Research Natural Area

Name: Bernalillo Watershed

Location:

State: NM County: Sandoval Forest: Cibola District: Sandia
T. 12 N R. 4E S. 1,2,3,10,11,12

Geology:

Description:

The area is underlain by alluvial deposits. The southern portion consists of valley fill, soil cover, and alluvial fan material; to the north and west grades into terrace alluvium consisting of sand, gravel, and alluvial fan material.

Reference:

Kelley, C. Vincent, and Northrop, Stuart A., 1975, Geology of Sandia Mountains and vicinity, New Mexico: New Mexico Bur. Mines & Mineral Resources Memoir 29, 136 p., map

Climate:

TES Gradient: HSC 4/-1 Elev: 5400 - 6000

Precipitation: ___ Annual: 14 in. Warm season (May - Oct.) = 67 %
Cool Season (Nov. - Apr.) = 33 %

Mean Annual Snow: 28 in.

Mean Temperature: Annual 52 °F Jul. 74 °F Jan. 31 °F
Freeze Free Period: 160 days

Mean Temperature: Annual ___ °F Jul. ___ °F Jan. ___ °F
Freeze Free Period: ___ days

Trewartha climate type: BSk = cold steppe

Reference: Forest Service, 1986, Terrestrial Ecosystem Handbook Appendix B: USDA FS R3

Soils:

5-89

ESTABLISHMENT RECORD

for

BERNALILLO WATERSHED RESEARCH NATURAL AREA

within

Cibola National Forest

Sandoval County, New Mexico

INTRODUCTION

The Bernalillo Watershed Research Natural Area (RNA) comprises approximately 990 acres (400.7 hectares) in the foothills of the Sandia Mountains in central New Mexico. The proposed RNA is located in the Sandia Ranger District, Cibola National Forest, in Sandoval County, and is all acquired National Forest land.

Grama - galleta steppe has been noted as an important ecosystem for protection within the RNA program (USFS Regional Guide, 1983: Table 3-1). The Bernalillo Watershed was selected for representation of this grassland type. The Bernalillo Watershed has been reseeded and protected from grazing since 1953, and provides an excellent example of grama - galleta steppe along with the adjacent juniper-grassland type, both of which are in good condition.

Land Management Planning

The need for representation of this biotic community was identified in the Southwestern Regional Guide (August 1983). The Cibola National Forest Plan (USFS 1985: 78-79) prescribes that approximately 990 acres (400.7 hectares) of the Bernalillo Watershed in Management Area 2 has been designated for establishment as a Research Natural Area, with establishment to be completed in Period 1. The environmental analysis conducted as part of the planning process supports the recommendation to establish this Research Natural Area.

JUSTIFICATION STATEMENT FOR ESTABLISHMENT OF AREA

This grassland type is in high demand for livestock grazing in New Mexico, and few examples exist which are not in grazing allotments. Though not a pristine area, the Bernalillo Watershed was originally dedicated to reduce erosion on these gently sloping piedmont alluvial fans. Reseeding, and exclusion from grazing since 1950, has allowed this area to return to very near its potential natural vegetation. Much interest has been placed on contrasts between this area as control, and other grasslands along alluvial piedmonts in central New Mexico where various grazing systems are being practiced. Ongoing studies have been conducted on the area for the last 25 years under auspices of the USFS Rocky Mountain Station and the University of New Mexico. Establishment of the area as an RNA would ensure protection of its distinctive attributes for continued study.

PRINCIPAL DISTINGUISHING FEATURES

Native grasses and shrubs provide almost continuous cover on the convex interfluve surfaces. The principal grasses are black grama (Bouteloua eriopoda), blue grama (B. gracilis), sand dropseed (Sporobolus cryptandrus), and three awns (Aristida spp.). Low shrubs include snakeweed (Gutierrezia sarothrae), plains yucca (Yucca glauca), fourwing saltbush (Atriplex canescens), cholla (Opuntia imbricata), and pricklypears (O. polyacantha, O. phaecantha). These grasslands commonly display cappings of cryptogams (lichens, mosses, algae) on the soil crust. One-seed junipers (Juniperus monosperma) are present here in low to moderate density.

Gravelly draws and broad washes are lined with populations of apache plume (Fallugia paradoxa), rabbitbrush (Chrysothamnus nauseosus), and sideoats grama (Bouteloua curtipendula). Pinyon (Pinus edulis) is found chiefly in washes at upper elevations within the RNA, where juniper is also most common.

LOCATION (Cibola National Forest)

Bernalillo Watershed lies approximately 18 miles (29.1 km) northeast of Albuquerque, New Mexico, at the foothills of the Sandia Mountains. The proposed RNA is located in the Placitas USFS 7.5' quadrangle (latitude 35 18', longitude 106 30'), Township 12 N, Range 4 E, Sections 1, 2, 3, 10, 11, and 12 (Map 2). **The boundary is within the perimeter defined by Forest Road 445 and a segment of state road 44 within section 2 of Township 12 N, Range 4 E (see Map 3).** Elevation ranges from slightly over 6000 feet (1830 m) at the southeast boundary to about 5515 ft (1680 m) at the northwest extreme. The area within the proposed RNA is approximately 990 acres (401 ha).

From the center of Albuquerque, take Interstate 25 north 15 miles (24.1 km; Map 1). Turn east off the interstate onto State Highway 44 and proceed 3.0 miles (4.8 km) to where unpaved Forest Road 445 turns to the right (south). This all-weather road circumnavigates the Research Natural Area (Map 3), returning to State Highway 44 about 0.6 miles (1.1 km) east of the first turn-off for FR 445. The RNA can be entered on foot from any point along this road. This is gently rolling open country, and foot travel is an easy matter.

AREA BY COVER TYPES

The distribution of cover types was determined from field surveys conducted in the summer of 1986 and from interpretation of 1981 aerial photography. Table 1 outlines the estimated total areas of vegetation types based on the Society of American Foresters forest type system (Eyre 1980) and the Kuchler Potential Natural Vegetation system (Kuchler 1964). Map 4 depicts the distribution of SAF type 239, plus a grassland type not covered in the SAF forest categories, on the candidate research natural area.

Table 1. Estimated Areas of Vegetation Types in the Bernalillo Watershed Research Natural Area.

Type	Society of American Foresters Cover Type[1]	Küchler PNV Type[2]	Surface Area Acres	Hectares
Pinyon - Juniper	SAF 239	K-21 Juniper - Pinyon Woodland	815	329.9
Grama - Galleta Grassland	[none]	K-47 Grama - Galleta Steppe	175	70.8
		TOTAL:	990	400.7

[1]Eyre 1980.
[2]Küchler 1964.

PHYSICAL AND CLIMATIC CONDITIONS

Bernalillo Watershed RNA is located in a narrow strip of semi-arid climate, between the northern extent of an arid climate zone along the Rio Grande Valley and the subhumid, woodland and forest covered Sandia Mountains to the east. The nearest long term weather station is at Albuquerque; slightly higher elevation at the RNA results in a minor increase in precipitation levels, slightly lower temperatures, and shorter frost free season. Average annual rainfall for the Bernalillo Watershed is 14 inches (356 mm), and average annual snowfall 28 inches (71.2 cm). Cool season precipitation (falling between November and April) accounts for 33% of annual precipitation. Mean annual temperature is 52° F (11.1° C), with a July average of 74° F (23.3° C) and a January average of 31° F (-0.6° C). The frost free period lasts an average of 160 days.

DESCRIPTION OF VALUES

Flora

A broad survey of habitat types (HT) was conducted during the 1986 field work. A brief review follows. No publication adequately classifies woodland-grassland habitat types for northern or north-central New Mexico; USDA Forest Service (1986) Forest and woodland habitat types of southern New Mexico and central Arizona served as the best available key for Bernalillo Watershed. Much of the open juniper savanna is classified in this guide as Juniperus monosperma/Bouteloua gracilis HT.

Grasses comprise up to 70 per cent of the cover on the flat, open grasslands topping the gently sloping piedmont alluvial fans on the west side of the RNA. Black grama (Bouteloua eriopoda) dominates, occurring

with ring muhly (Muhlenbergia torreyi), blue grama (Bouteloua gracilis), sand dropseed (Sporobolus cryptandrus), and galleta (Hilaria jamesii). Broom snakeweed (Gutierrezia sarothrae) is the most common shrub here with plains yucca (Yucca glauca) and cholla (Opuntia imbricata) occasional to common. This grama-galleta grassland comprises about 20% of the RNA.

Juniper is the dominant tree (typically the only tree) on the slightly steeper slopes, which make up the remainder of the proposed RNA. Shrub live oak (Quercus turbinella) appears as a large shrub at the upper (southeast) end of the RNA. Pinyon (Pinus edulis) is reproducing successfully along the north-facing washes near the east boundary of the area, but drops out where the slope flattens out below. The grass mix on the juniper slopes is similar to that found in the open grassland described above, with Bouteloua eriopoda remaining dominant, B. gracilis more common, sideoats grama (B. curtipendula) appearing frequently, and Muhlenbergia torreyi less frequently. Gutierrezia is less common in the woodland. JUMO/BOGR HT prevails throughout.

The several dry washes are dominated by rabbit brush (Chrysothamnus nauseosus), along with apache-plume (Fallugia paradoxa), brickellia (Brickellia california), and occasional squawberry (Rhus trilobata). Bouteloua curtipendula and B. eriopoda are the principal grasses in these arroyos, which also occasionally contain big bluestem (Andropogon gerardii) and bush muhly (Muhlenbergia porteri). Vegetation here probably is closest to Juniperus monosperma/Chrysothamnus nauseosus - Fallugia paradoxa habitat type (JUMO/CHNA - FAPA HT) as described in the literature.

A small population of grama grass cactus, Pediocactus papyracantha, a New Mexico Endangered plant and Federal candidate species, occurs on one portion of the proposed RNA. No other threatened or endangered plants are known to occur on Bernalillo Watershed.

The following plant list was compiled from field observations on October 29, 1986.

Abbreviated Plant List for Bernalillo Watershed RNA

Latin Name	Common Name[1]	Reference[2]	
GRASSES AND GRASS-LIKE PLANTS:			
Andropogon gerardii	Big bluestem		BD/MT
Aristida fendleriana	Fendler three-awn	FS	BD/MT
Aristida longiseta	Red three-awn	FS	BD/MT
Bouteloua curtipendula	Sideoats grama	FS	BD/MT
Bouteloua eriopoda	Black grama	FS	BD/MT
Bouteloua gracilis	Blue grama	FS	BD/MT
Bouteloua hirsuta	Hairy grama	FS	BD/MT
Eragrostis intermedia	Plains lovegrass	FS	
Hilaria jamesii	Galleta	FS	BD/MT
Lycurus phleoides	Wolftail	FS	BD/MT
Muhlenbergia porteri	Bush muhly	FS	BD/MT
Muhlenbergia torreyi	Ring muhly	FS	BD/MT
Poa arida	Plains bluegrass		BD/MT
Sitanion hystrix	Bottlebrush squirreltail	FS	BD/MT
Sporobolus cryptandrus	Sand dropseed	FS	BD/MT
Stipa comata	Needle and thread	FS	
Stipa neomexicana	New Mexican needlegrass	FS	
Tridens pulchella	Fluffgrass		BD/MT
FORBS:			
Allium sp.	Onion	FS	
Aster bigelovii	Bigelow aster		BD/MT
Astragalus spp.	Milkvetch	FS	
Castilleja sp.	Paintbrush		BD/MT
Cirsium sp.	Thistle		BD/MT
Conyza canadensis	Horseweed		BD/MT
Cucurbita foetidissima	Buffalogourd		BD/MT
Erigeron concinnus	Fleabane	FS	
Eriogonum polycladon	Sorrell buckwheat		BD/MT
Euphorbia sp.	Spurge	FS	BD/MT
Oreochrysum spinulosus	Spinyleaf goldenweed	FS	
Hymenopappus filifolius	White-ragweed	FS	
Hymenoxys acaulis	Nostem rubberweed	FS	
Lesquerella rectipes	Bladderpod	FS	
Leucelene ericoides	White aster	FS	
Melampodium leucanthum	Plains blackfoot	FS	BD/MT
Penstemon sp.	Beard tongue	FS	
Salsola kali	Russian thistle		BD/MT
Senecio longilobus	Threadleaf groundsel	FS	BD/MT
Solanum elaeagnifolium	White horsenettle		BD/MT
Sphaeralcea coccinea	Globemallow	FS	BD/MT
Stephanomeria pauciflora	Wirelettuce		BD/MT
Verbena spp.	Verbena	FS	BD/MT
Zinnia grandiflora	Rocky Mountain zinnia	FS	

HALF-SHRUBS, SHRUBS, AND TREES:

Artemisia frigida	Fringed sagebrush		BD/MT
Atriplex canescens	Four-wing saltbush	FS	BD/MT
Brickellia californica	California brickellia		BD/MT
Chrysothamnus nauseosus	Rubber rabbitbrush		BD/MT
Coryphantha vivipara	Coryphantha	FS	
Echinocereus sp.	Hedgehog cactus		BD/MT
Eurotia lanata	Winterfat		BD/MT
Fallugia paradoxa	Apache-plume		BD/MT
Gutierrezia sarothrae	Broom snakeweed	FS	BD/MT
Juniperus monosperma	One-seed juniper	FS	BD/MT
Nolina texana	Beargrass		BD/MT
Opuntia arbuscula	Pencil cholla		BD/MT
Opuntia clavata	Club cholla		BD/MT
Opuntia engelmannii	Engelmann pricklypear	FS	BD/MT
Opuntia imbricata	Cholla		BD/MT
Opuntia polyacantha	Plains pricklypear	FS	BD/MT
Pinus edulis	Pinyon		BD/MT
Quercus turbinella	Shrub live oak	FS	BD/MT
Rhus trilobata	Squawberry		BD/MT
Yucca glauca	Small soapweed	FS	BD/MT

[1]Common names used according to USDA, Forest Service 1974, or Martin & Hutchins 1981.
[2]FS = Bernalillo Watershed Transect Data, Rocky Mountain Experiment Station, USFS Southwest Region, Albuquerque, 1982
BD/MT = observed by Bill Dunmire (The Nature Conservancy) and Mollie S. Toll (Department of Biology, University of New Mexico) on October 29, 1986.

Fauna

No rare, endangered, or sensitive animal species are known to inhabit this area. Mule deer are the only ungulates now using the area, but this is not considered important deer habitat. Evidence of black-tailed jackrabbits is abundant. There is no perennial or open stream water on this RNA, and therefore riparian species are absent.

The following animal list was derived from the RUN WILD III computer-stored data base (Lehmkuhl and Patton 1982; Patton 1979) from the following habitat types, for Sandoval county, New Mexico:

1. Pinyon - juniper series
2. Plains grassland biome; grama grass series
3. Plains grassland biome; galleta grass series

These habitat types currently in the data base most closely correspond to those occurring in the proposed RNA.

