

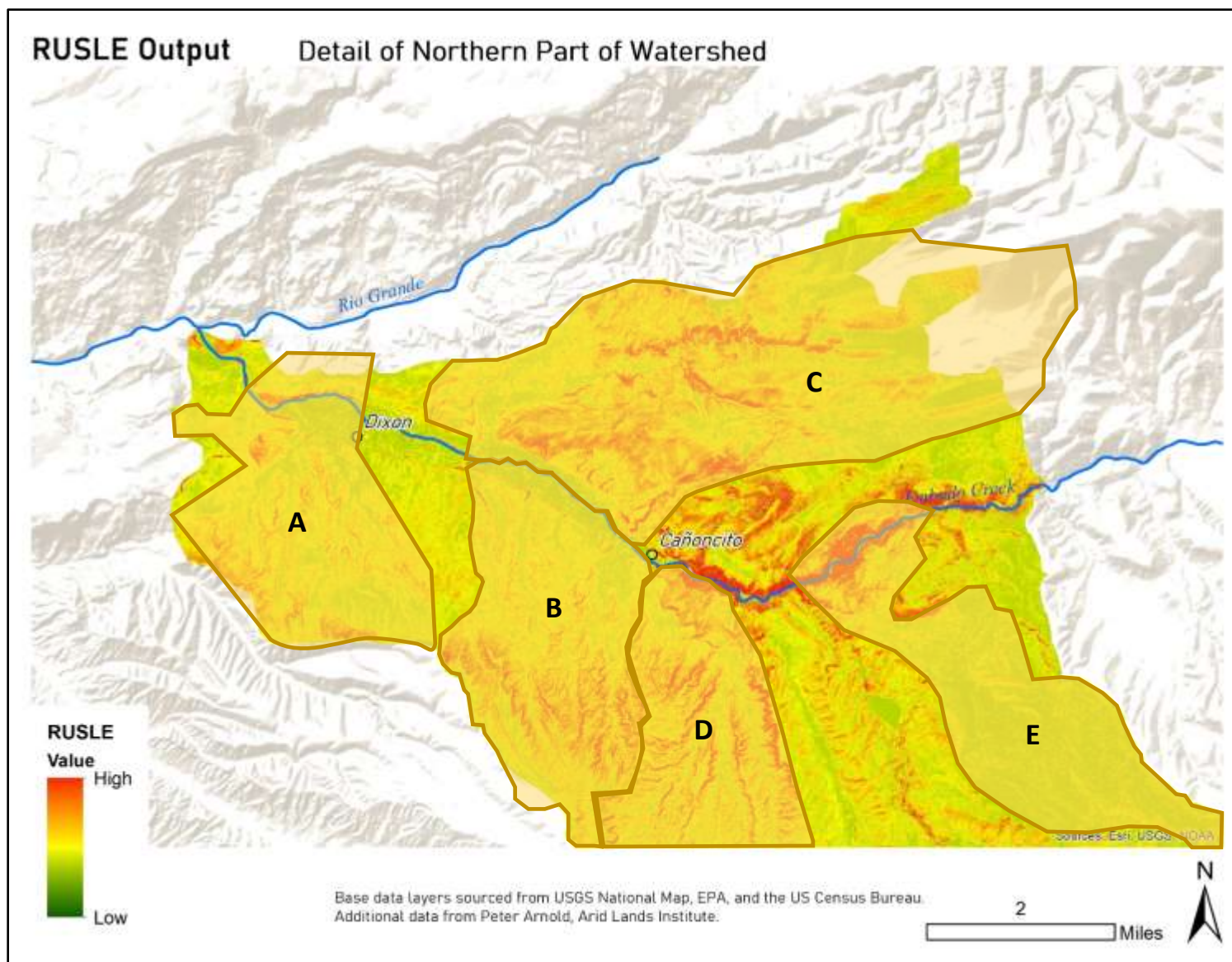
## APPENDIX 3 – SOIL SURVEYS

A Web Soil Survey (WSS) compilation was completed for 5 individual segments within the WBP boundary to characterize soil conditions in the WBP study area. The five WSS segments represent geographically distinct areas that offer varying degrees of the potential for soil conservation and management measures. Figure App.-03.1 provides an overview map of the WSS segments (numbered A-E) that were analyzed for the soil characterization. Soil maps for each segment are provided in each individual Custom Soil Survey report. Below is a summary of the findings of each individual WSS analysis.

***The Arroyo la Mina drainage (A)***, on the northwest side of the project area, encompasses 3,385 acres. The area is comprised of ten distinct soil/material dominated units varying from 1.8 to 2,033 acres in size. For this summary, units greater than 100 acres in size, making up more than 90% of the area of interest, are the focus of analysis. This selection leads to an analysis of four units. Of the acreage within the four units, at least 681 acres are rock outcrop. Of the remaining area, approximately 150 acres have a K factor (or Kf, is the soil erodibility factor as part of RUSLE modeling of soil loss) of 0.15, 1,118 acres have a Kf of 0.2, and 545 acres have a Kf of 0.24. These soils rate as having moderately low susceptibility to erosion. The tolerable soil loss (T factor) of all the soils within this unit is 5, meaning these soils have a potential to recover relatively quickly from soil loss impacts.

