureau concurs with recommendation. ☐ Yes ☐ No *If no, see attached reasons.* Signed: _____ Date: _____
EPA Region 6 technical approval granted. ☐ Yes ☐ No *If no, see attached reasons.* Signed: _____ Date: _____

Appendix B - Level 1 Hydrology Protocol Results

NMED Surface Water Quality Bureau – LEVEL 1 Hydrology Determination Field Sheet

Date: 06/20/17	**Stream Name: San Isidro Arroyo**	**Latitude: 35° 29' 58.66"**
Evaluator(s): CG JC JB JJ	**Site ID: Lee Ranch Mine**	**Longitude: 107° 35' 49.49"**
TOTAL POINTS: 8.5 *Stream is at least intermittent if ≥ 12*	**Assessment Unit: HP15**	**Drought Index (12-mo. SPI Value): 0 - -1**

WEATHER CONDITIONS	**NOW:** ___ storm (heavy rain) ___ rain (steady rain) ___ showers (intermittent) _5_ %cloud cover _X_ clear/sunny	**PAST 48 HOURS:** ___ storm (heavy rain) ___ rain (steady rain) ___ showers (intermittent) ___ %cloud cover _X_ clear/sunny	**Has there been a heavy rain in the last 48 hours?** ___ YES _X_ NO **Field evaluations should be performed at least 48 hours after the last known major rainfall event. **OTHER:** **Stream Modifications** ___ YES _X_ NO **Diversions** ___ YES _X_ NO **Discharges** ___ YES _X_ NO **Explain in further detail in NOTES section

LEVEL 1 INDICATORS	STREAM CONDITION			
	Strong	**Moderate**	**Weak**	**Poor**
1.1. Water in Channel	Flow is evident throughout the reach. Moving water is seen in riffle areas but may not be as evident throughout the runs.	Water is present in the channel but flow is barely discernable in areas of greatest gradient change (i.e. riffles) or floating object is necessary to observe flow.	Dry channel with standing pools. There is some evidence of base flows (i.e. riparian vegetation growing along channel, saturated or moist sediment under rocks, etc)	Dry channel. No evidence of base flows was found.
	6	**4**	**2**	**0**
1.2. Fish	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Fish are not present.
	3	**2**	**1**	**0**
1.3. Benthic Macroinvertebrates	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Macroinvertebrates are not present.
	3	**2**	**1**	**0**
1.4. Filamentous Algae/Periphyton	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Filamentous algae and/or periphyton are not present.
	3	**2**	**1**	**0**
1.5. Differences in Vegetation	Dramatic compositional differences in vegetation are present between the stream banks and the adjacent uplands. A distict riparian vegetation corridor exists along the entire reach – riparian, aquatic, or wetland species dominate the length of the reach.	A distinct riparian vegetation corridor exists along part of the reach. Riparian vegetation is interspersed with upland vegetation along the length of the reach.	Vegetation growing along the reach may occur in greater densities or grow more vigorously than vegetation in the adjacent uplands, but there are no dramatic compositional differences between the two.	No compositional or density differences in vegetation are present between the streambanks and the adjacent uplands.
	3	**2**	**1**	**0**
1.6. Absence of Rooted Upland Plants in Streambed	Rooted upland plants are absent within the streambed/thalweg.	There are a few rooted upland plants present within the streambed/thalweg.	Rooted upland plants are consistently dispersed throughout the streambed/thalweg	Rooted upland plants are prevalent within the streambed/thalweg.
	3	**2**	**1**	**0**
			SUBTOTAL (#1.1 – #1.6)	**4**

If the stream being evaluated has a subtotal ≤ 2 at this juncture, the stream is determined to be EPHEMERAL.
If the stream being evaluated has a subtotal ≥ 18 at this point, the stream is determined to be PERENNIAL.
YOU MAY STOP THE EVALUATION AT THIS POINT. If the stream has a subtotal between 2 and 18 continue the Level 1 Evaluation.

Appendix B - Level 1 Hydrology Protocol Results

LEVEL 1 INDICATORS	STREAM CONDITION			
	Strong	Moderate	Weak	Poor
1.7. Sinuosity	**Ratio > 1.4.** Stream has numerous, closely-spaced bends, few straight sections.	**Ratio < 1.4.** Stream has good sinuosity with some straight sections.	**Ratio < 1.2.** Stream has very few bends and mostly straight sections.	**Ratio = 1.0.** Stream is completely straight with no bends.
	3	2	1	0
1.8. Floodplain and Channel Dimensions	**Ratio > 2.5.** Stream is minimally confined with a wide, active floodplain.	**Ratio between 1.2 and 2.5.** Stream is moderately confined. Floodplain is present, but may only be active during larger floods.	**Ratio < 1.2.** Stream is incised with a noticeably confined channel. Floodplain is narrow or absent and typically disconnected from the channel.	
	3	1.5	0	
1.9. In-Channel Structure: Riffle-Pool Sequence	Demonstrated by a frequent number of riffles followed by pools along the entire reach. There is an obvious transition between riffles and pools.	Represented by a less frequent number of riffles and pools. Distinguishing the transition between riffles and pools is difficult.	Stream shows some flow but mostly has areas of pools or of riffles.	There is no sequence exhibited.
	3	2	1	0
SUBTOTAL (#1.1 – #1.9)				8

If the stream being evaluated has a subtotal ≤ 5 at this juncture, the stream is determined to be EPHEMERAL.
If the stream being evaluated has a subtotal ≥ 21 at this point, the stream is determined to be PERENNIAL.
YOU MAY STOP THE EVALUATION AT THIS POINT. If the stream has a subtotal between 5 and 21 continue the Level 1 Evaluation.

1.10. Particle Size or Stream Substrate Sorting	Particle sizes in the channel are noticeably different from particle sizes in areas close to but not in the channel. There is a clear distribution of various sized substrates in the stream channel with finer particles accumulating in the pools, and larger particles accumulating in the riffles/runs.	Particle sizes in the channel are moderately similar to particle sizes in areas close to but not in the channel. Various sized substrates are present in the stream channel and are represented by a higher ratio of larger particles (gravel/cobble).	Particle sizes in the channel are similar or comparable to particle sizes in areas close to but not in the channel. Substrate sorting is not readily observed in the stream channel.
	3	1.5	0
1.11. Hydric Soils	Hydric soils are found within the study reach.		Hydric soils are not found within the study reach.
	Present = 3		Absent = 0
1.12. Sediment on Plants and Debris	Sediment found readily on plants and debris within the stream channel, on the streambank, and within the floodplain throughout the length of the stream.	Sediment found on plants or debris within the stream channel although it is not prevalent along the stream. Mostly accumulating in pools.	Sediment is isolated in small amounts along the stream.	No sediment is present on plants or debris.
	1.5	1	0.5	0
TOTAL POINTS (#1.1 – #1.12)				8.5

SUPPLEMENTAL INDICATORS: **The following indicators do not occur consistently throughout New Mexico but may be useful in the determination of perenniality. If the indicator is present record score below and tally with previous score to compute TOTAL.**		
1.13. Seeps and Springs	Seeps and springs are found within the study reach.	Seeps and springs are not found within the study reach.
	Present = 1.5	Absent = 0
1.14. Iron Oxidizing Bacteria/Fungi	Iron-oxidizing bacteria and/or fungi are found within the study reach.	Iron-oxidizing bacteria and/or fungi are not found within the study reach.
	Present = 1.5	Absent = 0
TOTAL *plus* SUPPLEMENTAL POINTS (#1.1 – #1.14)		8.5

NMED Surface Water Quality Bureau – LEVEL 1 Hydrology Determination Field Sheet

Photo Descriptions and NOTES

Photo #	Description (US, DS, LB, RB, etc.)	Notes
17	HP15 upstream	
18	HP15 downstream	
19	HP15 soil profile (1)	
20	HP 15 soil profile (2)	

NOTES:

Channel: Site located upstream of a dike /diversion. Active channel approximately 4 feet wide. Bankfull height is approximately 1.5 feet. Multiple channels in wide floodplain.

Substrate: Fine to medium sand and silt.

Vegetation: Tamarisk near channel and in floodplain.

Soils: Silt and sand in upper 10 inches underlain by coarse sand. No indication of hydric soils (e.g. ox/redox on roots or reduced conditions).

Assessment Length: HP recommends use of either 40 times the channel width or 150 meters, whichever is larger, as the assessment length. Channel width is up to 4 feet. 40 times the channel width is less than 150 meters. Therefore, an assessment length of at least 150 meters was used.

Various: Mudcracks proof of flow. Some debris on tamarisk. Average sinuosity ratio: ~1.15. Upstream is sinuous, downstream channel is straight.

LEVEL 1 Field Measurements

INDICATOR #1.10 Particle Size or Stream Substrate Sorting

Used Sand Gauge (©1984 by W.F. McCollough)

INDICATOR #1.8 (*Floodplain and Channel Dimensions*) – MEASUREMENTS & CALCULATIONS**

Max Depth (#1)	Bankfull Stage (#2)	Maximum Depth Value (#3)	2x Maximum Depth Value (#3)	Flood-Prone Area Location (#4)	Flood-Prone Area Width (#5)	Bankfull Width (#6)	Floodplain to Active Channel Ratio (FPA Width / Bankfull Width)
4.99’	3.85’	1.14’	2.28’	2.71’	~178’	13.0’	13.69

****REFER to Figure 3 on page 19 for clarification**

Lee Ranch Mine Photos

17 - HP15 upstream

18 - HP15 downstream

19 - HP15 soil profile (1)

Lee Ranch Mine Photos

20 - HP15 soil profile (2)

Cover Sheet
Hydrology Protocol Use Attainability Analysis for an Ephemeral Stream[1]

Stream Name:	Basin:	8-digit HUC:
Doctor Arroyo (Subwatershed 1D)	Rio Grande	13020205
Reach Description:	**Upstream lat/long:**	**Downstream lat/long:**
Unlined, unclassified, ephemeral arroyo	35.491/-107.575	35.552/-107.539
Current WQS		**Assessment Unit ID:**
☒ Unclassified 20.6.4.98 or 99 NMAC ☐ Classified 20.6.4. _____ NMAC		Lee Ranch Mine

Reach Evaluation (How homogeneity of reach hydrology was verified)	
Methods Used:	(ex. aerial photos, "ground truthing", Google™ Earth, etc.) ground truthing, aerial photos
Reasoning:	Why is the stream homogeneous? Similar geology, sinuosity, and vegetation

Hydrology Protocol Results		Notes
Location 1 (lat/long): 35.556/-107.556	☒ eph ☐ int ☐ per	HP-18, watershed 1D outlet
Location 2 (lat/long): 35.528/-107.55	☒ eph ☐ int ☐ per	HP-17, watershed 1D Downstream of the Mine Exclusion Boundary
Location 3 (lat/long): 35.515/-107.56	☒ eph ☐ int ☐ per	HP-16, watershed 1D Upstream of the Mine Exclusion Boundary
☐ Additional location results attached.		

Hydroclimatic Conditions		If "yes" please describe.
Drought (SPI Value < - 1.5)	☐ yes ☒ no	-1 to 0 Eastern half of study area (June 2017, NOAA) 0 to 1 Western half of study area (June 2017, NOAA)
Recent Rainfall (within 48 hours)	☐ yes ☒ no	
Gauge data available?	☐ yes ☒ no	
If yes for any of above, please explain why these conditions do not impact the UAA conclusion that *natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use*:		

Hydrologic and Other Modifications		If "yes" please describe.
Dam/diversion	☒ yes ☐ no	See explanation at the end of the modification section
Channelization/roads	☐ yes ☒ no	
Groundwater pumping	☒ yes ☐ no	See explanation at the end of the modification section
Agricultural return flows	☐ yes ☒ no	

[1] This form is designed for the UAA process for ephemeral waters described in Subsection C of 20.6.4.15 NMAC.