Common Name	Latin Name
BIRDS:	
Bluebird, mountain	Sialia currucoides
Bluebird, western	Sialia mexicana
Chickadee, mountain	Parus gambeli
Dove, mourning	Zenaida macroura
Falcon, prairie	Falco mexicanus
Finch, house	Carpodacus mexicanus
Flicker, northern	Colaptes auratus
Flycatcher,ash-throated	Myiarchus cinerascens
Grosbeak, black-headed	Pheucticus melanocephalus
Hawk, ferruginous	Buteo regalis
Hawk, red-tailed	Buteo jamaicensis
Hawk, sharp-shinned	Accipiter striatus
Hummingbird, black-chinned	Archilochus alexandri
Jay, blue	Cyanocitta cristata
Jay, pinyon	Gymnorhinus cyanocephalus
Junco, dark-eyed	Junco hyemalis
Kingbird, Cassin's	Tyrannus vociferans
Lark, horned	Eremophila alpestris
Meadowlark, western	Sturnella neglecta
Nighthawk, common	Chordeiles minor
Nuthatch, pygmy	Sitta pygmaea
Oriole, Scott's	Icterus parisorum
Owl, short-eared	Asio flammeus
Phoebe, black	Sayornis nigricans
Pygmy-owl, northern	Glaucidium gnoma
Quail, scaled	Callipepla squamata
Raven, common	Corvus corax
Roadrunner, greater	Geococcyx californianus
Robin, American	Turdus migratorius
Shrike, loggerhead	Lanius ludovicianus
Siskin, pine	Carduelis pinus
Solitaire, Townsend's	Myadestes townsendi
Sparrow, black-throated	Amphispiza bilineata
Sparrow, Brewer's	Spizella breweri
Sparrow, chipping	Spizella passerina
Sparrow, lark	Chondestes grammacus
Swift, white-throated	Aeronautes saxatalis
Tanager, western	Piranga ludoviciana
Thrasher, Bendire's	Toxostoma bendirei
Titmouse, plain	Parus inornatus
Towhee, brown	Pipilo fuscus
Vireo, gray	Vireo vicinior
Warbler, black-throated gray	Dendroica nigrescens
Waxwing, cedar	Bombycilla cedrorum
Wood-pewee, western	Contopus sordidulus
Wren, Bewick's	Thryomanes bewickii

Wren, rock	Salpinctes obsoletus

MAMMALS:

Badger	Taxidea taxus
Chipmunk, Colorado	Tamias quadrivittatus
Cottontail, desert	Sylvilagus audubonii
Coyote	Canis latrans
Deer, mule	Odocoileus hemionus
Gopher, Botta's pocket	Thomomys bottae
Jackrabbit, black-tailed	Lepus californicus
Lion, mountain	Felis concolor
Mouse, brush	Peromyscus boylii
Mouse, deer	Peromyscus maniculatus
Mouse, hispid pocket	Peromyscus hispidus
Mouse, northern grasshopper	Onychomys leucogaster
Mouse, pinyon	Peromyscus truei
Mouse, plains pocket	Perognathus flavescens
Mouse, rock	Perognathus difficilis
Mouse, silky pocket	Perognathus flavus
Mouse, western harvest	Reithrodontomys megalotis
Mouse, white-footed	Peromyscus leucopus
Porcupine	Erethizon dorsatum
Rat, banner-tailed kangaroo	Dipodomys spectabilis
Rat, Merriam's kangaroo	Dipodomys merriami
Rat, Ord's kangaroo	Dipodomys ordii
Shrew, dwarf	Sorex nanus
Shrew, Merriam's	Sorex merriami
Skunk, striped	Mephitis mephitis
Squirrel, golden-mantled ground	Spermophilus lateralis
Squirrel, spotted ground	Spermophilus spilosoma
Squirrel, rock	Spermophilus variegatus
Squirrel, white-tailed antelope	Ammospermophilus leucurus
Weasel, long-tailed	Mustela frenata
Woodrat, Mexican	Neotoma mexicana
Woodrat, Stephen's	Neotoma stephensi
Woodrat, white-throated	Neotoma albigula

REPTILES:

Lizard, collared	Crotaphytus collaris
Lizard, sagebrush	Sceloporus graciosus
Lizard, side-blotched	Uta stansburiana
Lizard, tree	Urosaurus ornatus
Rattlesnake, western diamondback	Crotalus atrox
Whiptail, little striped	Cnemidophorus inornatus
Whiptail, plateau striped	Cnemidophorus velox

Geology

The Rio Grande depression, a major north-south trending basin in central New Mexico, is flanked on either side by uplifts. Bernalillo Watershed lies on the eastern border of this basin at the foot of the Sandia Mountains, which have a core of pre-Cambrian rocks locally exposed at the surface and overlain by sedimentary formations ranging in age from Cambrian through Tertiary (New Mexico Geological Society 1952).

The area of the proposed RNA is underlain by alluvial deposits. The southern portion consists of valley fill and alluvial fan material. With decreasing elevation to the north and west, this material grades into terrace alluvium consisting of sand, gravel, and alluvial fan material. Kelley and Northrop (1975) describe this area in detail and provide a geological map.

Soils

Undulating to rolling and hilly upland dissected by intermittent drainages and arroyos in the southeastern part of Sandoval County is categorized as Rough Broken Land - Embudo association (NMSU 1971:13). The soils, predominantly classified as Typic Haplustalfs, fine-loamy, mixed, mesic, are forming in unconsolidated old alluvium which is coarse to medium-textured and gravelly. Generally, soils of this association are calcareous and have gravelly sandy loam or gravelly loamy fine sand surface layers. Experience prior to 1950 indicates that the soils are highly subject to erosion.

Lands

There are no known outstanding rights or rights-of-way within the proposed boundaries.

Cultural

There are no known cultural resource sites within the RNA. Cultural information from similar areas nearby indicate moderate to high potential for presence of archeological sites, usually in the form of surface lithic and ceramic scatters.

IMPACTS AND POSSIBLE CONFLICTS

Mineral Resources

No known mineral resources exist in this area. As of 6/19/59, the area was withdrawn from mineral entry (Department Interior Withdrawal [EO 10355] BLM Serial No. NM 034615). The RNA is covered by three existing oil and gas leases. No activity concerning these leases has occurred. Sufficient stipulations exist for protection of the surface.

Grazing

Livestock have been permanently excluded from the area since 1950. No impacts or conflicts are expected as the area will remain closed to grazing. The RNA has two cross fences separating it into four pieces of unequal size. The perimeter, delineated by Forest Road 445, needs to be fenced to exclude unauthorized livestock including cattle and horses from private and Pueblo Indian lands nearby. Approximately 4.9 miles (7.9 km)

of fencing at an estimated cost of $14,700 (in 1987 dollars) will be required to complete the perimeter fence.

Timber

This area is sparsely covered with pinyon-juniper woodland, primarily in stringers associated with drainages. Removal of firewood and any other forest products has not been permitted since 1955. There are no commercial forest acres.

Watershed Values

Bernalillo Watershed is located in the Middle Rio Grande Basin of New Mexico, on the western slope of the Sandia Mountains and bench lands east of the community of Bernalillo. That portion contained within the National Forest is bounded by Cañon Agua Sarca on the north and Cañon del Agua on the south. Both drainages flow directly into the Rio Grande within less than 3 miles (4.8 km) of the forest boundary. The Bernalillo Watershed RNA is centrally located within the watershed. Of the 4422 acres (1789.5 hectares) of the Bernalillo watershed within the National Forest, the RNA occupies approximately 990 acres (400.6 hectares). The RNA comprises about 10 per cent of the total watershed (9050 acres or 3662.4 hectares total).

The candidate RNA lies within the larger Bernalillo Watershed Project which was started in 1953 under the sponsorship of the Santa Fe-Sandoval Conservation District, working with the Forest Service and the Soil Conservation Service. Project work, consisting of contour terracing, soil pitting, and reseeding with native grasses, mostly above and outside the RNA, was completed in 1955 (USDA Forest Service n.d.). The value of the soil stabilization achieved by this project was demonstrated many times in later years when torrential rain storms failed to cause floods and erosion that prevailed on lands adjacent to the project area.

Recreation Values

Recreation use in this area is diverse and ranges from jogging, hiking, and horseback riding to nature study, training for competitive "dog trials", and pinyon picking. Those who use the area include residents near the forest boundary, and others who come from farther away. All of the watershed within the National Forest is closed to ORV travel except on designated roads. Posting of the RNA perimeter and other appropriate closure devices will help attain compliance of the ORV closure within the RNA, and will not impair recreation opportunities in areas outside the RNA.

Wildlife and Plant Values

The Bernalillo Watershed RNA contains known populations of the grama grass cactus Pediocactus papyracanthus (Engelm.) Britt. & Rose, a New Mexico State listed T & E plant species. The presence of this species, which is very sensitive to overgrazing and other forms of disturbance, demonstrates that some portions of the RNA remain in an undisturbed condition. This provides a valuable contrast to those portions which were highly disturbed during construction of erosion control measures.

No T & E animal species are known to occur in the area. The RNA lies within the Sandia Game Refuge.

Wilderness, Wild and Scenic River, National Recreation Area Values

None of the above congressionally designated areas have been proposed for the Bernalillo Watershed RNA or vicinity.

Transportation Plans

The entire watershed within the National Forest is administratively closed to off-road travel. An obvious management need for protection of the RNA against damage from ORV's is to post the RNA. Forest Road 445, which circumscribes the RNA, can remain in place without adversely affecting the RNA.

Utility Corridor Plans

A major electric power transmission line crosses the southeast portion of the RNA. Periodic maintenance inspections are conducted from a vehicle using a primitive two-track road beneath the power line. This access may continue for actual repair needs only. Inspections can be conducted on foot.

MANAGEMENT PLAN

The Cibola National Forest Plan prescribes that there will be no harvest of firewood and no assigned grazing capacity on Research Natural Areas. The prescriptions also prohibit road or trail construction, new utility corridors, off-road vehicle travel, open campfires, and recreational use if degradation results. However, non-motorized dispersed recreation activities are permitted provided they do not significantly modify the area, or threaten or impair the research or educational value of the area. No flora, fauna, or other materials may be collected other than for research approved by the Station Director. Further watershed treatment activities are not allowed within the RNA until studies and determination are completed.

1. Vegetation Management

The Forest Plan provides that prescribed fire, using planned and unplanned ignitions, will be allowed on the Bernalillo Watershed RNA to maintain fire dependent ecosystems. Suppression action is limited to the use of hand tools, and fire retardant chemicals must not be used unless necessary to protect life and property outside the study area. Vegetation manipulation is allowed only when necessary to preserve the grama - galleta steppe vegetation for which the area is being studied.

ADMINISTRATIVE RECORDS AND PROTECTION

Administration and protection of the Bernalillo Watershed RNA will be the responsibility of the Cibola National Forest. The District Ranger, Sandia Ranger District, Tijeras, NM has direct responsibility.

The Director of the Rocky Mountain Forest and Range Experiment Station, or his designee, will be responsible for any studies or research conducted in the area, and requests to conduct research in the area will be referred to him. He, or his designee, will evaluate research proposals and coordinate all studies and research in the area with the District Ranger. All plant and animal specimens collected in the course of research conducted in the area will be properly preserved and maintained within university or federal agency herbaria and museums, approved by the Rocky Mountain Station Director.

Records for the Bernalillo Watershed RNA will be maintained in the following offices:

Regional Forester, Southwestern Region, Albuquerque, NM
Rocky Mountain Station, Fort Collins, CO
Cibola National Forest, Albuquerque, NM
District Ranger, Sandia Ranger District, Tijeras, NM

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USDA Forest Service. 1986. Forest and woodland habitat types (plant associations) of southern New Mexico and central Arizona (north of the Mogollon Rim). Edition 2. USDA Forest Service, Southwestern Region, Albuquerque. 71 pp.

DESIGNATION ORDER

By virtue of the authority vested in me by the Secretary of Agriculture under regulations 7 CFR 2.60(a) and 36 CFR 251.23, I hereby designate as the Bernalillo Watershed Research Natural Area the lands described in the following establishment record prepared by William W. Dunmire and Mollie S. Toll, dated November 12, 1987. These lands shall hereafter be administered as a research natural area subject to the above regulations and instructions issued thereunder.

_____ _____

Chief Date

ESTABLISHMENT RECORD

for

BERNALILLO WATERSHED RESEARCH NATURAL AREA

within

Cibola National Forest

Sandoval County, New Mexico

ESTABLISHMENT RECORD

BERNALILLO WATERSHED RESEARCH NATURAL AREA

USDA FOREST SERVICE
SOUTHWESTERN REGION
CIBOLA NATIONAL FOREST
SANDIA RANGER DISTRICT
SANDOVAL COUNTY, NEW MEXICO

Prepared by:_____ Date_____
William W. Dunmire, The Nature Conservancy
Mollie S. Toll, Department of Biology,
University of New Mexico

Recommended by:_____ Date_____
Floyd Thompson, District Ranger
Sandia Ranger District

Recommended by:_____ Date_____
C. Phil Smith, Forest Supervisor
Cibola National Forest

Recommended by:_____ Date_____
John W. Russell, Chairman
Southwestern Research Natural Area Committee

Recommended by:_____ Date_____
Sotero Muniz, Regional Forester
Southwestern Region

Recommended by:_____ Date_____
Charles M. Loveless, Station Director
Rocky Mountain Forest and Range Experiment
Station

INTRODUCTION

The Bernalillo Watershed Research Natural Area (RNA) comprises approximately 990 acres (400.7 hectares) in the foothills of the Sandia Mountains in central New Mexico. The proposed RNA is located in the Sandia Ranger District, Cibola National Forest, in Sandoval County, and is all acquired National Forest land.

Grama-galleta steppe has been noted as an important ecosystem for protection within the RNA program (USFS Regional Guide, 1983: Table 3-1). The Bernalillo Watershed was selected for representation of this grassland type. The Bernalillo Watershed has been reseeded and protected from grazing since 1953, and provides an excellent example of grama- galleta steppe along with the adjacent juniper-grassland type, both of which are in good condition.

LAND MANAGEMENT PLANNING

The need for representation of this biotic community was identified in the Southwestern Regional Guide (August 1983). The Cibola National Forest Plan (USFS 1985: 78-79) prescribes that approximately 990 acres (400.7 hectares) of the Bernalillo Watershed in Management Area 2 has been designated for establishment as a Research Natural Area, with establishment to be completed in Period 1. The environmental analysis conducted as part of the planning process supports the recommendation to establish this Research Natural Area.