The most prevalent ecological site of the four units is Gravelly Hills (R036XB132NM), comprising more than 1,500 acres. This ecological site occurs as “moderately steep to steep gravelly hills and ridges, often dissected by natural drainages”. This site may be associated with Gravelly and Loamy Ecological Sites. The reference plant community of the Gravelly Hills site is grass-dominated and supports a mixture of warm- and cool-season grasses, widely spaced shrubs and trees, and a minor component of forbs. Sideoats grama and black grama are the dominant grass species. Common shrubs include Bigelow sagebrush, broom snakeweed, longleaf ephedra, feather dalea, and yucca. Sparse stands of piñon-juniper (PJ) are widely scattered across the site. The loss of grass cover due to accelerated erosion may reduce competition, allowing PJ seedlings to establish and possibly facilitate the transition to the PJ Encroached State. A severe loss of grass cover from overgrazing and drought may lead to the Eroded State. The Eroded State is characterized by low cover and production of grasses and accelerated soil loss from large, interconnected bare areas and hydrologic events carrying sediment off-site. PJ and shrubs dominate and grass cover is very sparse and occurs mainly in tree-shrub interspaces; typical species may include blue grama, galleta, threeawns, hairy grama, and dropseeds. Broom snakeweed and pingue are often found at increased densities. Evidence of erosion such as rills, gullies, and pedestalled plants is common.

The areas managed by BLM and the State Trust Lands in the lower elevations of the watershed all exhibit these degraded soil and ecological site conditions. Steep slopes and ridges have in many cases degraded to the Eroded state, whereas alluvial areas sometimes have indicators of the Encroached State.



**Figure App.-03.1.** Overview map of WebSoil Survey (WSS) segments analyzed for a soil characterization in the WBP study area.

The WSS suggests that the restoration pathway from the Eroded State to the Reference State includes the removal of PJ to reduce competition for resources, erosion control structures in conjunction with seeding will be necessary to reestablish hydrology and grass dominance. Prescribed grazing will help ensure adequate rest following seeding and PJ removal and will assist in the establishment and maintenance of grass cover. The degree to which this site is capable of recovery is dependent on the extent of soil degradation.

An additional 140 acres within this area have an ecological site description of Gravelly (R035XG114NM). This site occurs as gravelly stream or fan terraces or as low rolling gravelly hills and ridges dissected by natural drainages. It often occurs adjacent to Loamy sites or is interspersed with inclusions of loamy soils. The historic plant community of the Gravelly site is grass dominated and supports a mixture of warm and cool-season grasses, widely spaced shrubs/trees and a minor component of forbs. Blue grama is the dominant grass species. Winterfat, yucca, broom snakeweed, and rabbitbrush are woody species typical of the site. The increase of rabbitbrush in response to fire, overgrazing, and decreased resource competition are factors that may facilitate the transition to the Shrub-Encroached state. This state is characterized by the noticeable increase of rabbitbrush, and decreased cover and production of grasses.

Brush control is necessary to initiate the transition back to the grassland state. Chemical control has been shown to be effective in the control of rabbitbrush. Due to its ability to vigorously re-sprout following disturbance, mechanical brush control methods are generally ineffective unless the plants are severed below the root crown. Prescribed grazing will help ensure adequate rest following brush control and will assist in the establishment and maintenance of grass cover.

***The drainages from Arroyo Lorenzo to Arroyo de los Pinos Reales (B)*** comprise the second segment that was surveyed. This area encompasses 3,680.5 acres and contains 13 distinct soil/material dominated units varying in size from 8.9 acres to 1,507.9 acres. For this area's summary only 6 of the 13 units which are greater than 100 acres are the focus. These 6 units make up more than 90% of the area of interest. Of the 3,330 acres within these 6 units, 377 acres are rock outcrop and another 193 acres are badlands. Of the remaining area, 1,155 acres have a Kf of 0.15-0.2 (rating as moderately low susceptibility to erosion), 841 acres have Kf of 0.28-0.32 (rating as moderate susceptibility to erosion), and 114 acres have a high risk of erosion with a Kf of 0.43. All these areas have good potential for recovering from soil loss with a T factor of 5, except for 80 acres that have a T factor of 3 but with a Kf of only 0.17.