Appendix B - Level 1 Hydrology Protocol Results

Hydrologic and Other Modifications		If "yes" please describe.
Existing point source discharge	☒ yes ☐ no	See explanation at the end of the modification section
Planned point source discharge	☐ yes ☒ no	
Other modifications e.g., land use practices	☒ yes ☐ no	*Please explain hydrologic impact* Mining, see explanation below

If yes for any of above, please explain why these modifications do not alter the uses supported by the natural flow regime:

Subwatershed 1-D is includes nearly the entirety of Doctor Arroyo from its headwaters to approximately 1500 ft upstream of its confluence with San Isidro Arroyo. There have been no modifications to the main channel of Doctor Arroyo. NPDES outfall 080 was built within a small unnamed tributary that flows into Doctor Arroyo north of the mining extraction area. A dike was also constructed approximately 500 feet west of the arroyo approximately between HP16 and PP290 to direct runoff from areas within the limits of mining disturbance to NPDES outfall 095. Both outfalls 080 and 095 are temporary and based on their small drainage areas (292 acres; ~4.75% of subwatershed 1D), have resulted in only minor reductions in the quantity of surface runoff to Doctor Arroyo. A diversion built in the southwestern headwaters of Doctor Arroyo to redirect drainage away from the mining area to the north has resulted in a change in the drainage break and directed more water towards the San Isidro Arroyo. The area affected by this diversion is small (149 acres; ~ 2.43% of subwatershed 1D) and the amount of water that has been redirected should be considered minor. Mining along the western end of the subwatershed has also removed a portion of an unnamed tributary (approximately between PP167 and PP168) that previously reported to Doctor Arroyo near the northern permit boundary. This drainage will be reconstructed during mine reclamation. Photo documentation throughout the subwatershed indicates that the flow regime of the drainage channels downstream or adjacent to the NPDES structures, diversions, and mining have not been significantly altered relative to the native areas within the watershed (see Appendix C).

Doctor Arroyo is located several miles from the two mine production wells. These wells are hydrologically isolated from Doctor Arroyo by several hundred feet of low permeable bedrock. The wells are screened within the Gallup aquifer > 1000 ft bgs. The Gallup aquifer is confined and the static water level is approximately 150 - 180 ft bgs. The LRM also has three diversion wells (W22-211, W22-212, W22-213) located within the subwatershed. In 2013 the LRM directed the water from W22-211, W22-212, and W22-213 to a newly installed water supply tank and three cattle drinkers to supplement the water needs of the local rancher and to supply additional water to the wetland feature near PP160. The combined withdrawal from these three wells since 2013 has ranged from 0.1 – 0.4 ac-ft per year (mean: 0.2 ac-ft per year). In addition there is 1 livestock well located within this subwatershed that has a permitted withdrawal of 3 ac-ft per year (see Figure 1). For purpose of this assessment this withdrawal, as well as the withdrawal from the three diversion wells, is considered to be insignificant.

Mine Pit 8 is located approximately 1500 ft west of the channel. Groundwater was not encountered in the unconsolidated material during the extensive exploration drilling program or during the mining process. Dr. Spring (s-3) is located within the mine exclusion area near photopoint PP160. The spring reports to a livestock tank that produces minor contributions of overflow to the channel. As described above the LRM installed an additional water supply tank and three cattle drinkers to supplement the needs of the rancher and supply additional water to the wetland feature. Overflow from the Doctor Spring area evaporates or soaks into the ground within a short distance (<900 ft within Doctor Arroyo), several thousand feet upstream of the northern mine exclusion boundary.

Current Uses Observed		If "yes" please describe.
Macroinvertebrates	☐ yes ☒ no	
Fish	☐ yes ☒ no	
Recreation (contact use)	☐ yes ☒ no	

If yes for any of the above, please explain why these observed uses are consistent with the UAA conclusion that

Current Uses Observed	If "yes" please describe.
101(a)(2) aquatic life and recreational uses are not feasible:	

Additional Comments:

Three assessment points were established within Subwatershed 1D: HP16 immediately upstream of the mining exclusion area, HP17 immediately downstream of the mining exclusion area, and HP18 at the outlet of the Doctor Arroyo 1D subwatershed. Assessment points HP16 and HP17 were established at the upstream and downstream portion of the mining exclusion area to evaluate potential changes to the Doctor Arroyo channel flow regime at the boundary of the LRM MMD permit. HP18 was established as close to the Doctor Arroyo watershed outlet as possible to represent the channel reach with the lowest elevation, largest contributing drainage area, and most developed hydrologic flow regime. This location provides a strong indication of the hydrologic conditions of the upstream lower order tributaries, absent direct connection with springs, which drain to it. Photopoints were established in the tributary headwaters and at their confluence with the trunk of Doctor Arroyo. PP167 and PP168 were established in the unaffected portions of the tributary that has been partially mined through. The drainage channel in these areas exhibit similar characteristics to stream reaches found at similar elevations within the subwatershed. The photo documentation of the drainages within the watershed (see Appendix C) indicates that these three assessment points established for this drainage should be representative of the entirety of the watershed except for the 900 ft of saturated channel adjacent to Doctor Springs. Scores from the Level 1 Evaluation at the three assessment points range from 6 – 8.5 and support the determination that the remainder of Subwatershed 1D is ephemeral.

ATTACHMENTS:

- ☒ Map and Photos (required)
- ☒ Hydrology Protocol Field Sheets for all locations (required)
- ☐ Level 2 Analysis (optional)
- ☒ Additional sites and/or documentation (optional)

CONCLUSION:

This UAA concludes that the stream reach identified above is ephemeral and that Clean Water Act Section 101(a)(2) aquatic life and recreational uses are neither existing nor attainable due to the factor identified in 40 CFR 131.10(g)(2): *natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent.* Based on this conclusion, we recommend that the designated uses and criteria identified in 20.6.4.97 NMAC be applied to this stream reach in accordance with the UAA process set forth in Subsection C of 20.6.4.15 NMAC.

Submitted by: James Boswell

Signed: _____ Date: 5/7/2018

Surface Water Quality Bureau concurs with recommendation. ☐ Yes ☐ No

If no, see attached reasons.

Signed: _____ Date: _____

EPA Region 6 technical approval granted. ☐ Yes ☐ No

If no, see attached reasons.

Signed: _____ Date: _____

Appendix B - Level 1 Hydrology Protocol Results

NMED Surface Water Quality Bureau – LEVEL 1 Hydrology Determination Field Sheet

Date: 6/19/17	**Stream Name: Doctor Arroyo**	**Latitude: 35° 30' 55.02"**
Evaluator(s): CG JC JB JJ	**Site ID: Lee Ranch Mine**	**Longitude: 107° 33' 22.21"**
TOTAL POINTS: 6.5 *Stream is at least intermittent if ≥ 12*	**Assessment Unit: HP16**	**Drought Index (12-mo. SPI Value): 0 - -1**

WEATHER CONDITIONS	**NOW:** ___ storm (heavy rain) ___ rain (steady rain) ___ showers (intermittent) ___ %cloud cover _X_ clear/sunny	**PAST 48 HOURS:** ___ storm (heavy rain) ___ rain (steady rain) ___ showers (intermittent) ___ %cloud cover _X_ clear/sunny	**Has there been a heavy rain in the last 48 hours?** ___ YES _X_ NO **Field evaluations should be performed at least 48 hours after the last known major rainfall event. **OTHER:** **Stream Modifications** ___ YES _X_ NO **Diversions** ___ YES _X_ NO **Discharges** ___ YES _X_ NO **Explain in further detail in NOTES section

LEVEL 1 INDICATORS	STREAM CONDITION			
	Strong	**Moderate**	**Weak**	**Poor**
1.1. Water in Channel	Flow is evident throughout the reach. Moving water is seen in riffle areas but may not be as evident throughout the runs.	Water is present in the channel but flow is barely discernable in areas of greatest gradient change (i.e. riffles) or floating object is necessary to observe flow.	Dry channel with standing pools. There is some evidence of base flows (i.e. riparian vegetation growing along channel, saturated or moist sediment under rocks, etc)	Dry channel. No evidence of base flows was found.
	6	**4**	**2**	**0**
1.2. Fish	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Fish are not present.
	3	**2**	**1**	**0**
1.3. Benthic Macroinvertebrates	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Macroinvertebrates are not present.
	3	**2**	**1**	**0**
1.4. Filamentous Algae/Periphyton	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Filamentous algae and/or periphyton are not present.
	3	**2**	**1**	**0**
1.5. Differences in Vegetation	Dramatic compositional differences in vegetation are present between the stream banks and the adjacent uplands. A distict riparian vegetation corridor exists along the entire reach – riparian, aquatic, or wetland species dominate the length of the reach.	A distinct riparian vegetation corridor exists along part of the reach. Riparian vegetation is interspersed with upland vegetation along the length of the reach.	Vegetation growing along the reach may occur in greater densities or grow more vigorously than vegetation in the adjacent uplands, but there are no dramatic compositional differences between the two.	No compositional or density differences in vegetation are present between the streambanks and the adjacent uplands.
	3	**2**	**1**	**0**
1.6. Absence of Rooted Upland Plants in Streambed	Rooted upland plants are absent within the streambed/thalweg.	There are a few rooted upland plants present within the streambed/thalweg.	Rooted upland plants are consistently dispersed throughout the streambed/thalweg	Rooted upland plants are prevalent within the streambed/thalweg.
	3	**2**	**1**	**0**
			SUBTOTAL (#1.1 – #1.6)	**2**

If the stream being evaluated has a subtotal ≤ 2 at this juncture, the stream is determined to be EPHEMERAL.
If the stream being evaluated has a subtotal ≥ 18 at this point, the stream is determined to be PERENNIAL.
YOU MAY STOP THE EVALUATION AT THIS POINT. If the stream has a subtotal between 2 and 18 continue the Level 1 Evaluation.

Appendix B - Level 1 Hydrology Protocol Results

LEVEL 1 INDICATORS	STREAM CONDITION			
	Strong	Moderate	Weak	Poor
1.7. Sinuosity	**Ratio > 1.4.** Stream has numerous, closely-spaced bends, few straight sections.	**Ratio < 1.4.** Stream has good sinuosity with some straight sections.	**Ratio < 1.2.** Stream has very few bends and mostly straight sections.	**Ratio = 1.0.** Stream is completely straight with no bends.
	3	2	1	0
1.8. Floodplain and Channel Dimensions	**Ratio > 2.5.** Stream is minimally confined with a wide, active floodplain.	**Ratio between 1.2 and 2.5.** Stream is moderately confined. Floodplain is present, but may only be active during larger floods.	**Ratio < 1.2.** Stream is incised with a noticeably confined channel. Floodplain is narrow or absent and typically disconnected from the channel.	
	3	1.5	0	
1.9. In-Channel Structure: Riffle-Pool Sequence	Demonstrated by a frequent number of riffles followed by pools along the entire reach. There is an obvious transition between riffles and pools.	Represented by a less frequent number of riffles and pools. Distinguishing the transition between riffles and pools is difficult.	Stream shows some flow but mostly has areas of pools or of riffles.	There is no sequence exhibited.
	3	2	1	0
SUBTOTAL (#1.1 – #1.9)				6

If the stream being evaluated has a subtotal ≤ 5 at this juncture, the stream is determined to be EPHEMERAL.
If the stream being evaluated has a subtotal ≥ 21 at this point, the stream is determined to be PERENNIAL.
YOU MAY STOP THE EVALUATION AT THIS POINT. If the stream has a subtotal between 5 and 21 continue the Level 1 Evaluation.

1.10. Particle Size or Stream Substrate Sorting	Particle sizes in the channel are noticeably different from particle sizes in areas close to but not in the channel. There is a clear distribution of various sized substrates in the stream channel with finer particles accumulating in the pools, and larger particles accumulating in the riffles/runs.	Particle sizes in the channel are moderately similar to particle sizes in areas close to but not in the channel. Various sized substrates are present in the stream channel and are represented by a higher ratio of larger particles (gravel/cobble).	Particle sizes in the channel are similar or comparable to particle sizes in areas close to but not in the channel. Substrate sorting is not readily observed in the stream channel.
	3	1.5	0
1.11. Hydric Soils	Hydric soils are found within the study reach.		Hydric soils are not found within the study reach.
	Present = 3		Absent = 0
1.12. Sediment on Plants and Debris	Sediment found readily on plants and debris within the stream channel, on the streambank, and within the floodplain throughout the length of the stream.	Sediment found on plants or debris within the stream channel although it is not prevalent along the stream. Mostly accumulating in pools.	Sediment is isolated in small amounts along the stream.	No sediment is present on plants or debris.
	1.5	1	0.5	0
TOTAL POINTS (#1.1 – #1.12)				6.5

SUPPLEMENTAL INDICATORS: **The following indicators do not occur consistently throughout New Mexico but may be useful in the determination of perenniality. If the indicator is present record score below and tally with previous score to compute TOTAL.**		
1.13. Seeps and Springs	Seeps and springs are found within the study reach.	Seeps and springs are not found within the study reach.
	Present = 1.5	Absent = 0
1.14. Iron Oxidizing Bacteria/Fungi	Iron-oxidizing bacteria and/or fungi are found within the study reach.	Iron-oxidizing bacteria and/or fungi are not found within the study reach.
	Present = 1.5	Absent = 0
TOTAL *plus* SUPPLEMENTAL POINTS (#1.1 – #1.14)		6.5

NMED Surface Water Quality Bureau – LEVEL 1 Hydrology Determination Field Sheet

Photo Descriptions and NOTES

Photo #	Description (US, DS, LB, RB, etc.)	Notes
21	HP16 upstream	
22	HP16 downstream	
23	HP16 rooted plants (1)	
24	HP16 rooted plants (2)	

NOTES:

Channel: Active channel width varies between 1.5 and 3.0 feet (mean: ~1.5 feet). Channel to floodplain ratio is misleading due to the wide floodplain, previously abandoned channels, and numerous gullies and erosional features.