JUSTIFICATION STATEMENT FOR ESTABLISHMENT OF AREA

This grassland type is in high demand for livestock grazing in New Mexico, and few examples exist which are not in grazing allotments. Though not a pristine area, the Bernalillo Watershed was originally dedicated to reduce erosion on these gently sloping piedmont alluvial fans. Reseeding and exclusion from grazing since 1950 has allowed this area to return to very near its potential natural vegetation. Much interest has been placed on contrasts between this area, used as a control, and other grasslands along alluvial piedmonts in central New Mexico where various grazing systems are being practiced. Ongoing studies have been conducted on the area for the last 25 years under the auspices of the USFS Rocky Mountain Station and the University of New Mexico. Establishment of the area as an RNA would ensure protection of its distinctive attributes for continued study.

PRINCIPAL DISTINGUISHING FEATURES

Native grasses and shrubs provide almost continuous cover on the convex interfluve surfaces. The principal grasses are black grama (Bouteloua eriopoda), blue grama (B. gracilis), sand dropseed (Sporobolus cryptandrus), and three awns (Aristida spp.). Low shrubs include snakeweed (Gutierrezia sarothrae), plains yucca (Yucca glauca), fourwing saltbush (Atriplex canescens), cholla (Opuntia imbricata), and pricklypears (O. polyacantha, O. phaecantha). These grasslands commonly display cappings of cryptogams (lichens, mosses, algae) on the soil crust. One-seed junipers (Juniperus monosperma) are present here in low to moderate density.

Gravelly draws and broad washes are lined with populations of apache plume (Fallugia paradoxa), rabbitbrush (Chrysothamnus nauseosus), and sideoats grama (Bouteloua curtipendula). Pinyon (Pinus edulis) is found chiefly in washes at upper elevations within the RNA, where juniper is also most common.

LOCATION

Bernalillo Watershed lies approximately 18 miles (29.1 km) northeast of Albuquerque, New Mexico, at the foothills of the Sandia Mountains. The proposed RNA is located in the Placitas USFS 7.5' quadrangle (latitude 35°18', longitude 106°30'), Township 12 N, Range 4 E, Sections 1, 2, 3, 10, 11, and 12 (Map 1). Elevation ranges from a high of slightly over 6,000 ft (1828.8 m) at the southeast edge, sloping gently to approximately 5,515 ft (1681.0 m) at the northwest extremes. The proposed RNA comprises approximately 990 acres (400.7 hectares).

From the center of Albuquerque, take Interstate 25 north 15 miles (24.1 km; Map 2). Turn east off the interstate onto State Highway 44 and proceed 3.0 miles (4.8 km) to where unpaved Forest Road 445 turns to the right (south). This all-weather road circumnavigates the Research Natural Area (Map 3), returning to State Highway 44 about 0.6 miles (1.1 km) east of the first turn-off for FR 445. The RNA can be entered on foot from any point along this road. This is gently rolling open country, and foot travel is an easy matter.

A boundary description of the proposed Bernalillo Watershed RNA is as follows:

Beginning at a point where State Highway 44 intersects U.S. Forest Service Road a distance more or less of 445 at lat. 35 deg. 18 min. 7 sec., long. 106 deg. 28 sec. 22 min., the beginning point for this tract;
THENCE, S 20 E, following U.S. Forest Service Road a distance more or less of 6,240 ft to a point at lat. 35 deg. 17 sec. 9 min., long. 106 deg. 28 min. 31 sec.;
THENCE, S 20 W, following said road a distance more or less of 1,345 ft to a point at lat. 35 deg. 16 sec. 57 min., long. 106 deg. 28 min. 37 sec.;
THENCE, West, following said road a distance more or less of 625 ft to a point at lat. 35 deg. 16 sec. 58 min., long 106 deg. 28 min. 44 sec.;

THENCE, S 42 W, following said road a distance more or less of 490 ft to a point at lat. 35 deg. 16 sec. 53 min., long 106 deg. 28 min. 48 sec.;
THENCE, S 22 E, following said road a distance more or less of 1,020 ft to a point at the intersection with U.S Forest Service Road 445a at lat. 35 deg. 17 sec. 14 min., long 106 deg. 28 min. 14 sec.;
THENCE, S 6 W, following said U.S. Forest Service Road 445 a distance more or less of 230 ft to a point at lat. 35 deg. 16 sec. 42 min., long. 106 deg. 28 min. 45 sec.;
THENCE, S 84 W, following said road a distance more or less of 660 ft to a point at lat. 35 deg. 16 sec. 40 min., long. 106 deg. 28 min. 53 sec.;
THENCE, S 28 W, following said road a distance more or less of 525 ft to a point at lat. 35 deg. 16 sec. 36 min., long. 106 deg. 28 min. 53 sec.;
THENCE, N 55 W, following said road a distance more or less of 6,400 ft to a point at lat. 35 deg. 17 sec. 13 min., long. 106 deg. 29 min. 55 sec.;
THENCE, N 28 E, following said road a distance more or less of 1,180 ft to a point at lat. 35 deg. 17 sec. 25 min., long. 106 deg. 29 min. 51 sec.;
THENCE, N 26 W, following said road a distance more or less of 1,840 ft to a point at lat. 35 deg. 17 sec. 40 min., long. 106 deg. 29 min. 59 sec.;
THENCE, N 77 E, following said road a distance more or less of 230 ft to a point at lat. 35 deg. 17 sec. 40 min., long. 106 deg. 29 min. 60 sec.;
THENCE, N 14 W, following said road a distance more or less of 790 ft to a point at lat. 35 deg. 17 sec. 48 min., long. 106 deg. 29 min. 57 sec.;
THENCE, N 86 E, following said road a distance more or less of 300 ft to a point at lat. 35 deg. 17 sec. 48 min., long. 106 deg. 29 min. 54 sec.;
THENCE, N 6 W, following said road a distance more or less of 790 ft to a point at lat. 35 deg. 17 sec. 57 min., long. 106 deg. 29 min. 54 sec.;
THENCE, N 39 E, following said road a distance more or less of 425 ft to a point at lat. 35 deg. 17 sec. 53 min., long. 106 deg. 29 min. 51 sec.;
THENCE, N 82 E, following said road a distance more or less of 1,080 ft to a point at lat. 35 deg. 17 sec. 58 min., long. 106 deg. 29 min. 41 sec.;
THENCE, North, following said road a distance more or less of 330 ft to a point at lat. 35 deg. 18 sec. 2 min., long. 106 deg. 29 min. 40 sec.;
THENCE, S 88 E, following said road a distance more or less of 330 ft to a point at lat. 35 deg. 18 sec. 1 min., long. 106 deg. 29 min. 35 sec.;
THENCE, N 8 W, following said road a distance more or less of 1,350 ft to a point at lat. 35 deg. 18 sec. 15 min., long. 106 deg. 29 min. 37 sec.;
THENCE, East, following said road a distance more or less of 425 ft to a point at lat. 35 deg. 18 sec. 15 min., long. 106 deg. 29 min. 31 sec.;
THENCE, S 41 E, following said road a distance more or less of 400 ft to a point at lat. 35 deg. 18 sec. 12 min., long. 106 deg. 29 min. 27 sec.;
THENCE, East, following said road a distance more or less of 755 ft to a point at lat. 35 deg. 18 sec. 12 min., long. 106 deg. 29 min. 16 sec.;
THENCE, N 26 E, following said road a distance more or less of 295 ft to a point at lat. 35 deg. 18 sec. 13 min., long. 106 deg. 29 min. 13 sec.;
THENCE, East, following said road a distance more or less of 525 ft to a point at the intersection with State Highway 44 lat. 35 deg. 18 sec. 14 min., long. 106 deg. 29 min. 7 sec.;
THENCE, S 60 E, following State Highway 44 a distance more or less of 1,640 ft to a

point at the intersection with U.S. Forest Service Road a distance more or less of 445 ft at lat. 35 deg. 18 sec. 7 min., long. 106 deg. 28 min. 22 sec., the point of beginning of said tract.

AREA BY COVER TYPES

The distribution of cover types was determined from field surveys conducted in the summer of 1986 and from interpretation of 1981 aerial photography. Table 1 outlines the estimated total areas of vegetation types based on the Society of American Foresters forest type system (Eyre 1980) and the Küchler Potential Natural Vegetation system (Küchler 1964). Map 4 depicts the distribution of SAF type 239, plus a grassland type not covered in the SAF forest categories, on the candidate research natural area.

Table 1. Estimated Areas of Vegetation Types in the Bernalillo Watershed Research Natural Area.

Type	Society of American Foresters Cover Type[1]	Küchler PNV Type[2]	Surface Area Acres	Hectares
Pinyon - Juniper	SAF 239	K-21 Juniper - Pinyon Woodland	815	329.9
Grama - Galleta Grassland	[none]	K-47 Grama - Galleta Steppe	175	70.8
		TOTAL:	990	400.7

[1]Eyre 1980.
[2]Küchler 1964.

PHYSICAL AND CLIMATIC CONDITIONS

Bernalillo Watershed RNA is located in a narrow strip of semi-arid climate, between the northern extent of an arid climate zone along the Rio Grande Valley and the subhumid, woodland and forest covered Sandia Mountains to the east. The nearest long term weather station is at Albuquerque; slightly higher elevation at the RNA results in a minor increase in precipitation levels, slightly lower temperatures, and shorter frost free season. Average annual rainfall for the Bernalillo Watershed is 14 inches (35.6 cm), and average annual snowfall is 28 inches (71.2 cm). Cool season precipitation (falling between November and April) accounts for 33% of annual precipitation. Mean annual temperature is 52° F (11.1° C), with a July average of 74° F (23.3° C) and a January average of 31° F (-0.6° C). The frost free period lasts an average of 160 days.

DESCRIPTION OF VALUES

Flora

A broad survey of habitat types (HT) was conducted during the 1986 field work. A brief review follows. No publication adequately classifies woodland-grassland habitat types for northern or north-central New Mexico. USDA Forest Service (1986) Forest and woodland habitat types of southern New Mexico and central Arizona served as the best available key for Bernalillo Watershed. Much of the open juniper savanna is classified in this guide as Juniperus monosperma/Bouteloua HT.

Grasses comprise up to 70 per cent of the cover on the flat, open grasslands topping the gently sloping piedmont alluvial fans on the west side of the RNA. Black grama (Bouteloua eriopoda) dominates, occurring with ring muhly (Muhlenbergia torreyi), blue grama (Bouteloua gracilis), sand dropseed (Sporobolus cryptandrus), and galleta (Hilaria jamesii). Broom snakeweed (Gutierrezia sarothrae) is the most common shrub here with plains yucca (Yucca glauca) and cholla (Opuntia imbricata) occasional to common. This grama-galleta grassland comprises about 20% of the RNA.

Juniper is the dominant and typically the only tree on the slightly steeper slopes, which make up the remainder of the proposed RNA. Shrub live oak (Quercus turbinella) appears as a large shrub at the upper (southeast) end of the RNA. Pinyon (Pinus edulis) is reproducing successfully along the north-facing washes near the east boundary of the area, but drops out where the slope flattens out below. The grass mix on the juniper slopes is similar to that found in the open grassland described above, with Bouteloua eriopoda remaining dominant, B. gracilis more common, sideoats grama (B. curtipendula) appearing frequently, and Muhlenbergia torreyi appearing less frequently. Gutierrezia is less common in the woodland. JUMO/BOGR HT prevails throughout.

The several dry washes are dominated by rabbit brush (Chrysothamnus nauseosus), along with apache-plume (Fallugia paradoxa), brickellia (Brickellia californica), and occasional squawberry (Rhus trilobata). Bouteloua curtipendula and B. eriopoda are the principal grasses in these arroyos, which also occasionally contain big bluestem (Andropogon gerardii) and bush muhly (Muhlenbergia porteri). Vegetation here probably is closest to Juniperus monosperma/Chrysothamnus nauseosus - Fallugia paradoxa habitat type (JUMO/CHNA - FAPA HT) as described in the literature.

A small population of grama grass cactus, Pediocactus papyracantha, a New Mexico Endangered plant and Federal candidate species, occurs on one portion of the proposed RNA. No other threatened or endangered plants are known to occur on Bernalillo Watershed.

The following plant list was compiled from field observations on October 29, 1986.

Abbreviated Plant List for Bernalillo Watershed RNA

Latin Name	Common Name[1]	Reference[2]
GRASSES AND GRASS-LIKE PLANTS:		
Andropogon gerardii	Big bluestem	BD/MT
Aristida fendleriana	Fendler three-awn	FS BD/MT
Aristida longiseta	Red three-awn	FS BD/MT
Bouteloua curtipendula	Sideoats grama	FS BD/MT
Bouteloua eriopoda	Black grama	FS BD/MT
Bouteloua gracilis	Blue grama	FS BD/MT
Bouteloua hirsuta	Hairy grama	FS BD/MT
Eragrostis intermedia	Plains lovegrass	FS
Hilaria jamesii	Galleta	FS BD/MT
Lycurus phleoides	Wolftail	FS BD/MT
Muhlenbergia porteri	Bush muhly	FS BD/MT
Muhlenbergia torreyi	Ring muhly	FS BD/MT
Poa arida	Plains bluegrass	BD/MT
Sitanion hystrix	Bottlebrush squirreltail	FS BD/MT
Sporobolus cryptandrus	Sand dropseed	FS BD/MT
Stipa comata	Needle and thread	FS
Stipa neomexicana	New Mexican needlegrass	FS
Tridens pulchella	Fluffgrass	BD/MT
FORBS:		
Allium sp.	Onion	FS
Aster bigelovii	Bigelow aster	BD/MT
Astragalus spp.	Milkvetch	FS
Castilleja sp.	Paintbrush	BD/MT
Cirsium sp.	Thistle	BD/MT
Conyza canadensis	Horseweed	BD/MT
Cucurbita foetidissima	Buffalogourd	BD/MT
Erigeron concinnus	Fleabane	FS
Eriogonum polycladon	Sorrell buckwheat	BD/MT
Euphorbia sp.	Spurge	FS BD/MT
Oreochrysum spinulosus	Spinyleaf goldenweed	FS
Hymenopappus filifolius	White-ragweed	FS
Hymenoxys acaulis	Nostem rubberweed	FS
Lesquerella rectipes	Bladderpod	FS
Leucelene ericoides	White aster	FS
Melampodium leucanthum	Plains blackfoot	FS/BD/MT
Penstemon sp.	Beard tongue	FS
Salsola kali	Russian thistle	BD/MT
Senecio longilobus	Threadleaf groundsel	FS BD/MT
Solanum elaeagnifolium	White horsenettle	BD/MT

Sphaeralcea coccinea	Globemallow	FS BD/MT
Stephanomeria pauciflora	Wirelettuce	BD/MT
Verbena spp.	Verbena	FS BD/MT
Zinnia grandiflora	Rocky Mountain zinnia	FS

HALF-SHRUBS, SHRUBS, AND TREES:

Artemisia frigida	Fringed sagebrush	BD/MT
Atriplex canescens	Four-wing saltbush	FS BD/MT
Brickellia californica	California brickellia	BD/MT
Chrysothamnus nauseosus	Rubber rabbitbrush	BD/MT
Coryphantha vivipara	Coryphantha	FS
Echinocereus sp.	Hedgehog cactus	BD/MT
Eurotia lanata	Winterfat	BD/MT
Fallugia paradoxa	Apache-plume	BD/MT
Gutierrezia sarothrae	Broom snakeweed	FS BD/MT
Juniperus monosperma	One-seed juniper	FS BD/MT
Nolina texana	Beargrass	BD/MT
Opuntia arbuscula	Pencil cholla	BD/MT
Opuntia clavata	Club cholla	BD/MT
Opuntia engelmannii	Engelmann pricklypear	FS BD/MT
Opuntia imbricata	Cholla	BD/MT
Opuntia polyacantha	Plains pricklypear	FS BD/MT
Pinus edulis	Pinyon	BD/MT
Quercus turbinella	Shrub live oak	FS BD/MT
Rhus trilobata	Squawberry	BD/MT
Yucca glauca	Small soapweed	FS BD/MT

[1]Common names used according to USDA, Forest Service 1974, or Martin & Hutchins 1981.
[2]FS = Bernalillo Watershed Transect Data, Rocky Mountain Experiment Station, USFS Southwest Region, Albuquerque, 1982
BD/MT = observed by Bill Dunmire (The Nature Conservancy) and Mollie S. Toll (Department of Biology, University of New Mexico) on October 29, 1986

Fauna

No rare, endangered, or sensitive animal species are known to inhabit this area. Mule deer are the only ungulates now using the area, but this is not considered important deer habitat. Evidence of black- tailed jackrabbits is abundant. There is no perennial or open stream water on this RNA, and therefore riparian species are absent.