In the drainages from Arroyo Lorenzo to Pinos Reales the predominant ecological site is also Gravelly Hills (R036XB132NM), covering 922 acres within the area of interest. A Gravelly ecological site (R035XG114NM) makes up an additional 105 acres. Both of these ecological site descriptions are the same as described for the Arroyo la Mina drainage. Another common ecological site within this area is Breaks (R051XA006NM), making up nearly 647 acres. This site occurs on very steep lands and the potential plant community is a mixture of grasses, forbs and shrubs. Shrubby one-seed juniper and/or piñon pine occur on cooler exposures, but they make up a minor part of the plant community. On south and west exposures, black grama may be the dominant grass species, while on cooler exposures it is a minor component. At higher elevations and on northern exposures, these species are abundant components of the herbaceous community.

***The drainages from the Cañada de Apodaca to Arroyo del Plomo (including the Cañada de Piedra Lumbre) (C)*** on the north side of the Rio Embudo encompass the next surveyed segment. This was the largest site for which a WSS report was completed, comprising 8,447.5 acres and 19 distinct soil/material dominated units varying from 1.9 acres to 3,363.8 acres in size. For the summarization of this segment, units greater than 200 acres in size were considered. This includes 8 units making up more than 90% of the area of interest. Of the 7,700 acres within these units, 1,490 acres are rock outcrop and another 257 acres are badlands. Of the remaining lands, 3,374 acres have moderately low K factors of 0.17-0.24 and 1,052 acres have moderate Kf values of 0.32-0.37. There is variability in the T factors of these soils, ranging from 1 to 5, but of interest, all the soils that are moderately susceptible to soil loss (Kf of 0.32-0.37) have a T factor of 5.

Within this segment, the Gravelly Hills (R036XB132NM) ecological site occurs on approximately 537 acres and the Gravelly site (R035XG114NM) occurs on only 53 acres. Rock outcrops and loamy soils are by far the most prevalent, accounting for a combined 3,300 acres. Additionally, Breaks (R051XA006NM) occur on 428 acres within this segment and Pine Grassland ecological sites (R048AY010NM) occur on 633 acres. Pine Grasslands are characterized by a savannah-type site with a cool-season grass understory and overstoryed predominantly by ponderosa pine. Rocky Mountain juniper and Gambel oak are minor components of the overstory. Shrubs are a minor component on the site. Forbs, when in bloom, are usually detectable. Other species that could appear on this site include: Indian ricegrass, little bluestem, spike muhly, sleepygrass, sideoats grama, mariposa lily, geranium, thistle spp., cudweed sagewort, fringed sagewort, alumroot, skunkbush sumac, currant, snowberry and serviceberry. Deterioration of the potential plant community is indicated by a decrease in Arizona fescue, western wheatgrass, prairie junegrass, muttongrass and pine dropseed. Species that increase include blue grama, galleta, sleepygrass, rabbitbrush and broom snakeweed.

***The Cañada del Oso and Cañada del Orilla (not including the adjacent Ojo Sarco) (D)*** comprise the fourth segment of selected soil surveys in the Rio Embudo watershed. This segment is 6,506 acres in size and includes 11 distinct soil/material dominated units varying in size from 1.1 to 2,890.2 acres in size. For this summarization, units greater than 100 acres, making up more than 95% of the entire segment were considered. Of the 6,307 acres in the 5 units that fall within this category, 85 acres are rock outcrop and 793 acres are badlands. Of the remaining lands, 333 acres have moderately low K factors of 0.17-0.24, and 3,841 acres have moderate K factors between 0.28-0.37. The T factor for 68 acres is 1, with 4,106 acres having a T factor of 5.

Within the 5 units of interest, the most prevalent ecological site is Breaks (R051XA006NM), accounting for 2,767 acres. The Gravelly Hills ecological site (R036XB132NM) occurs on 213 acres and a Gravelly ecological site occurs on 24 acres on the 5 units. More than 1,500 acres occur on Loamy or Limy ecological sites (offering limited opportunities for soil conservation) and pine grasslands occur on roughly 78 acres.

***The Cañada del Agua and Cañada de las Marias (E)*** comprises the fifth and final segment that was surveyed and is 4,221.6 acres in size. This segment includes 12 distinct soil/material dominated units ranging in size from 0.1 to 1,584.0 acres in size. Also for this summarization units greater than 100 acres were taken into account, including 5 units that comprise more than 95% of the total acreage of the

segment. Of the nearly 4,123 acres within the 5 units, around 283 occur as rock outcrop. Nearly 297 acres have a moderately low K factor of 0.24 and almost 2,719 acres have a moderate K factor between 0.28-0.32. T factors range from 1 to 5 with 1,946.8 acres having a Tf of 5, nearly 874 acres with a Tf of 4, and 194.7 acres having a Tf of 1.

Ecological site descriptions were only available for 1,843 acres within the 5 units of the final segment. Loamy, Mountain Loam, Gravelly Loam, and Limy accounted for 949 of these acres. Breaks (R051XA006NM) occurred on 792 acres, and Pine Grasslands occurred on 102 acres.