Substrate: Very fine sand. Uniform in channel and surrounding upland.

Vegetation: Active channel has some plants, floodplain area has dense vegetation. Vegetation on bank is similar to the upland area. Minimal amount of tamarisk present.

Assessment Length: HP recommends use of either 40 times the channel width or 150 meters, whichever is larger, as the assessment length. Channel width is up to 3 feet. 40 times the channel width is less than 150 meters. Therefore, an assessment length of at least 150 meters was used.

Various: Some debris on plants along streambed. Sinuosity ratio: ~1.1.

LEVEL 1 Field Measurements

INDICATOR #1.10 Particle Size or Stream Substrate Sorting

Used Sand Gauge (©1984 by W.F. McCollough)

INDICATOR #1.8 (*Floodplain and Channel Dimensions*) – MEASUREMENTS & CALCULATIONS**

Max Depth (#1)	Bankfull Stage (#2)	Maximum Depth Value (#3)	2x Maximum Depth Value (#3)	Flood-Prone Area Location (#4)	Flood-Prone Area Width (#5)	Bankfull Width (#6)	Floodplain to Active Channel Ratio (FPA Width / Bankfull Width)
5.99’	4.69’	1.3’	2.6’	3.39’	61.25’	9.42’	6.5

****REFER to Figure 3 on page 19 for clarification**

Lee Ranch Mine Photos

21 - HP16 upstream

22 - HP16 downstream

23 - HP16 rooted plants (1)

Lee Ranch Mine Photos

24 - HP16 rooted plants (2)

Appendix B - Level 1 Hydrology Protocol Results

NMED Surface Water Quality Bureau – LEVEL 1 Hydrology Determination Field Sheet

Date:6/19/2017	**Stream Name: Doctor Arroyo**	**Latitude: 35° 31' 40.09"**
Evaluator(s): CG JC JB JJ	**Site ID: Lee Ranch Mine**	**Longitude: 107° 33' 00.87"**
TOTAL POINTS: 7.5 *Stream is at least intermittent if ≥ 12*	**Assessment Unit: HP17**	**Drought Index (12-mo. SPI Value): 0 - -1**

WEATHER CONDITIONS	**NOW:** ___ storm (heavy rain) ___ rain (steady rain) ___ showers (intermittent) ___ %cloud cover _X_ clear/sunny	**PAST 48 HOURS:** ___ storm (heavy rain) ___ rain (steady rain) ___ showers (intermittent) ___ %cloud cover _X_ clear/sunny	**Has there been a heavy rain in the last 48 hours?** ___ YES _X_ NO **Field evaluations should be performed at least 48 hours after the last known major rainfall event. **OTHER:** **Stream Modifications** ___ YES _X_ NO **Diversions** ___ YES _X_ NO **Discharges** ___ YES _X_ NO **Explain in further detail in NOTES section

LEVEL 1 INDICATORS	STREAM CONDITION			
	Strong	**Moderate**	**Weak**	**Poor**
1.1. Water in Channel	Flow is evident throughout the reach. Moving water is seen in riffle areas but may not be as evident throughout the runs.	Water is present in the channel but flow is barely discernable in areas of greatest gradient change (i.e. riffles) or floating object is necessary to observe flow.	Dry channel with standing pools. There is some evidence of base flows (i.e. riparian vegetation growing along channel, saturated or moist sediment under rocks, etc)	Dry channel. No evidence of base flows was found.
	6	**4**	**2**	**0**
1.2. Fish	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Fish are not present.
	3	**2**	**1**	**0**
1.3. Benthic Macroinvertebrates	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Macroinvertebrates are not present.
	3	**2**	**1**	**0**
1.4. Filamentous Algae/Periphyton	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Filamentous algae and/or periphyton are not present.
	3	**2**	**1**	**0**
1.5. Differences in Vegetation	Dramatic compositional differences in vegetation are present between the stream banks and the adjacent uplands. A distict riparian vegetation corridor exists along the entire reach – riparian, aquatic, or wetland species dominate the length of the reach.	A distinct riparian vegetation corridor exists along part of the reach. Riparian vegetation is interspersed with upland vegetation along the length of the reach.	Vegetation growing along the reach may occur in greater densities or grow more vigorously than vegetation in the adjacent uplands, but there are no dramatic compositional differences between the two.	No compositional or density differences in vegetation are present between the streambanks and the adjacent uplands.
	3	**2**	**1**	**0**
1.6. Absence of Rooted Upland Plants in Streambed	Rooted upland plants are absent within the streambed/thalweg.	There are a few rooted upland plants present within the streambed/thalweg.	Rooted upland plants are consistently dispersed throughout the streambed/thalweg	Rooted upland plants are prevalent within the streambed/thalweg.
	3	**2**	**1**	**0**
			SUBTOTAL (#1.1 – #1.6)	**3**

If the stream being evaluated has a subtotal ≤ 2 at this juncture, the stream is determined to be EPHEMERAL.
If the stream being evaluated has a subtotal ≥ 18 at this point, the stream is determined to be PERENNIAL.
YOU MAY STOP THE EVALUATION AT THIS POINT. If the stream has a subtotal between 2 and 18 continue the Level 1 Evaluation.

Appendix B - Level 1 Hydrology Protocol Results

LEVEL 1 INDICATORS	STREAM CONDITION			
	Strong	Moderate	Weak	Poor
1.7. Sinuosity	**Ratio > 1.4.** Stream has numerous, closely-spaced bends, few straight sections.	**Ratio < 1.4.** Stream has good sinuosity with some straight sections.	**Ratio < 1.2.** Stream has very few bends and mostly straight sections.	**Ratio = 1.0.** Stream is completely straight with no bends.
	3	2	1	0
1.8. Floodplain and Channel Dimensions	**Ratio > 2.5.** Stream is minimally confined with a wide, active floodplain.	**Ratio between 1.2 and 2.5.** Stream is moderately confined. Floodplain is present, but may only be active during larger floods.	**Ratio < 1.2.** Stream is incised with a noticeably confined channel. Floodplain is narrow or absent and typically disconnected from the channel.	
	3	1.5	0	
1.9. In-Channel Structure: Riffle-Pool Sequence	Demonstrated by a frequent number of riffles followed by pools along the entire reach. There is an obvious transition between riffles and pools.	Represented by a less frequent number of riffles and pools. Distinguishing the transition between riffles and pools is difficult.	Stream shows some flow but mostly has areas of pools or of riffles.	There is no sequence exhibited.
	3	2	1	0
SUBTOTAL (#1.1 – #1.9)				7

If the stream being evaluated has a subtotal ≤ 5 at this juncture, the stream is determined to be EPHEMERAL.
If the stream being evaluated has a subtotal ≥ 21 at this point, the stream is determined to be PERENNIAL.
YOU MAY STOP THE EVALUATION AT THIS POINT. If the stream has a subtotal between 5 and 21 continue the Level 1 Evaluation.

1.10. Particle Size or Stream Substrate Sorting	Particle sizes in the channel are noticeably different from particle sizes in areas close to but not in the channel. There is a clear distribution of various sized substrates in the stream channel with finer particles accumulating in the pools, and larger particles accumulating in the riffles/runs.	Particle sizes in the channel are moderately similar to particle sizes in areas close to but not in the channel. Various sized substrates are present in the stream channel and are represented by a higher ratio of larger particles (gravel/cobble).	Particle sizes in the channel are similar or comparable to particle sizes in areas close to but not in the channel. Substrate sorting is not readily observed in the stream channel.	
	3	1.5	0	
1.11. Hydric Soils	Hydric soils are found within the study reach.		Hydric soils are not found within the study reach.	
	Present = 3		Absent = 0	
1.12. Sediment on Plants and Debris	Sediment found readily on plants and debris within the stream channel, on the streambank, and within the floodplain throughout the length of the stream.	Sediment found on plants or debris within the stream channel although it is not prevalent along the stream. Mostly accumulating in pools.	Sediment is isolated in small amounts along the stream.	No sediment is present on plants or debris.
	1.5	1	0.5	0
TOTAL POINTS (#1.1 – #1.12)				7.5

SUPPLEMENTAL INDICATORS: **The following indicators do not occur consistently throughout New Mexico but may be useful in the determination of perenniality. If the indicator is present record score below and tally with previous score to compute TOTAL.**			
1.13. Seeps and Springs	Seeps and springs are found within the study reach.	Seeps and springs are not found within the study reach.	
	Present = 1.5	Absent = 0	
1.14. Iron Oxidizing Bacteria/Fungi	Iron-oxidizing bacteria and/or fungi are found within the study reach.	Iron-oxidizing bacteria and/or fungi are not found within the study reach.	
	Present = 1.5	Absent = 0	
TOTAL *plus* SUPPLEMENTAL POINTS (#1.1 – #1.14)			7.5

NMED Surface Water Quality Bureau – LEVEL 1 Hydrology Determination Field Sheet

Photo Descriptions and NOTES

Photo #	Description (US, DS, LB, RB, etc.)	Notes
25	HP17 upstream	
26	HP17 downstream	
27	HP17 base of stream channel	
28	HP17 vegetation in channel	
29	HP17 soil profile	

NOTES:

Channel: Multiple incised discontinuous channels within floodplain. Primary channel used for all measurements. Broad floodplain area with low gradient.

Substrate: Silt channel bottom. Consistent with surrounding uplands.

Vegetation: Significant rooted plants immediately surrounding active channel.

Soils: Silt with clay. Profile generally uniform across 18" depth, no change in color or texture. Appears to be slight lamination. Roots extend down to approximately 12". No signs of oxidation or reduction occurring. No indication of hydric soils.

Assessment Length: HP recommends use of either 40 times the channel width or 150 meters, whichever is larger, as the assessment length. Channel width is up to 4 feet. 40 times the channel width is less than 150 meters. Therefore, an assessment length of at least 150 meters was used.

Various: Sinuosity ration: ~1.2. Spring (Doctor Spring) located upstream of this site with no apparent contribution to the hydrology. This site is completely dry.

LEVEL 1 Field Measurements

INDICATOR #1.10 Particle Size or Stream Substrate Sorting

Used Sand Gauge (©1984 by W.F. McCollough)

INDICATOR #1.8 (*Floodplain and Channel Dimensions*) – MEASUREMENTS & CALCULATIONS**

Max Depth (#1)	Bankfull Stage (#2)	Maximum Depth Value (#3)	2x Maximum Depth Value (#3)	Flood-Prone Area Location (#4)	Flood-Prone Area Width (#5)	Bankfull Width (#6)	Floodplain to Active Channel Ratio (FPA Width / Bankfull Width)
5.24’	4.68’	0.56’	1.12’	4.12’	182.5’	4.25’	42.94

****REFER to Figure 3 on page 19 for clarification**

Lee Ranch Mine Photos

25 - HP17 upstream

26 - HP17 downstream

27 - HP17 base of stream channel

Lee Ranch Mine Photos

28 - HP17 vegetation in channel

29 - HP17 soil profile

Appendix B - Level 1 Hydrology Protocol Results

NMED Surface Water Quality Bureau – LEVEL 1 Hydrology Determination Field Sheet

Date: 6/19/17	**Stream Name: Doctor Arroyo**	**Latitude: 35° 33' 05.51"**
Evaluator(s): CG JC JB JJ	**Site ID: Lee Ranch Mine**	**Longitude: 107° 32' 20.15"**
TOTAL POINTS: 8 *Stream is at least intermittent if ≥ 12*	**Assessment Unit: HP18**	**Drought Index (12-mo. SPI Value): 0 - -1**

WEATHER CONDITIONS	**NOW:** ___ storm (heavy rain) ___ rain (steady rain) ___ showers (intermittent) ___ %cloud cover _X_ clear/sunny	**PAST 48 HOURS:** ___ storm (heavy rain) ___ rain (steady rain) ___ showers (intermittent) ___ %cloud cover _X_ clear/sunny	**Has there been a heavy rain in the last 48 hours?** ___ YES _X_ NO **Field evaluations should be performed at least 48 hours after the last known major rainfall event. **OTHER:** **Stream Modifications** ___ YES _X_ NO **Diversions** ___ YES _X_ NO **Discharges** ___ YES _X_ NO **Explain in further detail in NOTES section