The following animal list was derived from the RUN WILD III computer-stored data base (Lehmkuhl and Patton 1982; Patton 1979) from the following habitat types, for Sandoval county, New Mexico:

1. Pinyon - juniper series
2. Plains grassland biome; grama grass series
3. Plains grassland biome; galleta grass series

These habitat types currently in the data base most closely correspond to those occurring in the proposed RNA.

Potential Animal List for Bernalillo Watershed RNA

Common Name	Latin name
BIRDS:	
Bluebird, mountain	Sialia currucoides
Bluebird, western	Sialia mexicana
Chickadee, mountain	Parus gambeli
Dove, mourning	Zenaida macroura
Falcon, prairie	Falco mexicanus
Finch, house	Carpodacus mexicanus
Flicker, northern	Colaptus auratus
Flycatcher, ash-throated	Myiarchus cinerascens
Grosbeak, black-headed	Pheucticus melanocephalus
Hawk, ferruginous	Buteo regalis
Hawk, red-tailed	Buteo iamaicensis
Hawk, sharp-shinned	Accipiter striatus
Hummingbird, black-chinned	Archilochus alexandri
Jay, blue	Cynanocitta cristata
Jay, pinyon	Gymnorhinus cyanocephalus
Junco, dark-eyed	Junco hyemalis
Kingbird, Cassin's	Tyrannus vociferans
Lark, horned	Eremophila alpestris
Meadowlark, western	Sturnella neglecta

Nighthawk, common	Chordeiles minor
Nuthatch, pygmy	Sitta pygmaea
Oriole, Scott's	Icterus parisorum
Owl, short-eared	Asio flammeus
Phoebe, black	Sayornis nigricans
Pygmy-owl, northern	Glaucidium gnoma
Quail, scaled	Callipepla squamata
Raven, common	Corvus corax
Roadrunner, greater	Geococcyx californianus
Robin, American	Turdus migratorius
Shrike, loggerhead	Lanius ludovicianus
Siskin, pine	Carduelis pinus
Solitaire, Townsend's	Myadestes townsendi
Sparrow, black-throated	Amphispiza bilineata
Sparrow, Brewer's	Spizella breweri
Sparrow, chipping	Spizella passerina
Sparrow, lark	Chondestes grammacus
Swift, white-throated	Aeronautes saxatalis
Tanager, western	Piranga ludoviciana
Thrasher, Bendire's	Toxostoma bendirei
Titmouse, plain	Parus inornatus
Towhee, brown	Pipilo fuscus
Vireo, gray	Vireo vicinior
Warbler, black-throated gray	Dendroica nigrescens
Waxwing, cedar	Bombycilla cedrorum
Wood-pewee, western	Contopus sordidulus
Wren, Bewick's	Thryomanes bewickii
Wren, rock	Salpinctes obsoletus

MAMMALS:

Badger	Taxidea taxus
Chipmonk, Colorado	Tamias quadrivittatus
Cottontail, desert	Sylvilagus audobonii
Coyote	Canis latrans
Deer, mule	Odocoileus hemionus
Gopher, Botta's pocket	Thomomys bottae
Jackrabbit, black-tailed	Lepus californicus
Lion, mountain	Felis concolor
Mouse, brush	Peromyscus boylii
Mouse, deer	Peromyscus maniculatus
Mouse, hispid pocket	Peromyscus hispidus
Mouse, northern grasshopper	Onychomys leucogaster
Mouse, pinyon	Peromyscus truei
Mouse, plains pocket	Perognathus flavescens
Mouse, rock	Perognathus difficilis
Mouse, silky pocket	Perognathus flavus

Mouse, western harvest	Reithrodontomys megalotis
Mouse, white-footed	Peromyscus leucopus
Porcupine	Erethizon dorsatum
Rat, banner-tailed kangaroo	Dipodomys spectabilis
Rat, Merriam's kangaroo	Dipodomys merriami
Rat, Ord's kangaroo	Dipodomys ordii
Shrew, dwarf	Sorex nanua
Shrew, Merriam's	Sorex merriami
Skunk, striped	Mephitis mephitis
Squirrel, golden-mantled ground	Spermophilus lateralis
Squirrel, spotted ground	Spermophilus spilosoma
Squirrel, rock	Spermophilus variegatus
Squirrel, white-tailed antelope	Ammospermophilus leucurus
Weasel, long-tailed	Mustela frenata
Woodrat, Mexican	Neotoma mexicana
Woodrat, Stephen's	Neotoma stephensi
Woodrat, white-throated	Neotoma albigula

REPTILES:

Lizard, collared	Crotaphytus collaris
Lizard, sagebrush	Sceloporus graciosus
Lizard, side-blotched	Uta stansburiana
Lizard, tree	Urosaurus ornatus
Rattlesnake, western diamondback	Crotalus atrox
Whiptail, little striped	Cnemidophorus inornatus
Whiptail, plateau striped	Cnemidophorus velox

Geology

The Rio Grande depression, a major north-south trending basin in central New Mexico, is flanked on either side by uplifts. Bernalillo Watershed lies on the eastern border of this basin at the foot of the Sandia Mountains, which have a core of pre-Cambrian rocks locally exposed at the surface and overlain by sedimentary formations ranging in age from Cambrian through Tertiary (New Mexico Geological Society, 1952).

The area of the proposed RNA is underlain by alluvial deposits. The southern portion consists of valley fill and alluvial fan material. With decreasing elevation to the north and west, this material grades into terrace alluvium consisting of sand, gravel, and alluvial fan material. Kelley and Northrop (1975) describe this area in detail and provide a geological map.

Soils

Undulating to rolling and hilly upland dissected by intermittent drainages and arroyos in the southeastern part of Sandoval County is categorized as Rough Broken Land - Embudo association (NMSU 1971:13). The soils, predominantly classified as fine-loamy, mixed, and mesic Typic Haplustalfs are forming in unconsolidated old alluvium which is coarse to medium-textured and gravelly. Generally, soils of this association are calcareous and have gravelly sandy loam or gravelly loamy fine sand surface layers. Experience prior to 1950 indicates that the soils are highly subject to erosion.

Lands

There are no known outstanding rights or rights-of-way within the proposed boundaries.

Cultural

There are no known cultural resource sites within the RNA. Cultural information from similar areas nearby indicate moderate to high potential for presence of archeological sites, usually in the form of surface lithic and ceramic scatters.

IMPACTS AND POSSIBLE CONFLICTS

Mineral Resources

No known mineral resources exist in this area. As of 6/19/59, the area was withdrawn from mineral entry (Department Interior Withdrawal [EO 10355] BLM Serial No. NM 034615). The RNA is covered by three existing oil and gas leases. No activity concerning these leases has occurred. Sufficient stipulations exist for protection of the surface.

Grazing

Livestock have been permanently excluded from the area since 1950. No impacts or conflicts are expected as the area will remain closed to grazing. The RNA has two cross fences separating it into four pieces of unequal size. The perimeter, delineated by Forest Road 445, needs to be fenced to exclude unauthorized livestock including cattle and horses from private and Pueblo Indian lands nearby. Approximately 4.9 miles (7.9 km) of fencing at an estimated cost of $14,700 (in 1987 dollars) will be required to complete the perimeter fence.

Timber

This area is sparsely covered with pinyon-juniper woodland, primarily in stringers associated with drainages. Removal of firewood and any other forest products has not been permitted since 1955. There are no commercial forest acres.

Watershed Values

Bernalillo Watershed is located in the Middle Rio Grande Basin of New Mexico, on the western slope of the Sandia Mountains and bench lands east of the community of Bernalillo. That portion contained within the National Forest is bounded by Cañon Agua Sarca on the north and Cañon del Agua on the south. Both drainages flow directly into the Rio Grande within less than 3 miles (4.8 km) of the forest boundary. The Bernalillo Watershed RNA is centrally located within the watershed. Of the 4,422 acres (1789.5 hectares) of the Bernalillo watershed within the National Forest, the RNA occupies approximately 990 acres (400.6 hectares). The RNA comprises about 10 per cent of the total watershed (9,050 acres or 3662.4 hectares total).

The candidate RNA lies within the larger Bernalillo Watershed Project which was started in 1953 under the sponsorship of the Santa Fe-Sandoval Conservation District, working with the Forest Service and the Soil Conservation Service. Project work, consisting of contour terracing, soil pitting, and reseeding with native grasses, mostly above and outside the RNA, was completed in 1955 (USDA Forest Service, n.d.). The value of the soil stabilization achieved by this project was demonstrated many times in

later years when torrential rain storms failed to cause floods and erosion that prevailed on lands adjacent to the project area.

Recreation Values

Recreation use in this area is diverse and ranges from jogging, hiking, and horseback riding to nature study, training for competitive "dog trials", and pinyon picking. Those who use the area include residents near the forest boundary, and others who come from farther away. All of the watershed within the National Forest is closed to ORV travel except on designated roads. Posting of the RNA perimeter and other appropriate closure devices will help attain compliance of the ORV closure within the RNA, and will not impair recreation opportunities in areas outside of the RNA.

Wildlife and Plant Values

The Bernalillo Watershed RNA contains known populations of the grama grass cactus Pediocactus papyracanthus (Engelm.) Britt. & Rose, a New Mexico State listed threatened and endangered (T & E) plant species. The presence of this species, which is very sensitive to overgrazing and other forms of disturbance, demonstrates that some portions of the RNA remain in an undisturbed condition. This provides a valuable contrast to those portions which were highly disturbed during construction of erosion control measures. No T & E animal species are known to occur in the area. The proposed RNA lies within the Sandia Game Refuge.

Wilderness, Wild and Scenic River, National Recreation Area Values

None of the above congressionally designated areas have been proposed for the Bernalillo Watershed RNA or vicinity.

Transportation Plans

The entire watershed within the National Forest is administratively closed to off-road travel. An obvious management need for protection of the RNA against damage from ORV's is to post the RNA. Forest Road 445, which circumscribes the RNA, can remain in place without adversely affecting the RNA.

Utility Corridor Plans

A major electric power transmission line crosses the southeast portion of the RNA. Periodic maintenance inspections are conducted from a vehicle using a primitive two-track road beneath the power line. This access may continue for actual repair needs only. Inspections can be conducted on foot.

MANAGEMENT PLAN

The Cibola National Forest Plan prescribes that there will be no harvest of firewood and no assigned grazing capacity on Research Natural Areas. The prescriptions also prohibit road or trail construction, new utility corridors, off-road vehicle travel, open campfires, and recreational use if degradation results. However, non-motorized dispersed recreation activities are permitted provided they do not significantly modify the area or threaten or impair the research or educational value of the area. No flora, fauna, or other materials may be collected other than for research approved by the Station Director. Further watershed treatment activities are not allowed within the RNA until studies and determination are completed.

1. Vegetation Management

The Forest Plan provides that prescribed fire, using planned and unplanned ignitions, will be allowed on the Bernalillo Watershed RNA to maintain fire dependent ecosystems. Suppression action is limited to the use of hand tools, and fire retardant chemicals must not be used unless necessary to protect life and property outside the study area. Vegetation manipulation is allowed only when necessary to preserve the grama - galleta steppe vegetation for which the area is being studied.

ADMINISTRATIVERECORDS AND PROTECTION

Administration and protection of the Bernalillo Watershed RNA will be the responsibility of the Cibola National Forest. The District Ranger, Sandia Ranger District, Tijeras, NM has direct responsibility.

The Director of the Rocky Mountain Forest and Range Experiment Station, or his designee, will be responsible for any studies or research conducted in the area, and requests to conduct research in the area will be referred to him. He, or his designee, will evaluate research proposals and coordinate all studies and research in the area with the District Ranger. All plant and animal specimens collected in the course of research conducted in the area will be properly preserved and maintained within university or federal agency herbaria and museums, approved by the Rocky Mountain Station Director.

Records for the Bernalillo Watershed RNA will be maintained in the following offices:

Regional Forester, Southwestern Region, Albuquerque, NM
Rocky Mountain Station, Fort Collins, CO
Cibola National Forest, Albuquerque, NM
District Ranger, Sandia Ranger District, Tijeras, NM

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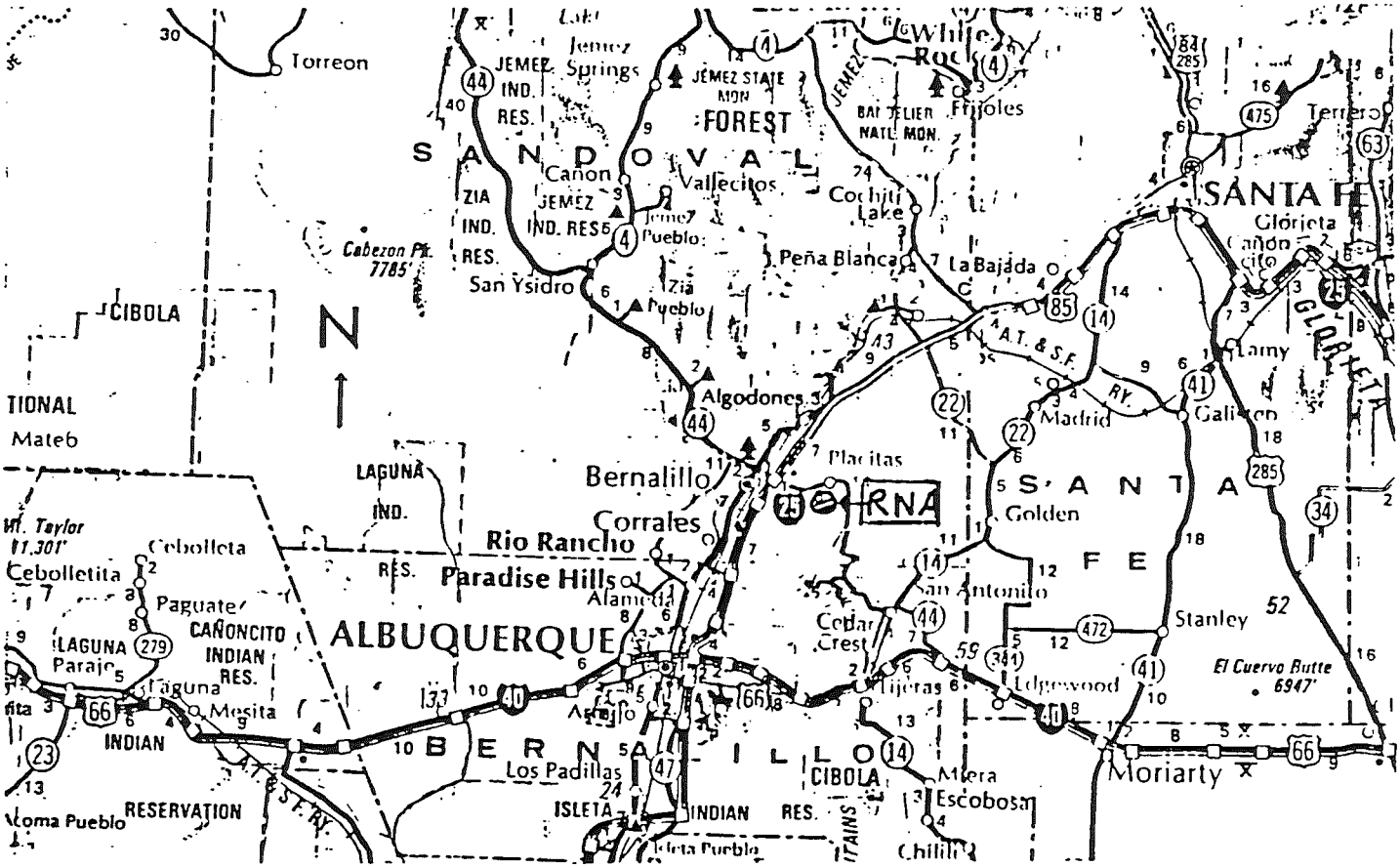
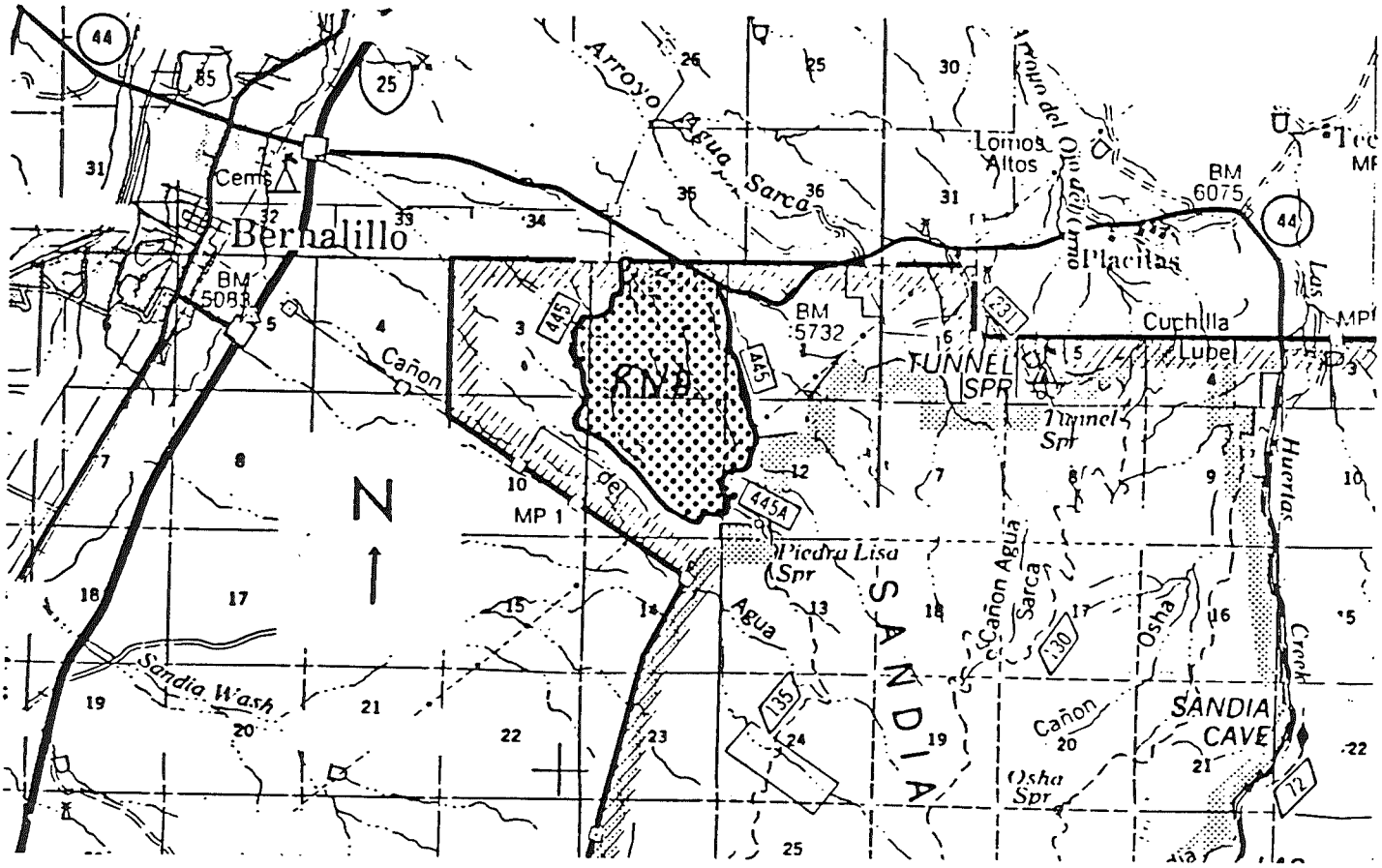
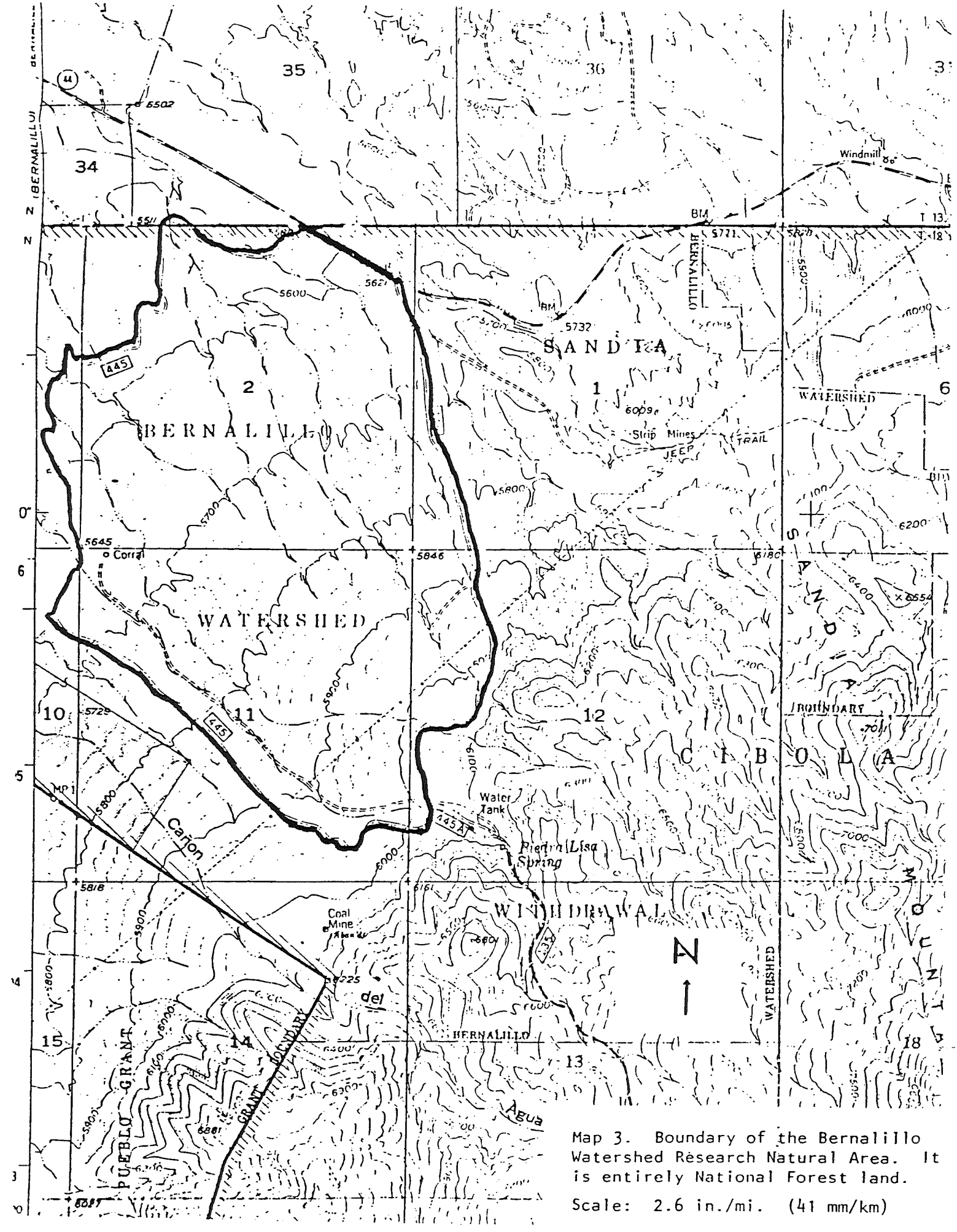


Map 1. Location of RNA (Central New Mexico)

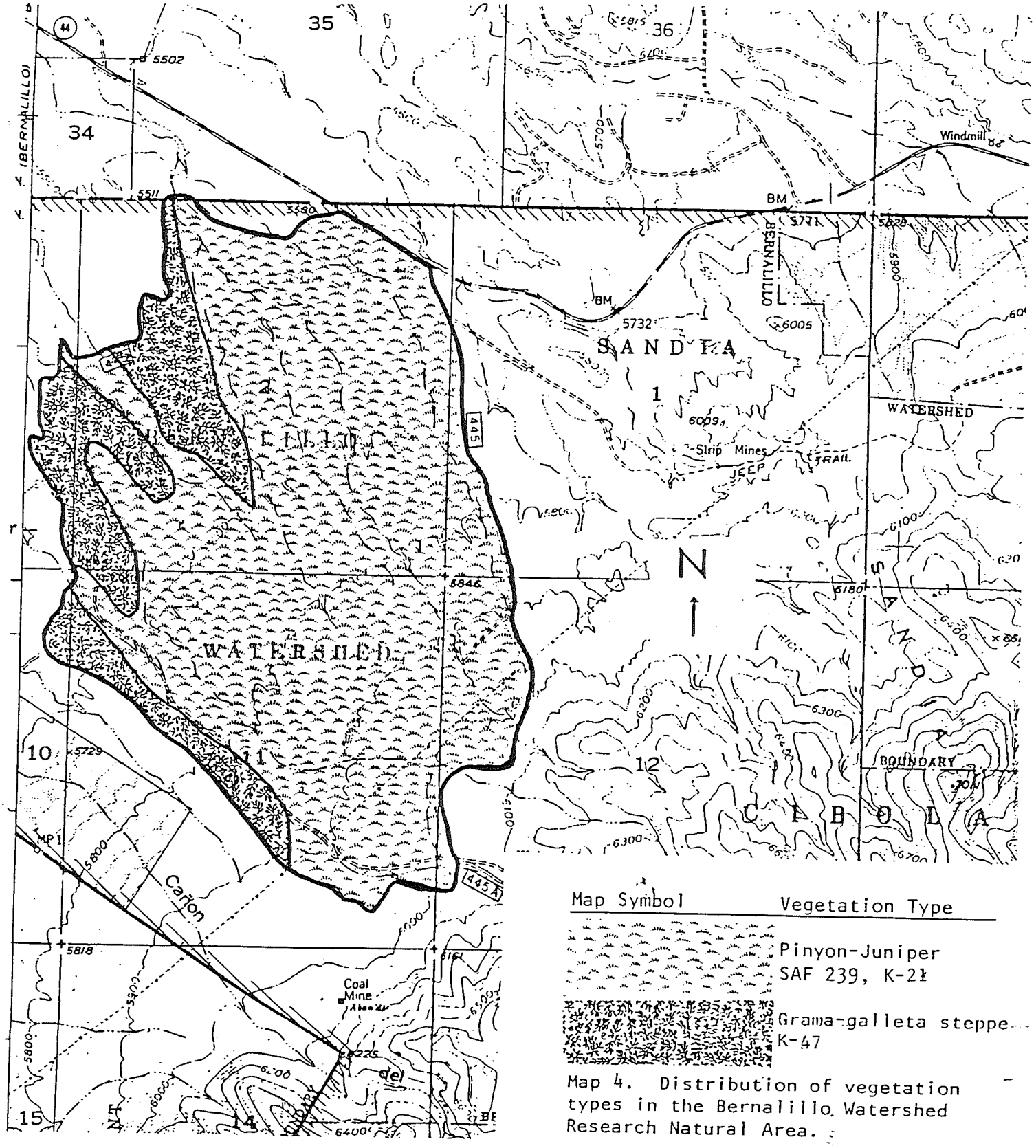


Map 2. Access Route to Bernalillo Watershed RNA



Map 3. Boundary of the Bernalillo Watershed Research Natural Area. It is entirely National Forest land.

Scale: 2.6 in./mi. (41 mm/km)



Map Symbol	Vegetation Type
	Pinyon-Juniper SAF 239, K-21
	Grama-galleta steppe K-47

Map 4. Distribution of vegetation types in the Bernalillo Watershed Research Natural Area.