LEVEL 1 INDICATORS	STREAM CONDITION			
	Strong	**Moderate**	**Weak**	**Poor**
1.1. Water in Channel	Flow is evident throughout the reach. Moving water is seen in riffle areas but may not be as evident throughout the runs.	Water is present in the channel but flow is barely discernable in areas of greatest gradient change (i.e. riffles) or floating object is necessary to observe flow.	Dry channel with standing pools. There is some evidence of base flows (i.e. riparian vegetation growing along channel, saturated or moist sediment under rocks, etc)	Dry channel. No evidence of base flows was found.
	6	**4**	**2**	**0**
1.2. Fish	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Fish are not present.
	3	**2**	**1**	**0**
1.3. Benthic Macroinvertebrates	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Macroinvertebrates are not present.
	3	**2**	**1**	**0**
1.4. Filamentous Algae/Periphyton	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Filamentous algae and/or periphyton are not present.
	3	**2**	**1**	**0**
1.5. Differences in Vegetation	Dramatic compositional differences in vegetation are present between the stream banks and the adjacent uplands. A distict riparian vegetation corridor exists along the entire reach – riparian, aquatic, or wetland species dominate the length of the reach.	A distinct riparian vegetation corridor exists along part of the reach. Riparian vegetation is interspersed with upland vegetation along the length of the reach.	Vegetation growing along the reach may occur in greater densities or grow more vigorously than vegetation in the adjacent uplands, but there are no dramatic compositional differences between the two.	No compositional or density differences in vegetation are present between the streambanks and the adjacent uplands.
	3	**2**	**1**	**0**
1.6. Absence of Rooted Upland Plants in Streambed	Rooted upland plants are absent within the streambed/thalweg.	There are a few rooted upland plants present within the streambed/thalweg.	Rooted upland plants are consistently dispersed throughout the streambed/thalweg	Rooted upland plants are prevalent within the streambed/thalweg.
	3	**2**	**1**	**0**
			SUBTOTAL (#1.1 – #1.6)	**1**

If the stream being evaluated has a subtotal ≤ 2 at this juncture, the stream is determined to be EPHEMERAL.
If the stream being evaluated has a subtotal ≥ 18 at this point, the stream is determined to be PERENNIAL.
YOU MAY STOP THE EVALUATION AT THIS POINT. If the stream has a subtotal between 2 and 18 continue the Level 1 Evaluation.

Appendix B - Level 1 Hydrology Protocol Results

LEVEL 1 INDICATORS	STREAM CONDITION			
	Strong	Moderate	Weak	Poor
1.7. Sinuosity	**Ratio > 1.4.** Stream has numerous, closely-spaced bends, few straight sections.	**Ratio < 1.4.** Stream has good sinuosity with some straight sections.	**Ratio < 1.2.** Stream has very few bends and mostly straight sections.	**Ratio = 1.0.** Stream is completely straight with no bends.
	3	2	1	0
1.8. Floodplain and Channel Dimensions	**Ratio > 2.5.** Stream is minimally confined with a wide, active floodplain.	**Ratio between 1.2 and 2.5.** Stream is moderately confined. Floodplain is present, but may only be active during larger floods.	**Ratio < 1.2.** Stream is incised with a noticeably confined channel. Floodplain is narrow or absent and typically disconnected from the channel.	
	3	1.5	0	
1.9. In-Channel Structure: Riffle-Pool Sequence	Demonstrated by a frequent number of riffles followed by pools along the entire reach. There is an obvious transition between riffles and pools.	Represented by a less frequent number of riffles and pools. Distinguishing the transition between riffles and pools is difficult.	Stream shows some flow but mostly has areas of pools or of riffles.	There is no sequence exhibited.
	3	2	1	0
SUBTOTAL (#1.1 – #1.9)				4.0

If the stream being evaluated has a subtotal ≤ 5 at this juncture, the stream is determined to be EPHEMERAL.
If the stream being evaluated has a subtotal ≥ 21 at this point, the stream is determined to be PERENNIAL.
YOU MAY STOP THE EVALUATION AT THIS POINT. If the stream has a subtotal between 5 and 21 continue the Level 1 Evaluation.

1.10. Particle Size or Stream Substrate Sorting	Particle sizes in the channel are noticeably different from particle sizes in areas close to but not in the channel. There is a clear distribution of various sized substrates in the stream channel with finer particles accumulating in the pools, and larger particles accumulating in the riffles/runs.	Particle sizes in the channel are moderately similar to particle sizes in areas close to but not in the channel. Various sized substrates are present in the stream channel and are represented by a higher ratio of larger particles (gravel/cobble).	Particle sizes in the channel are similar or comparable to particle sizes in areas close to but not in the channel. Substrate sorting is not readily observed in the stream channel.	
	3	1.5	0	
1.11. Hydric Soils	Hydric soils are found within the study reach.		Hydric soils are not found within the study reach.	
	Present = 3		Absent = 0	
1.12. Sediment on Plants and Debris	Sediment found readily on plants and debris within the stream channel, on the streambank, and within the floodplain throughout the length of the stream.	Sediment found on plants or debris within the stream channel although it is not prevalent along the stream. Mostly accumulating in pools.	Sediment is isolated in small amounts along the stream.	No sediment is present on plants or debris.
	1.5	1	0.5	0
TOTAL POINTS (#1.1 – #1.12)				5.5

SUPPLEMENTAL INDICATORS: **The following indicators do not occur consistently throughout New Mexico but may be useful in the determination of perenniality. If the indicator is present record score below and tally with previous score to compute TOTAL.**			
1.13. Seeps and Springs	Seeps and springs are found within the study reach.	Seeps and springs are not found within the study reach.	
	Present = 1.5	Absent = 0	
1.14. Iron Oxidizing Bacteria/Fungi	Iron-oxidizing bacteria and/or fungi are found within the study reach.	Iron-oxidizing bacteria and/or fungi are not found within the study reach.	
	Present = 1.5	Absent = 0	
TOTAL *plus* SUPPLEMENTAL POINTS (#1.1 – #1.14)			5.5

NMED Surface Water Quality Bureau – LEVEL 1 Hydrology Determination Field Sheet

Photo Descriptions and NOTES

Photo #	Description (US, DS, LB, RB, etc.)	Notes
30	HP18 upstream	
31	HP18 downstream	
32	HP18 survey	

NOTES:

Location originally proposed was inaccessible. Location moved upstream.

Channel: Approximately 8 feet wide. Minimum of at least 2 historical terraces.

Substrate: Very fine sand bed subrounded with some pebbles. This is the same as the upland substrate outside of the channel.

Vegetation: There is vegetation in the active channel. Shrubs and grasses on banks and floodplain. Some tamarisk but otherwise no change in vegetation composition.

Assessment Length: HP recommends use of either 40 times the channel width or 150 meters, whichever is larger, as the assessment length. Channel width is up to 8 feet. 40 times the channel width is less than 150 meters. Therefore, an assessment length of at least 150 meters was used.

Various: Mudcracking within channel. Some debris in vegetation on banks. Sinuosity ratio: ~1.48

LEVEL 1 Field Measurements

INDICATOR #1.10 Particle Size or Stream Substrate Sorting

Used Sand Gauge (©1984 by W.F. McCollough)

INDICATOR #1.8 (*Floodplain and Channel Dimensions*) – MEASUREMENTS & CALCULATIONS**

Max Depth (#1)	Bankfull Stage (#2)	Maximum Depth Value (#3)	2x Maximum Depth Value (#3)	Flood-Prone Area Location (#4)	Flood-Prone Area Width (#5)	Bankfull Width (#6)	Floodplain to Active Channel Ratio (FPA Width / Bankfull Width)
5.59’	4.85’	0.74’	1.48’	4.11’	16.0’	7.66’	2.09

****REFER to Figure 3 on page 19 for clarification**

Lee Ranch Mine Photos

30 - HP18 upstream

31 - HP 18 downstream

32 - HP18 survey

Cover Sheet
Hydrology Protocol Use Attainability Analysis for an Ephemeral Stream[1]

Stream Name:	Basin:	8-digit HUC:
San Isidro Arroyo, Mulatto Canyon, Arroyo Tinaja (Subwatershed 2ABC)	Rio Grande	13020205
Reach Description:	**Upstream lat/long:**	**Downstream lat/long:**
Unlined, unclassified, ephemeral arroyos within Subwatershed 2ABC.	35.461/-107.778	35.539/-107.573
Current WQS		**Assessment Unit ID:**
☒ Unclassified 20.6.4.98 or 99 NMAC ☐ Classified 20.6.4. _____ NMAC		Lee Ranch Mine

Reach Evaluation (How homogeneity of reach hydrology was verified)	
Methods Used:	(ex. aerial photos, "ground truthing", Google™ Earth, etc.) ground truthing, aerial photos
Reasoning:	Why is the stream homogeneous? Similar geology, sinuosity, and vegetation

Hydrology Protocol Results		**Notes**
Location 1 (lat/long): 35.537/-107.574	☒ eph ☐ int ☐ per	HP-21, watershed 2ABC outlet
Location 2 (lat/long): 35.485/-107.680	☐ eph ☐ int ☐ per	
Location 3 (lat/long): 35.474/-107.69	☐ eph ☐ int ☐ per	
☐ Additional location results attached.		

Hydroclimatic Conditions		**If "yes" please describe.**
Drought (SPI Value < - 1.5)	☐ yes ☒ no	-1 to 0 Eastern half of study area (June 2017, NOAA) 0 to 1 Western half of study area (June 2017, NOAA)
Recent Rainfall (within 48 hours)	☐ yes ☒ no	
Gauge data available?	☐ yes ☒ no	
If yes for any of above, please explain why these conditions do not impact the UAA conclusion that *natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use*:		

Hydrologic and Other Modifications		**If "yes" please describe.**
Dam/diversion	☒ yes ☐ no	See explanation at the end of the modification section
Channelization/roads	☐ yes ☒ no	
Groundwater pumping	☒ yes ☐ no	See explanation at the end of the modification section
Agricultural return flows	☐ yes ☒ no	

[1] This form is designed for the UAA process for ephemeral waters described in Subsection C of 20.6.4.15 NMAC.

Appendix B - Level 1 Hydrology Protocol Results

Hydrologic and Other Modifications		If "yes" please describe.
Existing point source discharge	☒ yes ☐ no	See explanation at the end of the modification section
Planned point source discharge	☐ yes ☒ no	
Other modifications e.g., land use practices	☒ yes ☒ no	*Please explain hydrologic impact* Mining, see explanation below

If yes for any of above, please explain why these modifications do not alter the uses supported by the natural flow regime:

Sub-watershed 2ABC is located within the San Isidro Arroyo and encompasses the Tier 1 watersheds of Arroyo Tinaja, Mulatto Canyon, and San Isidro Arroyo. This area collects drainage from the both the upper canyons and lower plains. This watershed overlaps the majority of the LRM permit area and includes several diversions to limit surface drainage originating upstream towards the mining area. Arroyo Tinaja and Mulatto Canyon were both diverted to the north and now wrap around the northern perimeter of the mining area before reconnecting with the native Arroyo Tinaja channel near photopoint PP284. Mulatto Canyon was diverted from approximately HP13 through PP169 where it joins Arroyo Tinaja. Several (6) temporary NPDES outfalls have been constructed along this reach of the Mulatto Canyon and adjacent to the Arroyo Tinaja channel near PP283 and PP284. The modified portion of the Arroyo Tinaja channel (see PP169, PP283, PP284) exhibits similar characteristics to both the native upstream (see PP12A) and downstream (PP285) reaches of the channel. The channel is similar in nature to a swale with a poorly defined active channel that is densely covered with upland vegetation. The bed material consists of silt and fine sand and does not exhibit evidence of riffle-pool structures. Similar channel characteristics are also seen in the native sections of the San Isidro Arroyo (see PP286, PP287, PP288) that exhibit a similar surface topography (~6600 – 6700 ft msl) and similar channel slope (0.4 – 0.6%). Runoff from several small unnamed tributaries in the headwaters of the San Isidro Arroyo is diverted to the east around the southern perimeter of the mine. A small dike was also constructed in the reach between HP15 and PP286 to direct runoff from mining disturbance towards temporary NPDES outfall 096. Several temporary outfalls were constructed in the vicinity of PP286 and further to the north near PP288.