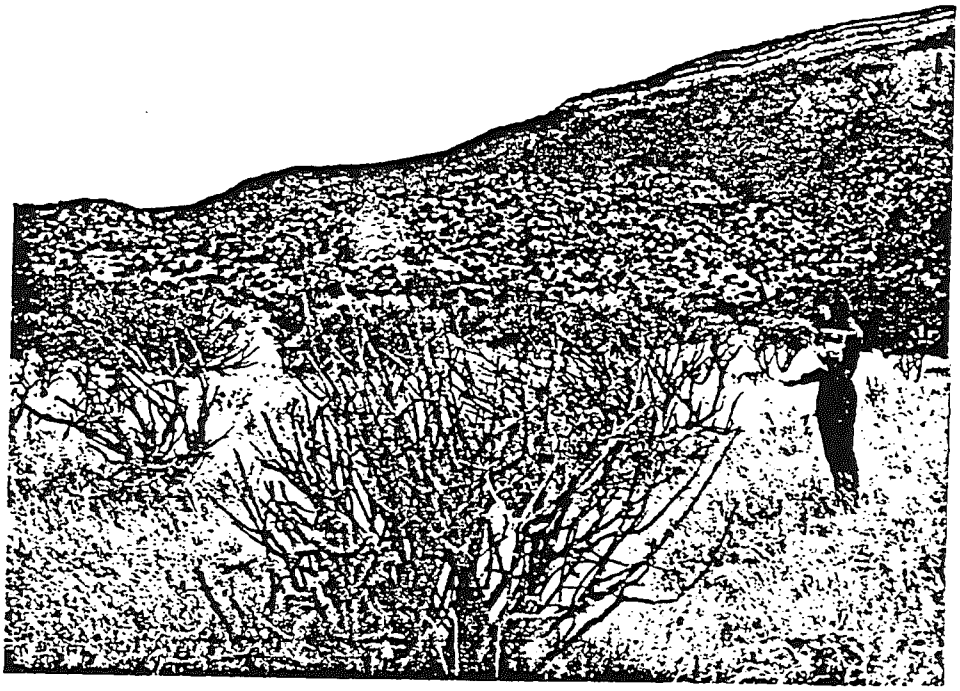


Photo 3. Opuntia imbricata is dying as the grassland matures on the piedmont alluvial fans of the RNA.

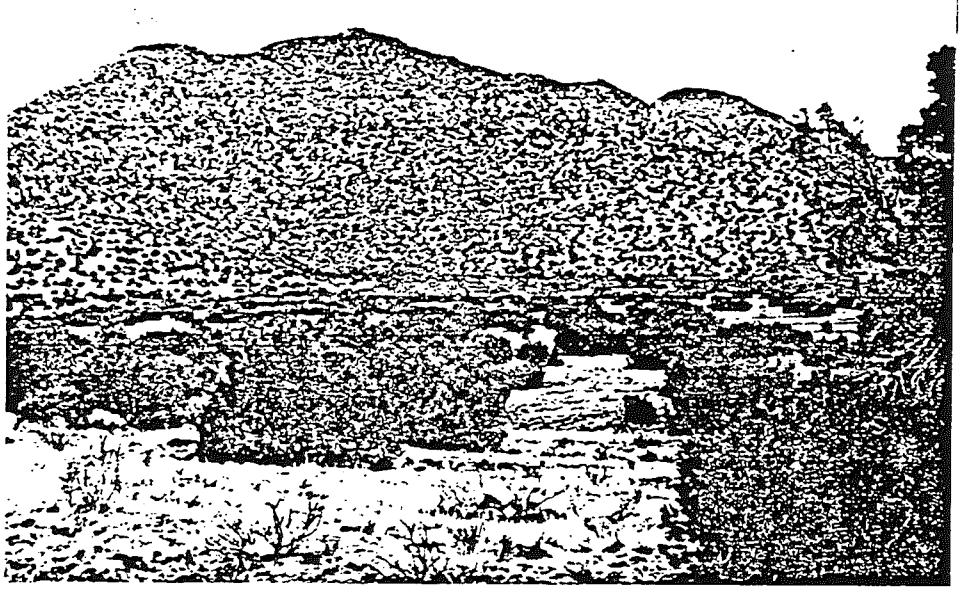


Photo 4. Juniperus monosperma, a common tree on the grasslands of the upper slopes of the RNA. Except within the dry arroyos, the entire area is JUMO/BOGR Habitat Type.

Photo 5. The dry washes of Bernalillo Watershed RNA are invaded by Chrysothamnus nauseosus, Fallugia paradoxa, Brickellia californica and Rhus trilobata.

Photo 6. Pinus edulis is reproducing along the north-facing washes near the east boundary of the area. Codominates here are Juniperus monosperma, Quercus turbinella.

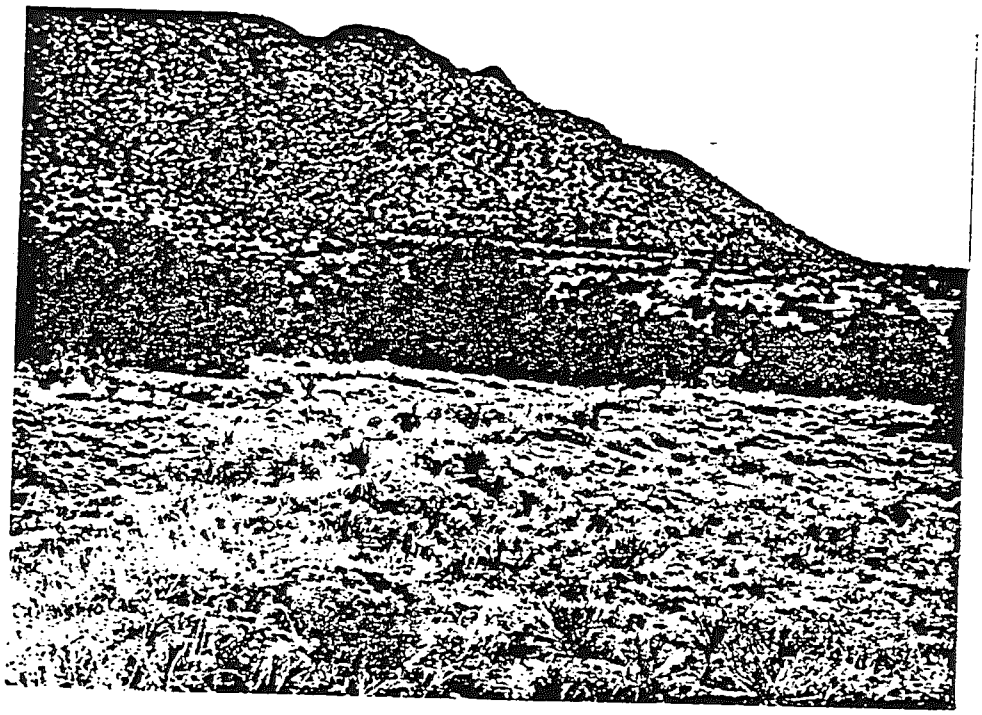


Photo 7. Flood control contour terracing constructed in the early 1950s has stabilized the upper portion of Bernalillo Watershed RNA. Terraces are dimly visible in the foreground and in the middle background.

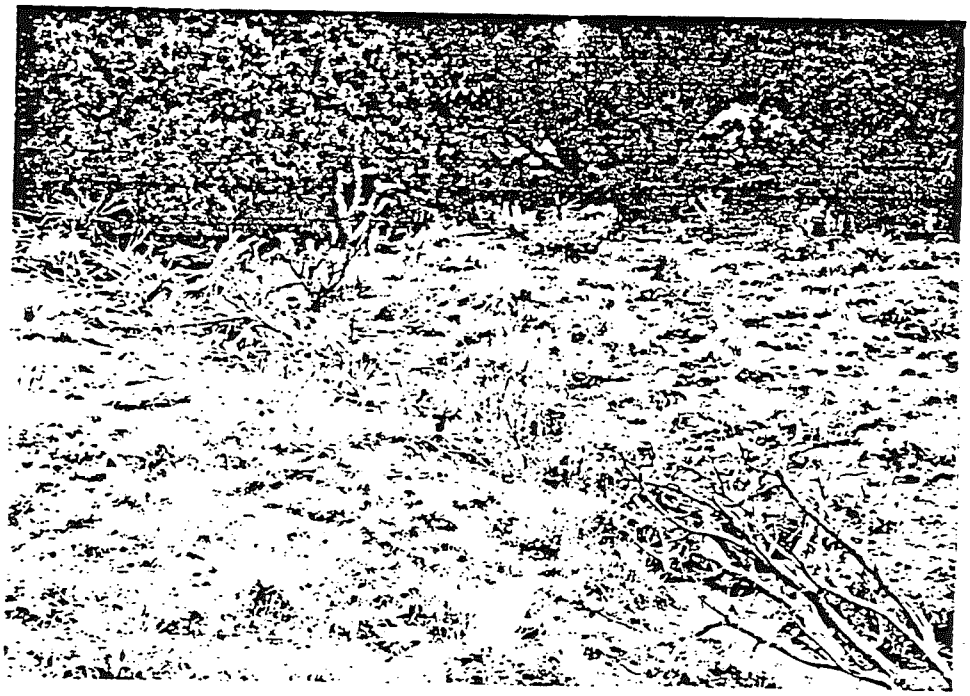


Photo 8. Evidence still remains of brush placement for erosion control that was done in the early 1950s.

USDA-FOREST SERVICE

PHOTOGRAPHIC RECORD

(See FSM 1643.52)

PHOTOGRAPHER	DATE SUBMITTED
William W. Dunmire	Nov. 16, 1987
HEADQUARTERS UNIT	**LOCATION**

INITIAL DISTRIBUTION OF PRINTS AND FORM 1600-1:

☐ WO ☐ RO ☐ DIV. ☐ FOREST ☐ DISTRICT ☐ PHOTOGRAPHER Date _____

INSTRUCTIONS: Submit to Washington Office in quadruplicate. Permanent numbers will be assigned and the forms will be distributed as follows: (1) Washington Office, (2) RO or Station, (3) Forest or Center and (4) Photographer.

PHOTOGRAPH NUMBER		SELECTED FOR W.O. PHOTO LIBRARY	DATE OF EXPOSURE	LOCATION (State, Forest, District and County)	CONCISE DESCRIPTION OF VIEW	NEGATIVE (Show size and BW for black and white or C for color)
TEMP. (1)	PERMANENT (To be filled in by the WO) (2)	(3)	(4)	(5)	(6)	(7)
				ALL: New Mexico Cibola NF Sandia Dist Sandoval Co		ALL: 24x36mm color slides
1.			10-29-86		South from Highway 44 toward the southwest corner of Bernalillo Watershed RNA.	
2.			10-20-86		Open grassland, northwest portion of Bernalillo Watershed RNA.	
3.			10-20-86		Dying Cholla cactus on piedmont alluvium of Bernalillo Watershed.	
4.			10-20-86		Upper slopes of Bernalillo Watershed RNA with one-seed juniper occurring throughout the grassland.	
5.			10-20-86		Rabbit brush, apache-plume and brickellia on one of several dry washes in the Bernalillo Watershed RNA.	
6.			10-20-86		Pinyon, one-seed juniper and shrub live oak with black grama grass in upper wash of Bernalillo Watershed.	
7.			10-20-86		Remnants of erosion control terracing constructed in the early 1950s still visible on Bernalillo Watershed.	
8.			10-20-86		Evidence of 30-year-old gully erosion control, Bernalillo Watershed RNA.	

ENVIRONMENTAL ASSESSMENT

Proposed Bernallilo Watershed

Research Natural Area

Cibola National Forest

U.S. Forest Service

Region 3

January 2, 1993

ENVIRONMENTAL ASSESSMENT

Proposed Bernalillo Watershed Research Natural Area

January 2, 1993

Alternatives and Environmental Consequences

Alternative A, Proposed Action

Alternative A would designate a 990 acre (400.7 hectares) area in the foothills of the Sandia Mountains of central New Mexico as the "Bernalillo Watershed" Research Natural Area. Management of the area would continue to limit recreation to dispersed, low intensity use, exclude fuelwood harvest, and has excluded grazing since 1950. Fire management would include planned and unplanned ignitions to maintain fire dependent ecosystems as long as persons or property outside of the RNA and the uniqueness of the RNA were not threatened. Suppression action would be limited to the use of hand tools. Management prescriptions are designed to prepare the candidate area for RNA status by prohibiting activities that would alter the natural characteristics of the area (Cibola Forest Plan, pages 25, 78-90).

The environmental consequences of Alternative A are described in the EIS for Cibola National Forest Plan (page 151). These consequences include short-term losses of opportunities to change vegetation conditions through management. Reduction in suitable timber, grazing lands and mineral accessibility to protect the proposed RNA are not significant. There are no significant cumulative effects of the establishing of the RNA.

The direction in the Forest Plan for established RNA's also includes reasonably foreseeable actions such as withdrawal of the area from mineral entry. The general consequences of withdrawal are discussed in the Forest Plan EIS (pages 147, 151). As of 6/19/59, the area was withdrawn from mineral entry (Department Interior Withdrawal [EO 10355] BLM Serial No. NM 034615). The proposed RNA is covered by three existing oil and gas leases. No activity concerning these leases has occurred. Sufficient stipulations exist for protection of the surface.

Alternative B, No Action

This alternative continues management according to direction in the Forest Plan (pages 79-80) for a "proposed" RNA. This management includes limiting recreation to dispersed, low intensity use, no fuelwood harvest, no open campfires, ORV activity, and no new road or trail construction, or management practices that would alter the educational and research values of the area. There are no significant cumulative effects of this alternative.

The environmental consequences of Alternative B, the "No Action" alternative, are as described in the Cibola Fe Forest Plan (page 25). These consequences include short-term losses of opportunities to change the vegetation conditions through management. Additionally, as future uses of natural resources increases, the options for designating RNAs will diminish. This is especially true as the population in the vicinity increases and future needs for recreation and fuelwood increase. For the proposed Bernalillo Watershed RNA, there may also be the consequence of losing a valuable, long-term study site for the grama-galleta steppe ecosystem due to encroachment and insufficient protection.

Agencies and Persons Consulted

In the process of updating information to determine whether or not conditions had changed since adoption of the Forest Plan (or as part of the Forest Plan monitoring process), the State Natural Heritage Program, Nature Conservancy, Livestockman's Association, range permittees, mineral exploration companies, etc. were contacted. The following comments were received and addressed as indicated (or no comments were received):

Natural Heritage Program -- supported establishment of the RNA.

Livestockman's Association -- no problem with establishment of the RNA because boundary changes were made at the time the Forest Plan was adopted by the Regional Forester.

Research Natural Areas

USDA Forest Service, Rocky Mountain, Intermountain, Southwestern and Great Plains States

SEARCH RNAs BY
County
GO

ABOUT RNAs
HOME
ABOUT
USING
OPPORTUNITES
REFERENCES
CONTACT US
RELATED SITES
CREDITS

A cooperative project of the

USDA Forest Service Northern Region, Rocky Mountain Region, Southwestern Region, Intermountain Region, Rocky Mountain Research Station, and the Montana Natural Heritage Program

BERNALILO WATERSHED

General Information S.USNAHP*80

- Created: 1997
- Size: 1030 (acres)
- Elevation Range: 5515 - 6000ft
- Location: *The RNA is located north of Albuquerque in the foothills and bajada of the Sandia Mountains.*

Site Description

Bernalilo Watershed RNA is the control area for watershed improvement projects implemented in the mid 1950's. This upland site is dominated by grasslands with low shrubs at the low end of and just below the one-seed juniper community. Primary grass species include: black grama (Bouteloua eriopoda), blue grama (Bouteloua gracilis), sand dropseed (Sporobolus cryptandrus) and various three-awns (Aristida spp.). Low shrubs include snakeweed (Gutierreza sarothrae), plains yucca (Yucca glauca), fourwing saltbush (Atriplex canescens), cholla (Opuntia imbricata), and pricklypears (O. polyacantha, O. phaecantha). Gravelly draws and broad washes support populations of Apache plume (Fallugia paradoxa), rabbitbrush (Chrysothamnus nauseosus) and sideoats grama (Bouteloua curtipedula). Pinyon (Pinus edulis) is found chiefly in washes at upper elevations within the RNA.

Climate and Enviromental Information

Data not Available

Vegetation - Bernalilo Watershed

Pinyon-Juniper (SAF 239, K21)

United States Department of Agriculture
Forest Service
Cibola NF
13 Osuna Rd NE, Suite A
Albuquerque, NM 87113
505-761-4650

File Code 4060
Route To

Date Sept 19 1997

Subject Bernalillo Watershed Research Natural Area

To Director, FMR

Enclosed is the original of the Bernalillo Watershed Research Natural Area, Sandia Ranger District, Cibola National Forest, Region 3 Copies have been sent to the Regional Forester, Region 3 and the Rocky Mountain Research Station The Regional Office will ensure that the designation order is noted in the landownership status record

Karen Carter

KAREN M CARTER
RNA Coordinator
Cibola National Forest

Enclosure

cc

Sandia Ranger District
R Fletcher Regional Office R-3

DESIGNATION ORDER

By virtue of the authority vested in the Secretary of Agriculture and further delegated to me under regulations at 7 CFR 2 42 36 CFR 251 23 and 36 CFR 219 I hereby establish the Bernalillo Watershed Research Natural Area (RNA) It shall be comprised of approximately 1030 acres of land in Sandoval County New Mexico on the Sandia Ranger District of the Cibola National Forest as described in the section of the Establishment Record entitled "Location "

The proposal to establish the Bernalillo Watershed Research Natural Area (RNA) occurred in the Record of Decision for the Cibola National Forest Land and Resource Management Plan (Forest Plan) when it was approved in 1985 An analysis of the factors listed in 36 CFR 219 25 and Forest Service Manual 4063 41 was completed and are documented in the Forest Plan and Final Environmental Impact Statement which are available to the public

The Forest Supervisor for the Cibola National Forest has reexamined that portion of the Bernalillo Watershed area to determine whether the environmental effects of establishing an RNA have not changed since 1985 This analysis is documented in an environmental assess ment (EA) Based on the analysis presented in the EA it is my decision to adopt Alternative A to establish a portion of the Bernalillo Watershed as a RNA Alternative A is selected because it provides long term protection and recognition of a grama galleta steppe and juniper grassland ecosystem The Bernalillo RNA will be managed in compliance with all relevant laws regulations and Forest Service Manual direction regarding RNAs and in accordance with management direction identified in the Forest Plan

The other alternative considered was Alternative B the "No Action" alternative which would have continued management of that portion of the Bernalillo Watershed as a proposed RNA Alternative B was not selected because it would only provide short term protection for this potential natural research area

Alternative B is consistent with the Forest Plan Although the proposed action Alternative A is consistent with the management direction in the Forest Plan it is not consistent with the land allocation for this portion of the Bernalillo Watershed area The Forest Plan is hereby amended to change the allocation of that portion of the Bernalillo Watershed area from "Proposed" to an "Established" RNA This is a nonsignificant amendment of the Forest Plan (36 CFR 219 10(f))

Legal notice of this decision will appear in the Federal Register The Forest Supervisor of the Cibola National Forest shall notify the public of this decision and mail a copy of the Decision Notice and Designation Order to all persons on the Cibola Forest Plan mailing list

It has been determined through the environmental assessment that the proposed action is not a major Federal action that would significantly affect the quality of the human environ ment therefore an environmental impact statement is not needed This determination is

based on the analysis of significance presented in the EA in accordance with (40 CFR 1508 27) with which I concur

This decision is subject to appeal pursuant to 36 CFR Part 217 Appeals must be in writing and postmarked or received by the Appeal Deciding Officer for the Chief of the Forest Service at USDA Forest Service P O Box 96090 NFS 3NW Appeals Office Washington DC 20090-6090 within 45 days of the date of the legal notice of this decision in the Albuquer que Journal Review by the Secretary of Agriculture is wholly discretionary If the Secretary has not decided within 15 days of receiving the Notice of Appeal to review the Regional Forester s Decision appellants will be notified that the Regional Forester s decision is the final administrative decision of the U S Department of Agriculture (36 CFR 217 17(d))

JOHN R. KIRKPATRICK
CHARLES W CARTWRIGHT JR
Regional Forester
Southwestern Region
USDA Forest Service

Aug 27, 1997
Date

DECISION NOTICE

BERNALILLO WATERSHED RESEARCH NATURAL AREA

USDA--Forest Service
Southwestern Region
Cibola National Forest
Sandia Ranger District
Sandoval County, New Mexico

The establishment of the proposed Bernalillo Watershed Research Natural Area (RNA) occurred in the Record of Decision for the Cibola National Forest Land and Resource Management Plan (Forest Plan) when it was approved in 1985 An analysis of the factors listed in 36 CFR 219 25 and Forest Service Manual 4063 41 was completed and are documented in the Forest Plan and Final Environmental Impact Statement which are available to the public

The Forest Supervisor for the Cibola National Forest has reexamined that portion of the Bernalillo Watershed area to determine whether the environmental effects of establishing an RNA have not changed since 1985 This analysis is documented in an environmental assessment (EA) Based on the analysis presented in the EA it is my decision to adopt Alternative A to establish a portion of the Bernalillo Watershed as a RNA Alternative A is selected because it provides long term protection and recognition of a grama galleta steppe and juniper-grassland ecosystem The Bernalillo RNA will be managed in compliance with all relevant laws regulations and Forest Service Manual direction regarding RNAs and in accordance with management direction identified in the Forest Plan

The other alternative considered was Alternative B the "No Action" alternative which would have continued management of that portion of the Bernalillo Watershed as a proposed RNA Alternative B was not selected because it would only provide short term protection for this potential natural research area

Alternative B is consistent with the Forest Plan Although the proposed action Alternative A is consistent with the management direction in the Forest Plan it is not consistent with the land allocation for this portion of the Bernalillo Watershed area The Forest Plan is hereby amended to change the allocation of that portion of the Bernalillo Watershed area from "Proposed" to an "Established" RNA This is a nonsignificant amendment of the Forest Plan (36 CFR 219 10(f))

It has been determined through the environmental assessment that the proposed action is not a major Federal action that would significantly affect the quality of the human environment therefore an environmental impact statement is not needed This determination is based on the analysis of significance presented in the EA in accordance with (40 CFR 1508 27) with which I concur

This decision is subject to appeal pursuant to 36 CFR Part 217 Appeals must be in writing and postmarked or received by the Appeal Deciding Officer for the Chief of the Forest Service at USDA Forest Service P O Box 96090 NFS 3NW Appeals Office Washington DC 20090-6090 within 45 days of the date of the legal notice of this decision in the Albuquer que Journal The notice of appeal must include sufficient narrative evidence and argument to show why this decision should be changed or reversed (36 CFR 217 9) Requests to stay the approval of this amendment of the Forest Plan will not be granted (36 CFR 217 10(b))

Implementation of this amendment will be effective seven days following the publication of the legal notice of this decision notice in the Albuquerque Journal Anyone interested in more information concerning this amendment should contact Dave Sire Ecosystem Analysis and Planning Staff 517 Gold Avenue SW Albuquerque NM 87102 or call (505) 842 3214 You may also contact Cibola National Forest Environmental Coordinator Jimmy E Hibbetts 2113 Osuna Road NE Albuquerque NM 87113 or call (505) 761 4650

JOHN R KIRKPATRICK

CHARLES W CARTWRIGHT JR
Regional Forester
Southwestern Region
USDA Forest Service

Aug 27, 1997
Date

MANAGEMENT PRESCRIPTIONS
APPLICABLE TO ALL AREAS
(Continued)

Decision Variables	Activities	Applicable Analysis Areas	Standards and Guidelines
			Managers Navajo Medicine Men s Association and with Land Grants including but not limited to San Mateo Cebolleta Tajique Torreon Manzano and Chilili will be held followed by issue sessions Prior to issue sessions community contacts will be asked to submit to the Forest Service a list of appropriate information needed to participate effectively in the issue session The Forest Service realizes that this information many times is technical therefore adequate time is need between information dissemination and the actual issue session for community people to understand and use the data
Research Nat ural Areas		4 5 8 14 18	The following areas will be studied for possible designation as Research Natural Areas (RNAs)

MANAGEMENT PRESCRIPTIONS
APPLICABLE TO ALL AREAS
(Continued)

Decision Variables	Activities	Applicable Analysis Areas	Standards and Guidelines
			1 Approximately 882 acres in Little Water Canyon in Management Area 8 and 28 acres in Management Area 14 have been designated for establishment as a Research Natural Area
			2 Approximately 300 acres (Black Kettle) in Management Area 4 for the protection and study of the native vegetation
			3 Approximately 300 acres on Kiowa NG and 300 acres on Rita Blanca NG in Management Area 5 for the protection and study of native vegetation
			Establishment of the Little Water Canyon RNAs and study of the other potential sites in Management Areas 4 and 5 will be completed in Period 2 Once designated as a RNA the following standards and guidelines will apply
			Emphasize natural processes protect natural features and preserve examples of naturally occurring ecosystems in an unmodified condi tion for research and educational purposes
080	C03		Allow vegetation manipulation only when necessary to preserve the vegetation for which the area is being studied
			Emphasize diversity of vegetation species that can result in wildlife species diversity
140			Allow use by livestock as a tool to apply effects of grazing and animal impact emulating previous herds of large ungulates (bison elk and proghorn) Maintain existing fence sur rounding study areas
270	G02		Propose withdrawal of Research Natural Areas from mineral entry but not from mineral leasing
160			Prohibit all firewood activities within the study areas
480			Allow no new road construction
			Allow no trail construction
010	A15		Allow nonmotorized dispersed recreation activities provided they do not modify the area or threaten or impair the research or educational value of the study areas

MANAGEMENT AREA 2
(Continued)

	Decision Variables	Activities	Applicable Analysis Areas	Standards and Guidelines
Transportation/Travel	010	L19	2	Maintain roads to Levels 3 4 and 5 in developed recreation sites
	010 110 230	A03 C03 F01 K03 L01	2	Manage an average road density of 1 5 miles of road per square mile
				All Forest System roads south of I 40 and west of Highway 337 are to be closed to public passenger vehicle use except when opened for public wood product sales These roads are available for administrative use and for recreational trail use
	010	L21	2	Perform trail preconstruction engineering at the rates indicated below
				Period 1 8 5 miles Period 2 7 0 miles Period 3 9 0 miles
	010 160 480	L01 L14 L29	2	Perform preconstruction and construction engineering at the following rate with emphasis on existing old roads
				Period 3 2 miles
	010 470	L19	2	Maintain Forest System roads to Levels 3 4 and 5 at the rate of 90 miles per period
		L19	2	Maintain Forest System roads to Level 2 at the rate of 45 miles per period
Research Natural Areas			2	**Apply the following standards and guidelines to manage the 1 030 acre Bernalillo Water shed Research Natural Area**
			2	**Emphasize natural processes protect natural features and preserve examples of naturally occurring ecosystems in an unmodified condition for research and educational purposes**
	080	**C03**	2	**Allow vegetation manipulation only when necessary to preserve the vegetation for which the area is being studied**
	270 280		2	**Maintain mineral withdrawal on the Bernalillo Watershed Permit mineral leasing but exclude surface occupancy**
	160		2	**Prohibit all firewood activities within the RNA**
	480		2	**Allow no new road or trail construction within the RNA**
	010	**A15**	2	**Allow nonmotorized dispersed recreation activities provided they do not modify the area or threaten or impair the research or educational value of the RNA**

USDA - Forest Service
Southwestern Region
Cibola National Forest
Sandia Ranger District
Sandoval County New Mexico

On July ** 1997 Regional Forester Charles W Cartwright Jr Southwestern Region made a decision to formally designate 1 030 acres of the Bernalillo Watershed as a Research Natural Area This area is located approximately four miles southwest of Placitas New Mexico This decision will result in a nonsignificant amendment to the Cibola National Forest Land and Resource Management Plan

The associated Decision Notice and Finding of No Significant Impact are available upon request from the Forest Service Southwestern Region 517 Gold Avenue SW Albuquerque NM 87102

This decision is subject to appeal pursuant to Forest Service regulations at 36 CFR Part 217 Appeals must be filed within 45 days from the date of publication of this legal notice Notices of appeal must meet the requirements of 36 CFR 217 9

ESTABLISHMENT RECORD

for

BERNALILLO WATERSHED RESEARCH NATURAL AREA

within

Cibola National Forest

Sandoval County New Mexico

ESTABLISHMENT RECORD

BERNALILLO WATERSHED RESEARCH NATURAL AREA

USDA FOREST SERVICE
SOUTHWESTERN REGION
CIBOLA NATIONAL FOREST
SANDIA RANGER DISTRICT
SANDOVAL COUNTY, NEW MEXICO

Recommended by _____ Date 9-30-93
Floyd Thompson, District Ranger
Sandia Ranger District

Recommended by _____ Date 9/30/93
Jeanine A Derby, Forest Supervisor
Cibola National Forest

Recommended by _____ Date 11/1/93
Art Briggs, Chairman
Southwestern Research Natural Area Committee

Recommended by _____ Date 11/3/93
Larry Henson, Regional Forester
Southwestern Region

Recommended by _____ Date 11/18/93
Denver P Burns, Station Director
Rocky Mountain Forest and Range Experiment Station

INTRODUCTION

The Bernalillo Watershed Research Natural Area (RNA) comprises approximately 1,030 acres (412 hectares) in the foothills of Sandia Mountain in central New Mexico The proposed RNA is located in the Sandia Ranger District, Cibola National Forest in Sandoval County, and is all acquired National Forest System lands