The two production wells at the LRM are hydrologically isolated from these drainage channels by several hundred feet of low permeable bedrock. The wells are screened within the Gallup aquifer > 1000 ft bgs. The Gallup aquifer is confined and the static water level is approximately 150 - 180 ft bgs. Groundwater was not encountered in the alluvium during the extensive exploration drilling program completed for SMCRA Permit 19-2P or during the mining process. In addition there are a total of 8 active livestock diversion wells located within subwatershed 2ABC that each have a permitted withdrawals of 3 ac-ft per year (see Figure 1). The semi-arid climate limits the vegetative biomass available to support livestock in this region and the herds need to graze several hundred acres per year to accommodate their dietary needs. These wells are used on an as needed basis when this herd is in the immediate area. Therefore the withdrawal from these wells is insignificant and did not have impacts on the flow regime of the drainage channels within the study area during the 2017 HP Assessment.

Current Uses Observed		If "yes" please describe.
Macroinvertebrates	☐ yes ☒ no	
Fish	☐ yes ☒ no	
Recreation (contact use)	☐ yes ☒ no	

If yes for any of the above, please explain why these observed uses are consistent with the UAA conclusion that 101(a)(2) aquatic life and recreational uses are not feasible:

Additional Comments:
Sub-watershed 2ABC is located within the San Isidro Arroyo and encompasses the Tier 1 watersheds of Arroyo Tinaja, Mulatto Canyon, and San Isidro Arroyo. This area collects drainage from the both the upper canyons and lower plains. The sub-watershed encompasses the majority of the LRM permit area. Several diversions have

been constructed in this watershed to direct drainage from the headwaters of these streams around the perimeter of the mine. Assessment point HP21 was established at the outlet of Subwatershed 2ABC downstream of the confluence of Arroyo Tinaja and Mulatto Canyon and is considered representative of the hydrologic regime of the entire subwatershed. HP21 is located in the stream reach with the greatest potential to support non-ephemeral flow within subwatershed 2ABC and therefore provides a conservative estimation of the flow regime of the upstream tributaries that drain to it. HP-21 received a Level 1 Evaluation score of 8.0 which provides further evidence that flow in the San Isidro Arroyo is only in response to precipitation or snow melt events. This Level 1 Evaluation score is very similar to HP-15 (Subwatershed 1C), which is also located in the lower plains. The Level 1 Evaluation scores at assessment points HP-11 (Subwatershed 1A) and HP-13 (Subwatershed 1B), located at the base of the canyons, further indicate that the flow regime within subwatershed 2ABC is ephemeral. Photopoints located throughout the 2ABC sub-watershed provide additional evidence that the flow regime is consistent throughout the watershed (see Appendix C). Additional information for the HP assessment points in Subwatersheds 1A – 1C can be found in Appendix B and part 4.51 – 4.53 of the LRM UAA report.

ATTACHMENTS:

- ☒ Map and Photos (required)
- ☒ Hydrology Protocol Field Sheets for all locations (required)
- ☐ Level 2 Analysis (optional)
- ☒ Additional sites and/or documentation (optional)

CONCLUSION:

This UAA concludes that the stream reach identified above is ephemeral and that Clean Water Act Section 101(a)(2) aquatic life and recreational uses are neither existing nor attainable due to the factor identified in 40 CFR 131.10(g)(2): *natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent.* Based on this conclusion, we recommend that the designated uses and criteria identified in 20.6.4.97 NMAC be applied to this stream reach in accordance with the UAA process set forth in Subsection C of 20.6.4.15 NMAC.

Submitted by: James Boswell

Signed: _____ Date: 5/7/2018

Surface Water Quality Bureau concurs with recommendation. ☐ Yes ☐ No

If no, see attached reasons.

Signed: _____ Date: _____

EPA Region 6 technical approval granted. ☐ Yes ☐ No

If no, see attached reasons.

Signed: _____ Date: _____

Appendix B - Level 1 Hydrology Protocol Results

NMED Surface Water Quality Bureau – LEVEL 1 Hydrology Determination Field Sheet

Date: 6/20/17	**Stream Name: San Isidro Arroyo**	**Latitude: 35° 32' 20.29"**
Evaluator(s): CG JC JB JJ	**Site ID: Lee Ranch Mine**	**Longitude: 107° 34' 21.72"**
TOTAL POINTS: 8.0 *Stream is at least intermittent if ≥ 12*	**Assessment Unit: HP21**	**Drought Index (12-mo. SPI Value): 0 - -1**

WEATHER CONDITIONS	**NOW:** ___ storm (heavy rain) ___ rain (steady rain) ___ showers (intermittent) ___ %cloud cover _X_ clear/sunny	**PAST 48 HOURS:** ___ storm (heavy rain) ___ rain (steady rain) ___ showers (intermittent) ___ %cloud cover _X_ clear/sunny	**Has there been a heavy rain in the last 48 hours?** ___ YES _X_ NO **Field evaluations should be performed at least 48 hours after the last known major rainfall event. **OTHER:** **Stream Modifications** ___ YES _X_ NO **Diversions** ___ YES _X_ NO **Discharges** ___ YES _X_ NO **Explain in further detail in NOTES section

LEVEL 1 INDICATORS	STREAM CONDITION			
	Strong	**Moderate**	**Weak**	**Poor**
1.1. Water in Channel	Flow is evident throughout the reach. Moving water is seen in riffle areas but may not be as evident throughout the runs.	Water is present in the channel but flow is barely discernable in areas of greatest gradient change (i.e. riffles) or floating object is necessary to observe flow.	Dry channel with standing pools. There is some evidence of base flows (i.e. riparian vegetation growing along channel, saturated or moist sediment under rocks, etc)	Dry channel. No evidence of base flows was found.
	6	**4**	**2**	**0**
1.2. Fish	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Fish are not present.
	3	**2**	**1**	**0**
1.3. Benthic Macroinvertebrates	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Macroinvertebrates are not present.
	3	**2**	**1**	**0**
1.4. Filamentous Algae/Periphyton	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Filamentous algae and/or periphyton are not present.
	3	**2**	**1**	**0**
1.5. Differences in Vegetation	Dramatic compositional differences in vegetation are present between the stream banks and the adjacent uplands. A distict riparian vegetation corridor exists along the entire reach – riparian, aquatic, or wetland species dominate the length of the reach.	A distinct riparian vegetation corridor exists along part of the reach. Riparian vegetation is interspersed with upland vegetation along the length of the reach.	Vegetation growing along the reach may occur in greater densities or grow more vigorously than vegetation in the adjacent uplands, but there are no dramatic compositional differences between the two.	No compositional or density differences in vegetation are present between the streambanks and the adjacent uplands.
	3	**2**	**1**	**0**
1.6. Absence of Rooted Upland Plants in Streambed	Rooted upland plants are absent within the streambed/thalweg.	There are a few rooted upland plants present within the streambed/thalweg.	Rooted upland plants are consistently dispersed throughout the streambed/thalweg	Rooted upland plants are prevalent within the streambed/thalweg.
	3	**2**	**1**	**0**
			SUBTOTAL (#1.1 – #1.6)	**4**

If the stream being evaluated has a subtotal ≤ 2 at this juncture, the stream is determined to be EPHEMERAL.
If the stream being evaluated has a subtotal ≥ 18 at this point, the stream is determined to be PERENNIAL.
YOU MAY STOP THE EVALUATION AT THIS POINT. If the stream has a subtotal between 2 and 18 continue the Level 1 Evaluation.

Appendix B - Level 1 Hydrology Protocol Results

LEVEL 1 INDICATORS	STREAM CONDITION			
	Strong	Moderate	Weak	Poor
1.7. Sinuosity	**Ratio > 1.4.** Stream has numerous, closely-spaced bends, few straight sections.	**Ratio < 1.4.** Stream has good sinuosity with some straight sections.	**Ratio < 1.2.** Stream has very few bends and mostly straight sections.	**Ratio = 1.0.** Stream is completely straight with no bends.
	3	2	1	0
1.8. Floodplain and Channel Dimensions	**Ratio > 2.5.** Stream is minimally confined with a wide, active floodplain.	**Ratio between 1.2 and 2.5.** Stream is moderately confined. Floodplain is present, but may only be active during larger floods.	**Ratio < 1.2.** Stream is incised with a noticeably confined channel. Floodplain is narrow or absent and typically disconnected from the channel.	
	3	1.5	0	
1.9. In-Channel Structure: Riffle-Pool Sequence	Demonstrated by a frequent number of riffles followed by pools along the entire reach. There is an obvious transition between riffles and pools.	Represented by a less frequent number of riffles and pools. Distinguishing the transition between riffles and pools is difficult.	Stream shows some flow but mostly has areas of pools or of riffles.	There is no sequence exhibited.
	3	2	1	0
SUBTOTAL (#1.1 – #1.9)				7.5

If the stream being evaluated has a subtotal ≤ 5 at this juncture, the stream is determined to be EPHEMERAL.
If the stream being evaluated has a subtotal ≥ 21 at this point, the stream is determined to be PERENNIAL.
YOU MAY STOP THE EVALUATION AT THIS POINT. If the stream has a subtotal between 5 and 21 continue the Level 1 Evaluation.

1.10. Particle Size or Stream Substrate Sorting	Particle sizes in the channel are noticeably different from particle sizes in areas close to but not in the channel. There is a clear distribution of various sized substrates in the stream channel with finer particles accumulating in the pools, and larger particles accumulating in the riffles/runs.	Particle sizes in the channel are moderately similar to particle sizes in areas close to but not in the channel. Various sized substrates are present in the stream channel and are represented by a higher ratio of larger particles (gravel/cobble).	Particle sizes in the channel are similar or comparable to particle sizes in areas close to but not in the channel. Substrate sorting is not readily observed in the stream channel.
	3	1.5	0
1.11. Hydric Soils	Hydric soils are found within the study reach.		Hydric soils are <u>not</u> found within the study reach.
	Present = 3		Absent = 0
1.12. Sediment on Plants and Debris	Sediment found readily on plants and debris within the stream channel, on the streambank, and within the floodplain throughout the length of the stream.	Sediment found on plants or debris within the stream channel although it is not prevalent along the stream. Mostly accumulating in pools.	Sediment is isolated in small amounts along the stream.	No sediment is present on plants or debris.
	1.5	1	0.5	0
TOTAL POINTS (#1.1 – #1.12)				8.0

SUPPLEMENTAL INDICATORS: **The following indicators do not occur consistently throughout New Mexico but may be useful in the determination of perenniality. <u>If the indicator is present</u> record score below and tally with previous score to compute TOTAL.**		
1.13. Seeps and Springs	Seeps and springs are found within the study reach.	Seeps and springs are <u>not</u> found within the study reach.
	Present = 1.5	Absent = 0
1.14. Iron Oxidizing Bacteria/Fungi	Iron-oxidizing bacteria and/or fungi are found within the study reach.	Iron-oxidizing bacteria and/or fungi are <u>not</u> found within the study reach.
	Present = 1.5	Absent = 0
TOTAL *plus* SUPPLEMENTAL POINTS (#1.1 – #1.14)		8.0

NMED Surface Water Quality Bureau – LEVEL 1 Hydrology Determination Field Sheet

Photo Descriptions and NOTES

Photo #	Description (US, DS, LB, RB, etc.)	Notes
33	HP21 upstream	
34	HP21 downstream	
35	HP21 vegetation in channel	

NOTES:

Channel: Small entrenched channel in wide flood plain with several abandoned historical channels. Some undercut banks. Mass wasting / sloughing of upper terrace walls.

Substrate: Very fine sand and silt.

Vegetation: Some tamarisk but also contains rooted upland plants that are the same composition as the surrounding upland area.

Soils: Channel compacted.

Assessment Length: HP recommends use of either 40 times the channel width or 150 meters, whichever is larger, as the assessment length. Channel width is up to 4 feet. 40 times the channel width is less than 150 meters. Therefore, an assessment length of at least 150 meters was used.

Various: Moderately sinuous (approximately 1.3). NMED present for study (Shelly Lemon and Brian Dahl).

LEVEL 1 Field Measurements

INDICATOR #1.10 Particle Size or Stream Substrate Sorting

Used Sand Gauge (©1984 by W.F. McCollough)

INDICATOR #1.8 (*Floodplain and Channel Dimensions*) – MEASUREMENTS & CALCULATIONS**

Max Depth (#1)	Bankfull Stage (#2)	Maximum Depth Value (#3)	2x Maximum Depth Value (#3)	Flood-Prone Area Location (#4)	Flood-Prone Area Width (#5)	Bankfull Width (#6)	Floodplain to Active Channel Ratio (FPA Width / Bankfull Width)
5.71’	5.39’	0.32’	0.64	5.07’	7.17’	4.08’	1.76

****REFER to Figure 3 on page 19 for clarification**

Lee Ranch Mine Photos

33 - HP21 upstream

34 - HP21 downstream

P35 - HP21 vegetation in channel

Lee Ranch 6-20-17
HP UAA

HYDROLOGY DETERMINATION
FIELD SHEETS

Available at the SWQB Hydrology Protocol website:
(http://www.nmenv.state.nm.us/swqb/Hydrology/index.html)

Appendix B - Level 1 Hydrology Protocol Results

NMED Surface Water Quality Bureau – LEVEL 1 Hydrology Determination Field Sheet

Date: 6-20-2017	**Stream Name:**	**Latitude:** 35.53896
Evaluator(s): SL, BD	**Site ID:** HP21	**Longitude:** 107.57271
TOTAL POINTS: *Stream is at least intermittent if ≥ 12*	**Assessment Unit:**	**Drought Index (12-mo. SPI Value):**

WEATHER CONDITIONS	**NOW:**	**PAST 48 HOURS:**	**Has there been a heavy rain in the last 48 hours?** ___ YES ___ NO **Field evaluations should be performed at least 48 hours after the last known major rainfall event.
	___ storm (heavy rain) ___ rain (steady rain) ___ showers (intermittent) ___ %cloud cover X clear/sunny	___ storm (heavy rain) ___ rain (steady rain) ___ showers (intermittent) ___ %cloud cover X clear/sunny	**OTHER:** Cattle Grazing/Trails **Stream Modifications** ___ YES ___ NO **Diversions** ___ YES ___ NO **Discharges** ___ YES X NO through-out channel **Explain in further detail in NOTES section

LEVEL 1 INDICATORS	**STREAM CONDITION**			
	Strong	**Moderate**	**Weak**	**Poor**
1.1. Water in Channel	Flow is evident throughout the reach. Moving water is seen in riffle areas but may not be as evident throughout the runs.	Water is present in the channel but flow is barely discernable in areas of greatest gradient change (i.e. riffles) or floating object is necessary to observe flow.	Dry channel with standing pools. There is some evidence of base flows (i.e. riparian vegetation growing along channel, saturated or moist sediment under rocks, etc)	Dry channel. No evidence of base flows was found.
	6	**4**	**2**	**0**
1.2. Fish	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Fish are not present.
	3	**2**	**1**	**0**
1.3. Benthic Macroinvertebrates	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Macroinvertebrates are not present.
	3	**2**	**1**	**0**
1.4. Filamentous Algae/Periphyton	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Filamentous algae and/or periphyton are not present.
	3	**2**	**1**	**0**
1.5. Differences in Vegetation	Dramatic compositional differences in vegetation are present between the stream banks and the adjacent uplands. A distict riparian vegetation corridor exists along the entire reach – riparian, aquatic, or wetland species dominate the length of the reach.	A distinct riparian vegetation corridor exists along part of the reach. Riparian vegetation is interspersed with upland vegetation along the length of the reach.	Vegetation growing along the reach may occur in greater densities or grow more vigorously than vegetation in the adjacent uplands, but there are no dramatic compositional differences between the two.	No compositional or density differences in vegetation are present between the streambanks and the adjacent uplands.
	3	**2**	**1**	**0**
1.6. Absence of Rooted Upland Plants in Streambed	Rooted upland plants are absent within the streambed/thalweg.	There are a few rooted upland plants present within the streambed/thalweg.	Rooted upland plants are consistently dispersed throughout the streambed/thalweg	Rooted upland plants are prevalent within the streambed/thalweg.
	3	**2**	**1**	**0**
			SUBTOTAL (#1.1 – #1.6)	2-4

If the stream being evaluated has a subtotal ≤ 2 at this juncture, the stream is determined to be EPHEMERAL.
If the stream being evaluated has a subtotal ≥ 18 at this point, the stream is determined to be PERENNIAL.
YOU MAY STOP THE EVALUATION AT THIS POINT. If the stream has a subtotal between 2 and 18 continue the Level 1 Evaluation.

Appendix B - Level 1 Hydrology Protocol Results

LEVEL 1 INDICATORS	STREAM CONDITION			
	Strong	Moderate	Weak	Poor
1.7. Sinuosity	**Ratio > 1.4.** Stream has numerous, closely-spaced bends, few straight sections.	**Ratio < 1.4.** Stream has good sinuosity with some straight sections.	**Ratio < 1.2.** Stream has very few bends and mostly straight sections.	**Ratio = 1.0.** Stream is completely straight with no bends.
	3	2	1	0
1.8. Floodplain and Channel Dimensions	**Ratio > 2.5.** Stream is minimally confined with a wide, active floodplain.	**Ratio between 1.2 and 2.5.** Stream is moderately confined. Floodplain is present, but may only be active during larger floods.	**Ratio < 1.2.** Stream is incised with a noticeably confined channel. Floodplain is narrow or absent and typically disconnected from the channel.	
	3	1.5	0	
1.9. In-Channel Structure: Riffle-Pool Sequence	Demonstrated by a frequent number of riffles followed by pools along the entire reach. There is an obvious transition between riffles and pools.	Represented by a less frequent number of riffles and pools. Distinguishing the transition between riffles and pools is difficult.	Stream shows some flow but mostly has areas of pools or of riffles.	There is no sequence exhibited.
	3	2	1	SL 0
			SUBTOTAL (#1.1 – #1.9)	5.5 ~~6.5~~ 7.5-8.5

If the stream being evaluated has a subtotal ≤ 5 at this juncture, the stream is determined to be EPHEMERAL.
If the stream being evaluated has a subtotal ≥ 21 at this point, the stream is determined to be PERENNIAL.
YOU MAY STOP THE EVALUATION AT THIS POINT. If the stream has a subtotal between 5 and 21 continue the Level 1 Evaluation.

1.10. Particle Size or Stream Substrate Sorting	Particle sizes in the channel are noticeably different from particle sizes in areas close to but not in the channel. There is a clear distribution of various sized substrates in the stream channel with finer particles accumulating in the pools, and larger particles accumulating in the riffles/runs.	Particle sizes in the channel are moderately similar to particle sizes in areas close to but not in the channel. Various sized substrates are present in the stream channel and are represented by a higher ratio of larger particles (gravel/cobble).	Particle sizes in the channel are similar or comparable to particle sizes in areas close to but not in the channel. Substrate sorting is not readily observed in the stream channel.
	3	1.5	0
1.11. Hydric Soils	Hydric soils are found within the study reach.		Hydric soils are not found within the study reach.
	Present = 3		Absent = 0
1.12. Sediment on Plants and Debris	Sediment found readily on plants and debris within the stream channel, on the streambank, and within the floodplain throughout the length of the stream.	Sediment found on plants or debris within the stream channel although it is not prevalent along the stream. Mostly accumulating in pools.	Sediment is isolated in small amounts along the stream.	No sediment is present on plants or debris.
	1.5	1	0.5	SL 0
			TOTAL POINTS (#1.1 – #1.12)	6 ~~7~~ - 9

SUPPLEMENTAL INDICATORS: The following indicators do not occur consistently throughout New Mexico but may be useful in the determination of perenniality. If the indicator is present record score below and tally with previous score to compute TOTAL.

1.13. Seeps and Springs	Seeps and springs are found within the study reach.	Seeps and springs are not found within the study reach.
	Present = 1.5	Absent = 0
1.14. Iron Oxidizing Bacteria/Fungi	Iron-oxidizing bacteria and/or fungi are found within the study reach.	Iron-oxidizing bacteria and/or fungi are not found within the study reach.
	Present = 1.5	Absent = 0
		TOTAL *plus* SUPPLEMENTAL POINTS (#1.1 – #1.14) 6-9

5.39 = BF
5.71 = Max Depth

5.71
5.39
0.32 = Max Depth
× 2
0.64

5.71
- .64
5.07

NMED Surface Water Quality Bureau – LEVEL 1 Hydrology Determination Field Sheet

Photo Descriptions and NOTES

Photo #	Description (US, DS, LB, RB, etc.)	Notes

NOTES:

BF Width = 4.08ft
Flood Prone Area Width = 7.2ft
Max Depth = 0.32'
2x Max = 0.64'
-tamarisk in channel
mass wasting
incised
undercut banks

Cover Sheet
Hydrology Protocol Use Attainability Analysis for an Ephemeral Stream[1]

Stream Name:	Basin:	8-digit HUC:
San Isidro Arroyo (Subwatershed 3ABCD)	Rio Grande	13020205
Reach Description:	**Upstream lat/long:**	**Downstream lat/long:**
Unlined, unclassified, ephemeral arroyo within Subwatershed 3ABCD.	35.461/-107.778	35.580/-107.519
Current WQS		**Assessment Unit ID:**
☒ Unclassified 20.6.4.98 or 99 NMAC ☐ Classified 20.6.4. _____ NMAC		Lee Ranch Mine

Reach Evaluation (How homogeneity of reach hydrology was verified)	
Methods Used:	(ex. aerial photos, "ground truthing", Google™ Earth, etc.) ground truthing, aerial photos
Reasoning:	Why is the stream homogeneous? Similar geology, sinuosity, and vegetation

Hydrology Protocol Results		**Notes**
Location 1 (lat/long): 35.58/-107.52	☒ eph ☐ int ☐ per	HP-31, watershed 3ABCD outlet
Location 2 (lat/long): 35.537/-107.57	☐ eph ☐ int ☐ per	
Location 3 (lat/long): 35.556/-107.54	☐ eph ☐ int ☐ per	
☐ Additional location results attached.		

Hydroclimatic Conditions		**If "yes" please describe.**
Drought (SPI Value < - 1.5)	☐ yes ☒ no	-1 to 0 Eastern half of study area (June 2017, NOAA) 0 to 1 Western half of study area (June 2017, NOAA)
Recent Rainfall (within 48 hours)	☐ yes ☒ no	
Gauge data available?	☐ yes ☒ no	
If yes for any of above, please explain why these conditions do not impact the UAA conclusion that *natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use*:		

Hydrologic and Other Modifications		**If "yes" please describe.**
Dam/diversion	☐ yes ☒ no	See explanation at the end of the modification section
Channelization/roads	☐ yes ☒ no	
Groundwater pumping	☒ yes ☐ no	See explanation at the end of the modification section
Agricultural return flows	☐ yes ☒ no	
Existing point source discharge	☐ yes ☒ no	See explanation at the end of the modification section

[1] This form is designed for the UAA process for ephemeral waters described in Subsection C of 20.6.4.15 NMAC.

Hydrologic and Other Modifications		If "yes" please describe.
Planned point source discharge	☐ yes ☒ no	
Other modifications e.g., land use practices	☐ yes ☒ no	*Please explain hydrologic impact*

If yes for any of above, please explain why these modifications do not alter the uses supported by the natural flow regime:

Watershed 3ABCD is located downstream of the northern LRM permit boundary within the San Isidro Arroyo downstream to its confluence with Arroyo Chico. There have been no alterations to the stream channel or construction of NPDES impoundments within the drainage area downstream of Subwatersheds 2ABC and 1D. Alterations within Subwatershed 2ABC and 1D have been described in the Appendix B UAA cover sheets for those subwatersheds. The two mine production wells at LRM are hydrologically isolated from the San Isidro Arroyo by several hundred feet of low permeable bedrock. The wells are located on the southern end of the mine property and are screened within the Gallup aquifer > 1000 ft bgs. The Gallup aquifer is confined and the static water level is approximately 150 - 180 ft bgs. In addition there are 18 active livestock diversion wells located within watershed 3ABCD with permitted withdrawals of 3 ac-ft per year (see Figure 1). The semi-arid climate limits the vegetative biomass available to support livestock in this region and the herds need to graze several hundred acres per year to accommodate their dietary needs. These wells are used on an as needed basis when this herd is in the immediate area. Therefore the withdrawal from these wells is insignificant and did not have impacts on the flow regime of the drainage channels within the study area during the 2017 HP Assessment.

Current Uses Observed		If "yes" please describe.
Macroinvertebrates	☐ yes ☒ no	
Fish	☐ yes ☒ no	
Recreation (contact use)	☐ yes ☒ no	

If yes for any of the above, please explain why these observed uses are consistent with the UAA conclusion that 101(a)(2) aquatic life and recreational uses are not feasible:

Additional Comments:

Watershed 3ABCD includes the lower reach of the San Isidro Arroyo main channel north of the mine. There have been no alterations to the stream channel or mine related disturbance within the drainage area downstream of Subwatershed 2ABC and 1D. Hydrologic assessment point HP-31 was established within the San Isidro Arroyo just above its confluence with the Arroyo Chico. This point is located approximately 4.8 miles downstream of the mining boundary and receives drainage from subwatersheds 2ABC and 1D. This point was determined to be representative of the hydrologic processes for the entire drainage basin because it receives runoff from all subwatersheds and should provide a conservative estimation of the flow regime of the upstream lower order tributaries that drain to it. The Level 1 Evaluation score for assessment point HP-31 was 7.0, which supports the determination that the flow regime in this watershed is ephemeral. This is similar to the scores observed at HP18 (6) and HP21 (8) which are also located in the lower topographic portion of the watershed (~ 6450 – 6550 ft msl). The Level 1 Evaluation scores observed at assessment points HP-11 (5) and HP13 (7.5), located near the outlets of Subwatersheds 1A and 1B at the base of the mesa canyons, and HP14 (6.5), located within the mesa canyons indicate that the flow regime in the upstream headwater reaches of the drainage basin are also ephemeral. One reach located within Doctor Arroyo was identified as having water within the channel (PP160). This reach is located within the mining exclusion area and receives overflow from bedrock livestock wells installed to supplement the water available to the rancher's cattle and to the wetland in the Doctor Springs (S-3) area. The drainage channel has a sand bottom and the water in the channel evaporates or soaks into the ground within several hundred feet. Assessment points HP16 and HP17 were established at the upstream and downstream portion of the mining exclusion area. Level 1 Evaluation scores at HP-16 and HP-17 were 6.5 and 8.5 indicating that the flow regime of Doctor Arroyo immediately above and below the exclusion area is ephemeral. A total of nine Level 1 Evaluations were completed at critical points

throughout the 3ABCD watershed. The assessment points encompass the variety of landscape topography, geology, and Ecoregions found throughout the drainage basin. The results of all nine Level 1 Evaluation scores support the determination that flow regime of the drainage channels within Watershed 3ABCD are ephemeral. Additional information for the HP assessment points in Subwatersheds 1A – 1D and 2ABC can be found in Appendix B and part 4.51 – 4.53 of the LRM UAA report. Additional photo documentation is also available in Appendix C.

ATTACHMENTS:

- ☒ Map and Photos (required)
- ☒ Hydrology Protocol Field Sheets for all locations (required)
- ☐ Level 2 Analysis (optional)
- ☒ Additional sites and/or documentation (optional)

CONCLUSION:

This UAA concludes that the stream reach identified above is ephemeral and that Clean Water Act Section 101(a)(2) aquatic life and recreational uses are neither existing nor attainable due to the factor identified in 40 CFR 131.10(g)(2): *natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent*. Based on this conclusion, we recommend that the designated uses and criteria identified in 20.6.4.97 NMAC be applied to this stream reach in accordance with the UAA process set forth in Subsection C of 20.6.4.15 NMAC.

Submitted by: James Boswell

Signed: _____ Date: 5/7/2018

Surface Water Quality Bureau concurs with recommendation. ☐ Yes ☐ No

If no, see attached reasons.

Signed: _____ Date: _____

EPA Region 6 technical approval granted. ☐ Yes ☐ No

If no, see attached reasons.

Signed: _____ Date: _____

Appendix B - Level 1 Hydrology Protocol Results

NMED Surface Water Quality Bureau – LEVEL 1 Hydrology Determination Field Sheet

Date: 06/21/17	**Stream Name: San Isidro Arroyo**	**Latitude: 35° 34' 47.66"**
Evaluator(s): CG JC JB JJ	**Site ID: Lee Ranch Mine**	**Longitude: 107° 31' 08.58"**
TOTAL POINTS: 6.5 *Stream is at least intermittent if ≥ 12*	**Assessment Unit: HP31**	**Drought Index (12-mo. SPI Value): 0 - -1**

WEATHER CONDITIONS	**NOW:** ___ storm (heavy rain) ___ rain (steady rain) ___ showers (intermittent) ___ %cloud cover _X_ clear/sunny	**PAST 48 HOURS:** ___ storm (heavy rain) ___ rain (steady rain) ___ showers (intermittent) ___ %cloud cover _X_ clear/sunny	**Has there been a heavy rain in the last 48 hours?** ___ YES _X_ NO **Field evaluations should be performed at least 48 hours after the last known major rainfall event. **OTHER:** **Stream Modifications** ___ YES _X_ NO **Diversions** ___ YES _X_ NO **Discharges** ___ YES _X_ NO **Explain in further detail in NOTES section

LEVEL 1 INDICATORS	STREAM CONDITION			
	Strong	**Moderate**	**Weak**	**Poor**
1.1. Water in Channel	Flow is evident throughout the reach. Moving water is seen in riffle areas but may not be as evident throughout the runs.	Water is present in the channel but flow is barely discernable in areas of greatest gradient change (i.e. riffles) or floating object is necessary to observe flow.	Dry channel with standing pools. There is some evidence of base flows (i.e. riparian vegetation growing along channel, saturated or moist sediment under rocks, etc)	Dry channel. No evidence of base flows was found.
	6	**4**	**2**	**0**
1.2. Fish	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Fish are not present.
	3	**2**	**1**	**0**
1.3. Benthic Macroinvertebrates	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Macroinvertebrates are not present.
	3	**2**	**1**	**0**
1.4. Filamentous Algae/Periphyton	Found easily and consistently throughout the reach.	Found with little difficulty but not consistently throughout the reach.	Takes 10 or more minutes of extensive searching to find.	Filamentous algae and/or periphyton are not present.
	3	**2**	**1**	**0**
1.5. Differences in Vegetation	Dramatic compositional differences in vegetation are present between the stream banks and the adjacent uplands. A distict riparian vegetation corridor exists along the entire reach – riparian, aquatic, or wetland species dominate the length of the reach.	A distinct riparian vegetation corridor exists along part of the reach. Riparian vegetation is interspersed with upland vegetation along the length of the reach.	Vegetation growing along the reach may occur in greater densities or grow more vigorously than vegetation in the adjacent uplands, but there are no dramatic compositional differences between the two.	No compositional or density differences in vegetation are present between the streambanks and the adjacent uplands.
	3	**2**	**1**	**0**
1.6. Absence of Rooted Upland Plants in Streambed	Rooted upland plants are absent within the streambed/thalweg.	There are a few rooted upland plants present within the streambed/thalweg.	Rooted upland plants are consistently dispersed throughout the streambed/thalweg	Rooted upland plants are prevalent within the streambed/thalweg.
	3	**2**	**1**	**0**
			SUBTOTAL (#1.1 – #1.6)	**4**

If the stream being evaluated has a subtotal ≤ 2 at this juncture, the stream is determined to be EPHEMERAL.
If the stream being evaluated has a subtotal ≥ 18 at this point, the stream is determined to be PERENNIAL.
YOU MAY STOP THE EVALUATION AT THIS POINT. If the stream has a subtotal between 2 and 18 continue the Level 1 Evaluation.

Appendix B - Level 1 Hydrology Protocol Results

LEVEL 1 INDICATORS	STREAM CONDITION			
	Strong	Moderate	Weak	Poor
1.7. Sinuosity	**Ratio > 1.4.** Stream has numerous, closely-spaced bends, few straight sections.	**Ratio < 1.4.** Stream has good sinuosity with some straight sections.	**Ratio < 1.2.** Stream has very few bends and mostly straight sections.	**Ratio = 1.0.** Stream is completely straight with no bends.
	3	2	1	0.50 / 0
1.8. Floodplain and Channel Dimensions	**Ratio > 2.5.** Stream is minimally confined with a wide, active floodplain.	**Ratio between 1.2 and 2.5.** Stream is moderately confined. Floodplain is present, but may only be active during larger floods.	**Ratio < 1.2.** Stream is incised with a noticeably confined channel. Floodplain is narrow or absent and typically disconnected from the channel.	
	3	1.5	0	
1.9. In-Channel Structure: Riffle-Pool Sequence	Demonstrated by a frequent number of riffles followed by pools along the entire reach. There is an obvious transition between riffles and pools.	Represented by a less frequent number of riffles and pools. Distinguishing the transition between riffles and pools is difficult.	Stream shows some flow but mostly has areas of pools or of riffles.	There is no sequence exhibited.
	3	2	1	0
SUBTOTAL (#1.1 – #1.9)				6

If the stream being evaluated has a subtotal ≤ 5 at this juncture, the stream is determined to be EPHEMERAL.
If the stream being evaluated has a subtotal ≥ 21 at this point, the stream is determined to be PERENNIAL.
YOU MAY STOP THE EVALUATION AT THIS POINT. If the stream has a subtotal between 5 and 21 continue the Level 1 Evaluation.

1.10. Particle Size or Stream Substrate Sorting	Particle sizes in the channel are noticeably different from particle sizes in areas close to but not in the channel. There is a clear distribution of various sized substrates in the stream channel with finer particles accumulating in the pools, and larger particles accumulating in the riffles/runs.	Particle sizes in the channel are moderately similar to particle sizes in areas close to but not in the channel. Various sized substrates are present in the stream channel and are represented by a higher ratio of larger particles (gravel/cobble).	Particle sizes in the channel are similar or comparable to particle sizes in areas close to but not in the channel. Substrate sorting is not readily observed in the stream channel.	
	3	1.5	0	
1.11. Hydric Soils	Hydric soils are found within the study reach.		Hydric soils are not found within the study reach.	
	Present = 3		Absent = 0	
1.12. Sediment on Plants and Debris	Sediment found readily on plants and debris within the stream channel, on the streambank, and within the floodplain throughout the length of the stream.	Sediment found on plants or debris within the stream channel although it is not prevalent along the stream. Mostly accumulating in pools.	Sediment is isolated in small amounts along the stream.	No sediment is present on plants or debris.
	1.5	1	0.5	0
TOTAL POINTS (#1.1 – #1.12)				6.5

SUPPLEMENTAL INDICATORS: **The following indicators do not occur consistently throughout New Mexico but may be useful in the determination of perenniality. If the indicator is present record score below and tally with previous score to compute TOTAL.**

1.13. Seeps and Springs	Seeps and springs are found within the study reach.	Seeps and springs are not found within the study reach.
	Present = 1.5	Absent = 0
1.14. Iron Oxidizing Bacteria/Fungi	Iron-oxidizing bacteria and/or fungi are found within the study reach.	Iron-oxidizing bacteria and/or fungi are not found within the study reach.
	Present = 1.5	Absent = 0
TOTAL *plus* SUPPLEMENTAL POINTS (#1.1 – #1.14)		6.5

NMED Surface Water Quality Bureau – LEVEL 1 Hydrology Determination Field Sheet

Photo Descriptions and NOTES

Photo #	Description (US, DS, LB, RB, etc.)	Notes
36	HP31 upstream	
37	HP31 downstream	
38	HP31 channel bottom	

NOTES:

Channel: Upper terrace approximately 135 feet across and 30 feet tall. Historical terrace about 6 feet above active channel. Active channel approximately 4 feet across.

Substrate: Silt with some medium sand. No water in channel but some mudcracks present.

Vegetation: Tamarisk within floodplain (some but not dominant). Upland vegetation on bank. Very little upland vegetation in channel.

Soils: Compacted silt in upper 6 inches with sand underlying. No signs of water (e.g. damp soil) or frequent wetting drying (oxidation – reduction).

Assessment Length: HP recommends use of either 40 times the channel width or 150 meters, whichever is larger, as the assessment length. Channel width is up to 4 feet. 40 times the channel width is less than 150 meters. Therefore, an assessment length of at least 150 meters was used.

Various: No water present, no signs of aquatic life. Minimal debris found in vegetation on banks. Sinuosity ration: ~0.5.

LEVEL 1 Field Measurements

INDICATOR #1.10 Particle Size or Stream Substrate Sorting

Used Sand Gauge (©1984 by W.F. McCollough)

INDICATOR #1.8 (*Floodplain and Channel Dimensions*) – MEASUREMENTS & CALCULATIONS**

Max Depth (#1)	Bankfull Stage (#2)	Maximum Depth Value (#3)	2x Maximum Depth Value (#3)	Flood-Prone Area Location (#4)	Flood-Prone Area Width (#5)	Bankfull Width (#6)	Floodplain to Active Channel Ratio (FPA Width / Bankfull Width)
4.74’	4.13’	0.61’	1.22’	3.52’	5’ 9” (5.75’)	3’ 9” (3.75’)	1.53

****REFER to Figure 3 on page 19 for clarification**

Lee Ranch Mine Photos

36 - HP31 upstream

37 - HP31 downstream

38 - HP31 channel bottom

Appendix C

Lee Ranch Mine Photo Log

Lee Ranch Mine – Arroyo Tinaja Photos

Subwatershed 1A

P1 – PP151 Upstream

P2 – PP151 Downstream

P3 – HP11 Upstream

P4 – HP11 Downstream

P5 – PP12B Upstream

P6 – PP12B Downstream

Lee Ranch Mine – Arroyo Tinaja Photos

Subwatershed 1A (cont.)

P7 – PP12A Upstream

P8 – PP12A Downstream

Subwatershed 2ABC

P9 – PP169 Upstream

P10 – PP169 Downstream

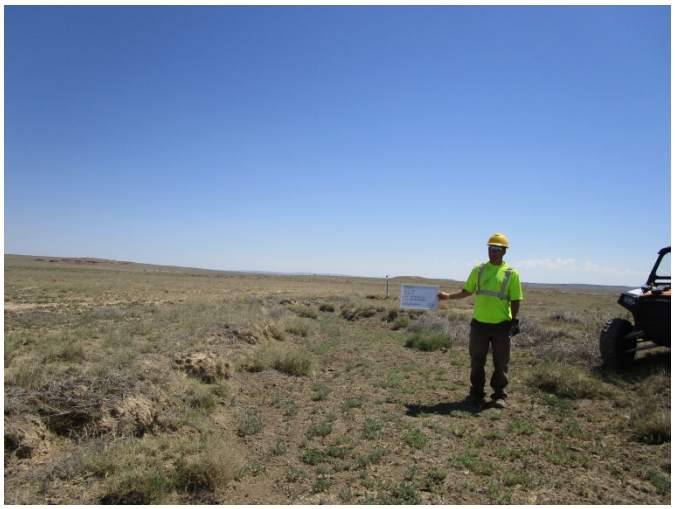
P11 – PP283 Upstream

P12 – PP283 Downstream

Lee Ranch Mine – Arroyo Tinaja Photos

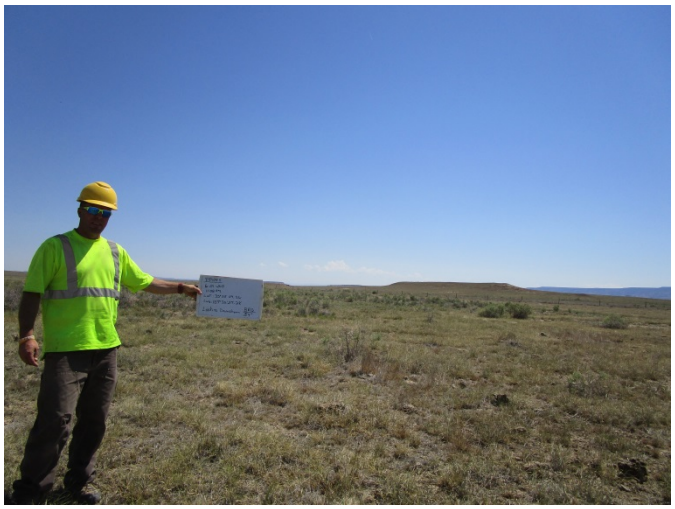
Subwatershed 2ABC (cont.)

P13 – PP284 Upstream



P14 – PP284 Downstream

P15 – PP285 Upstream



P16 – PP285 Downstream

Lee Ranch Mine – Mulatto Canyon Photos

Subwatershed 1B

P17 – HP14 Upstream

P18 – HP14 Downstream

P19 – HP13 Upstream

P20 – HP13 Downstream

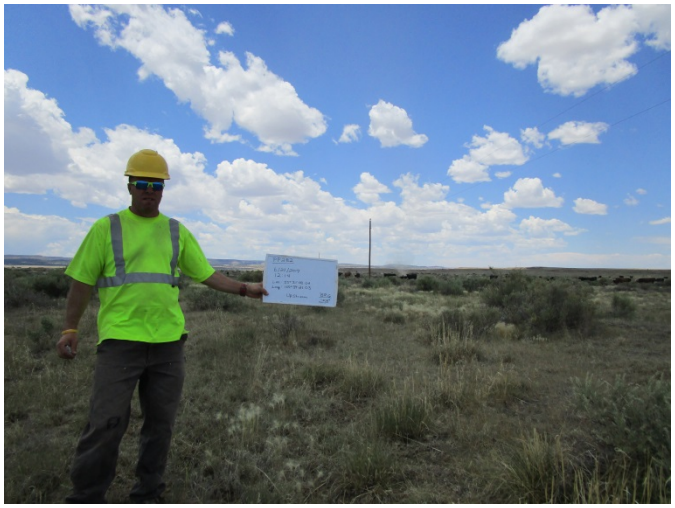
Subwatershed 2ABC

P21 – PP281 Upstream

P22 – PP281 Downstream

Lee Ranch Mine – Mulatto Canyon Photos

Subwatershed 2ABC (cont.)



P23 – PP282 Upstream

P24 – PP282 Downstream

Lee Ranch Mine – San Isidro Arroyo Photos

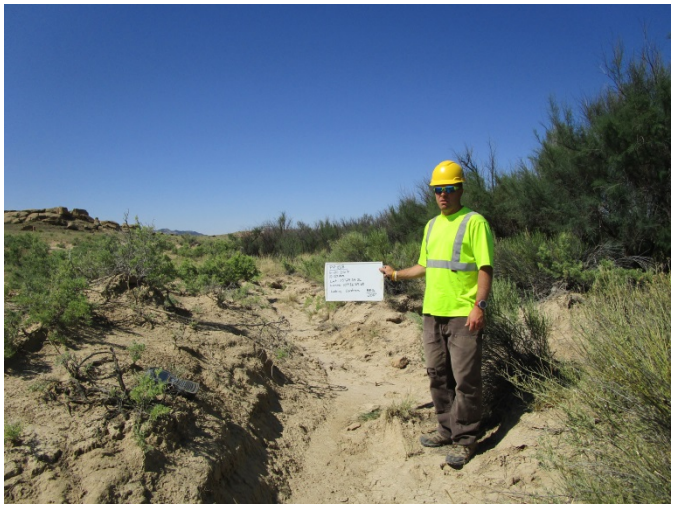
Subwatershed 1C

P25 – PP157 Upstream

P26 – PP157 Downstream

P27 – PP156 Upstream

P28 – PP156 Downstream



P29 – PP158 Upstream

P30 – PP158 Downstream

Lee Ranch Mine – San Isidro Arroyo Photos

Subwatershed 1C (cont.)

P31 – HP15 Upstream

P32 – HP15 Downstream

Subwatershed 2ABC

P33 – PP152 Upstream

P34 – PP152 Downstream

P35 – PP153 Upstream

P36 – PP153 Downstream

Lee Ranch Mine – San Isidro Arroyo Photos

Subwatershed 2ABC (cont.)

P37 – PP154 Upstream

P38 – PP154 Downstream

P39 – PP155 Upstream

P40 – PP155 Downstream

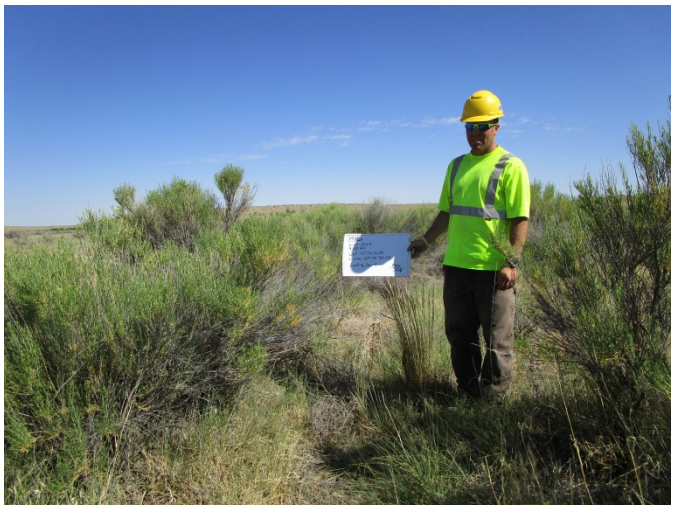
P41 – PP170 Upstream

P42 – PP170 Downstream

Lee Ranch Mine – San Isidro Arroyo Photos

Subwatershed 2ABC (cont.)

P43 – PP286 Upstream



P44 – PP286 Downstream

P45 – PP287 Upstream

P46 – PP287 Downstream

P47 – PP288 Upstream

P48 – PP288 Downstream

Lee Ranch Mine – San Isidro Arroyo Photos

Subwatershed 2ABC (cont.)

P49 – HP21 Upstream

P50 – HP21 Downstream

Subwatershed 3ABCD

P51 – HP31 Upstream

P52 – HP31 Downstream

Lee Ranch Mine – Doctor Arroyo Photos

Subwatershed 1D

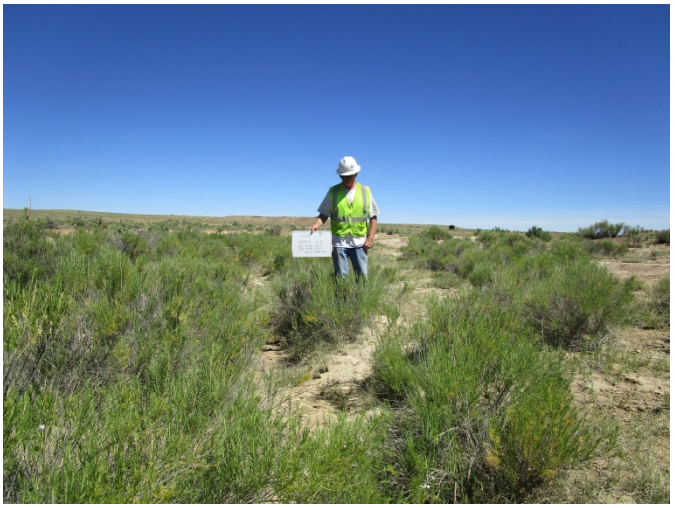
P53 – PP159 Upstream

P54 – PP159 Downstream

P55 – PP289 Upstream

P56 – PP289 Downstream

P57 – HP16 Upstream



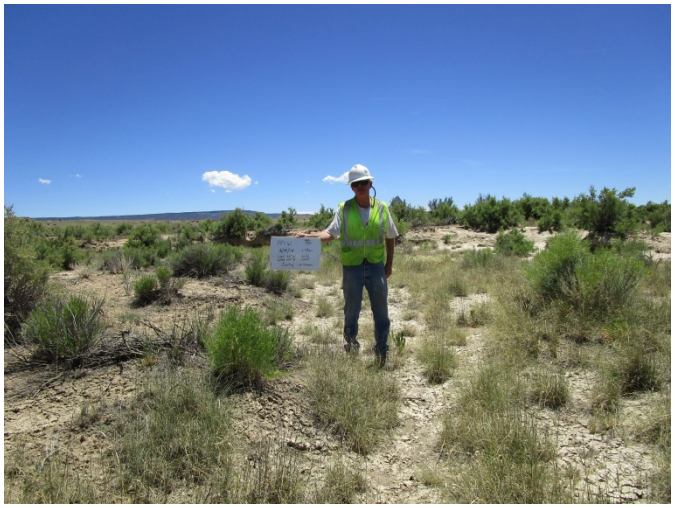
P58 – HP16 Downstream

Lee Ranch Mine – Doctor Arroyo Photos

Subwatershed 1D (cont.)

P59 – PP160 Upstream

P60 – PP160 Downstream



P61 – PP161 Upstream

P62 – PP161 Downstream

P63 – PP290 Upstream

P64 – PP290 Downstream

Lee Ranch Mine – Doctor Arroyo Photos

Subwatershed 1D (cont.)

P65 – HP17 Upstream

P66 – HP17 Downstream

P67 – PP291 Upstream

P68 – PP291 Downstream

P69 – PP167 Upstream

P70 – PP167 Downstream

Lee Ranch Mine – Doctor Arroyo Photos

Subwatershed 1D (cont.)

P71 – PP168 Upstream

P72 – PP168 Downstream

P73 – PP292 Upstream

P74 – PP292 Downstream

P75 – PP163 Upstream

P76 – PP163 Downstream

Lee Ranch Mine – Doctor Arroyo Photos

Subwatershed 1D (cont.)

P77 – PP164 Upstream

P78 – PP164 Downstream

P79 – PP166 Upstream

P80 – PP166 Downstream

P81 – HP18 Upstream

P82 – HP18 Downstream