Grama-galleta steppe has been noted as an important ecosystem for protection within the RNA program (USFS Regional Guide, 1983 Table 3-1) The Bernalillo Watershed was selected for representation of this grassland type The Bernalillo Watershed has been reseeded and protected from grazing since 1953, and provides an excellent example of grama-galleta steppe along with the adjacent juniper-grassland type, both of which are in good condition

LAND MANAGEMENT PLANNING

The need for representation of this biotic community was identified in the Southwestern Regional Guide (August 1983) The Cibola National Forest Land and Resource Management Plan (USFS 1985 78-79) prescribes that approximately 990 acres (400 7 hectares) of the Bernalillo Watershed in Management Area 2 has been designated for establishment as a Research Natural Area, with establishment to be completed in Period 1 More accurate mapping and acreage computation has established the acreage within the RNA as 1 030 acres (412 hectares) The environmental analysis conducted as part of the planning process supports the recommendation to establish this Research Natural Area

JUSTIFICATION STATEMENT FOR ESTABLISHMENT OF AREA

This grassland type is in high demand for livestock grazing in New Mexico, and few examples exist which are not in grazing allotments Though not a pristine area, the Bernalillo Watershed was originally dedicated to reduce erosion on these gently sloping piedmont alluvial fans Reseeding and exclusion from grazing since 1950 has allowed this area to return to very near its potential natural vegetation Much interest has been placed on contrasts between this area, used as a control, and other grasslands along alluvial piedmonts in central New Mexico where various grazing systems are being practiced Ongoing studies have been conducted on the area for the last 25 years under the auspices of the USFS Rocky Mountain Station and the University of New Mexico Establishment of the area as an RNA would ensure protection of its distinctive attributes for continued study

PRINCIPAL DISTINGUISHING FEATURES

Native grasses and shrubs provide almost continuous cover on the convex interfluve surfaces The principal grasses are black grama (*Bouteloua eriopoda*), blue grama (*B gracilis*), sand dropseed (*Sporobolus cryptandrus*), and three awns (*Aristida spp*) Low shrubs include snakeweed (*Gutierrezia sarothrae*), plains yucca (*Yucca glauca*), fourwing saltbrush (*Atriplex canescens*), cholla (*Opuntia imbricata*), and pricklypears (*O polyacan-*

tha O phaecantha) These grasslands commonly display cappings of cryptogams (lichens mosses, algae) on the soil crust One-seed junipers (*Juniperus monosperma)* are present here in low to moderate density

Gravelly draws and broad washes are lined with populations of apache plume (*Fallugia paradoxa*), rabbitbrush (*Chrysothamnus nauseosus*) and sideoats grama (*Bouteloua curtipendula*) Pinyon (*Pinus edulis*) is found chiefly in washes at upper elevations within the RNA, where juniper is also most common

LOCATION

Bernalillo Watershed lies approximately 18 miles (29 1 km) northeast of Albuquerque New Mexico, at the foothills of Sandia Mountain The proposed RNA is located in the Placitas USFS 7 5' quadrangle (latitude 35°18', longitude 106°30') Township 12 North Range 4 East Sections 1 2 3 10 11 and 12 (Map 1) Elevation ranges from a high of slightly over 6 000 ft (1,828 8 m) at the southeast edge, sloping gently to approximately 5 515 ft (1 681 0 m) at the northwest extremes The proposed RNA comprises approximately 1 030 acres (412 hectares)

From the center of Albuquerque, take Interstate 25 north 15 miles (24 1 km, Map 2) Turn east off the Interstate onto State Highway 165 and proceed 3 0 miles (4 8 km) to where unpaved Forest road 445 turns to the right (south) This all-weather road circumnavigates the Research Natural Area (Map 3), returning to State Highway 165 about 0 6 miles (1 1 km) east of the first turn-off for FR 445 The RNA can be entered on foot from any point along this road This is gently rolling open country and foot travel is an easy matter

A boundary description of the proposed Bernalillo Watershed RNA is as follows

> The boundary of the RNA is set back 100 feet inside FR 445 which surrounds most of the area with the exception of that portion adjacent to State Highway 165 in which case the boundary is set back 100 feet inside of the right-of-way fence A plat prepared by Douglas J Williams dated June 14, 1993 following page displays the boundary location

AREA BY COVER TYPES

The distribution of cover types was determined from field surveys conducted in the summer of 1986 and from interpretation of 1981 aerial photography Table 1 outlines the estimated total areas of vegetation types based on the Society of American Forester's forest type system (Eyre 1980) and (Kuchler 1964) Map 4 depicts the distribution of SAF Type 239 plus a grassland type not covered in the SAF forest categories, on the candidate research natural area

Table 1 Estimated Areas of Vegetation Types in the Bernalillo Watershed Research Natural Area

Type	Society of American Foresters Cover Type[1]	Kuchler PNV Type[2]	Surface Area	
			Acres	Hectares
Pinyon - Juniper	SAF 239	K 21 Juniper - Pinyon Woodland	855	342 0
Grama - Galleta	[none]	K-47 Grama -Galleta Steppe	175	70 0
		TOTAL	1 030	412 0

[1]Eyre 1980
[2]Kuchler 1964

PHYSICAL AND CLIMATIC CONDITIONS

Bernalillo Watershed RNA is located in a narrow strip of semi-arid climate between the northern extent of an arid climate zone along the Rio Grande Valley and the subhumid woodland and forest covered Sandia Mountain to the east The nearest long term weather station is at Albuquerque, slightly higher elevation at the RNA results in a minor increase in precipitation levels, slightly lower temperatures, and shorter frost free season Average annual rainfall for the Bernalillo Watershed is 14 inches (35 6 cm), and average annual snowfall is 28 inches (71 2 cm) Cool season precipitation (falling between November and April) accounts for 33 percent of annual precipitation Mean annual temperature is 52° F (11 1° C), with a July average of 74° F (23 3° C) and a January average of 31° F (-0 6° C) The frost free period lasts an average of 160 days

DESCRIPTION OF VALUES

Flora

A broad survey of habitat types (HT) was conducted during the 1986 field work A brief review follows No publication adequately classifies woodland-grassland habitat types for northern or north-central New Mexico USDA Forest Service (1986) Forest and woodland habitat types of southern New Mexico and central Arizona served as the best available key for Bernalillo Watershed Much of the open juniper savanna is classified in this guide as Juniperus monosperma/Bouteloua HT

Grasses comprise up to 70 per cent of the cover on the flat, open grasslands topping the gently sloping piedmont alluvial fans on the west side of the RNA Black grama (Bouteloua eriopoda) dominates occurring with ring muhly (Muhlenbergia torreyi) blue grama (Bouteloua gracilis) sand dropseed (Sporobolus cryptandrus), and galleta (Hilaria jamesii) Broom snakeweed (Gutierrezia sarothrae) is the most common shrub here with plains yucca (Yucca glauca) and cholla (Opuntia imbricata) occasional to common This grama galleta grassland comprises about 20% of the RNA

Juniper is the dominant and typically the only tree on the slightly steeper slopes, which make up the remainder of the proposed RNA Shrub live oak (Quercus turbinella) appears as a large shrub at the upper (southeast) end of the RNA Pinyon (Pinus edulis) is reproducing successfully along the north facing washes near the east boundary of the area but drops out where the slope flattens out below The grass mix on the juniper slopes is similar to that found in the open grassland described above, with Bouteloua eriopoda remaining dominant B gracilis more common sideoats grama (B curtipendula) appearing frequently, and Muhlenbergia torreyi appearing less frequently Gutierrezia is less common in the woodland JUMO/BOGR HT prevails throughout

The several dry washes are dominated by rabbit brush (Chrysothamnus nauseosus), along with apache-plume (Fallugia paradoxa), brickellia (Brickellia californica) and occasional squawberry (Rhus trilobata) Bouteloua curtipendula and B eriopoda are the principal grasses in these arroyos which also occasionally contain big bluestem (Andropogon gerardii) and bush muhly (Muhlenbergia porteri) Vegetation here probably is closest to Juniperus monosperma/Chrysothamnus nauseosus Fallugia paradoxa habitat type (JUMO/CHNA FAPA HT) as described in the literature

A small population of grama grass cactus Pediocactus papyracantha, a New Mexico Endangered plant and Federal candidate species occurs on one portion of the proposed RNA No other threatened or endangered plants are known to occur on Bernalillo Watershed

The following plant list was compiled from field observations on October 29 1986

Abbreviated Plant List for Bernalillo Watershed RNA

Latin Name	Common Name[1]	Reference[2]
GRASSES AND GRASS-LIKE PLANTS		
Andropogon gerardii	Big bluestem	BD/MT
Aristida fendleriana	Fendler three awn	FS BD/MT
Aristida longiseta	Red three-awn	FS BD/MT
Bouteloua curtipendula	Sideoats grama	FS BD/MT
Bouteloua eriopoda	Black grama	FS BD/MT
Bouteloua gracilis	Blue grama	FS BD/MT
Bouteloua hirsuta	Hairy grama	FS BD/MT
Eragrostis intermedia	Plains lovegrass	FS
Hilaria jamesii	Galleta	FS BD/MT
Lycurus phleoides	Wolftail	FS BD/MT
Muhlenbergia porteri	Bush muhly	FS BD/MT
Muhlenbergia torreyi	Ring muhly	FS BD/MT
Poa arida	Plains bluegrass	BD/MT
Sitanion hystrix	Bottlebrush squirreltail	FS BD/MT
Sporobolus cryptandrus	Sand dropseed	FS BD/MT
Stipa comata	Needle and thread	FS
Stipa neomexicana	New Mexican needlegrass	FS
Tridens pulchella	Fluffgrass	BD/MT
FORBS		
Allium sp	Onion	FS
Aster bigelovii	Bigelow aster	BD/MT
Astragalus spp	Milkvetch	FS
Castilleja sp	Paintbrush	BD/MT
Cirsium sp	Thistle	BD/MT
Conyza canadensis	Horseweed	BD/MT
Cucurbita foetidissima	Buffalogourd	BD/MT
Erigeron concinnus	Fleabane	FS
Eriogonum polycladon	Sorrell buckwheat	BD/MT
Euphorbia sp	Spurge	FS BD/MT
Oreochrysum spinulosus	Spinyleaf goldenweed	FS
Hymenopappus filifolius	White-ragweed	FS
Hymenoxys acaulis	Nostem rubberweed	FS
Lesquerella rectipes	Bladderpod	FS
Leucelene ericoides	White aster	FS
Melampodium leucanthum	Plains blackfoot	FS/BD/MT
Penstemon sp	Beard tongue	FS
Salsola kali	Russian thistle	BD/MT
Senecio longilobus	Threadleaf groundsel	FS BD/MT
Solanum elaeagnifolium	White horsenettle	BD/MT

Sphaeralcea coccinea	Globemallow	FS BD/MT
Stephanomeria pauciflora	Wirelettuce	BD/MT
Verbena spp	Verbena	FS BD/MT
Zinnia grandiflora	Rocky Mountain zinnia	FS

HALF SHRUBS SHRUBS AND TREES

Artemisia frigida	Fringed sagebrush	BD/MT
Atriplex canescens	Four-wing saltbush	FS BD/MT
Brickellia californica	California brickellia	BD/MT
Chrysothamnus nauseosus	Rubber rabbitbrush	BD/MT
Coryphantha vivipara	Coryphantha	FS
Echinocereus sp	Hedgehog cactus	BD/MT
Eurotia lanata	Wintertat	BD/MT
Fallugia paradoxa	Apache plume	BD/MT
Gutierrezia sarothrae	Broom snakeweed	FS BD/MT
Juniperus monosperma	One-seed juniper	FS BD/MT
Nolina texana	Beargrass	BD/MT
Opuntia arbuscula	Pencil cholla	BD/MT
Opuntia clavata	Club cholla	BD/MT
Opuntia engelmannii	Engelmann pricklypear	FS BD/MT
Opuntia imbricata	Cholla	BD/MT
Opuntia polyacantha	Plains pricklypear	FS BD/MT
Pinus edulis	Pinyon	BD/MT
Quercus turbinella	Shrub live oak	FS BD/MT
Rhus trilobata	Squawberry	BD/MT
Yucca glauca	Small soapweed	FS BD/MT

[1]Common names used according to USDA Forest Service 1974 or Martin & Hutchins 1981
[2]FS = Bernalillo Watershed Transect Data Rocky Mountain Experiment Station USFS Southwest Region Albuquerque 1982
BD/MT = observed by Bill Dunmire (The Nature Conservancy) and Mollie S Toll (Department of Biology University of New Mexico) on October 29, 1986

Fauna

No rare endangered or sensitive animal species are known to inhabit this area Mule deer are the only ungulates now using the area, but this is not considered important deer habitat Evidence of black tailed jackrabbits is abundant There is no perennial or open stream water on this RNA, and therefore riparian species are absent

The following animal list was derived from the RUN WILD III computer-stored data base (Lehmkuhl and Patton 1982 Patton 1979) from the following habitat types, for Sandoval county, New Mexico

1 Pinyon juniper series
2 Plains grassland biome grama grass series
3 Plains grassland biome galleta grass series

These habitat types currently in the data base most closely correspond to those occurring in the proposed RNA

Potential Animal List for Bernalillo Watershed RNA

Common Name	Latin name
BIRDS	
Bluebird mountain	Sialia currucoides
Bluebird western	Sialia mexicana
Chickadee mountain	Parus gambeli
Dove mourning	Zenaida macroura
Falcon prairie	Falco mexicanus
Finch, house	Carpodacus mexicanus
Flicker, northern	Colaptus auratus
Flycatcher ash-throated	Myiarchus cinerascens
Grosbeak black-headed	Pheucticus melanocephalus
Hawk, ferruginous	Buteo regalis
Hawk red-tailed	Buteo jamaicensis
Hawk sharp-shinned	Accipiter striatus
Hummingbird black-chinned	Archilochus alexandri
Jay, blue	Cynanocitta cristata
Jay, pinyon	Gymnorhinus cyanocephalus
Junco dark eyed	Junco hyemalis
Kingbird Cassin s	Tyrannus vociferans
Lark horned	Eremophila alpestris
Meadowlark western	Sturnella neglecta

Nighthawk common	Chordeiles minor
Nuthatch pygmy	Sitta pygmaea
Oriole Scott s	Icterus parisorum
Owl short eared	Asio flammeus
Phoebe black	Sayornis nigricans
Pygmy owl, northern	Glaucidium gnoma
Quail, scâled	Callipepla squamata
Raven, common	Corvus corax
Roadrunner, greater	Geococcyx californianus
Robin American	Turdus migratorius
Shrike loggerhead	Lanius ludovicianus
Siskin, pine	Carduelis pinus
Solitaire Townsend s	Myadestes townsendi
Sparrow black throated	Amphispiza bilineata
Sparrow Brewer s	Spizella breweri
Sparrow chipping	Spizella passerina
Sparrow lark	Chondestes grammacus
Swift white throated	Aeronautes saxatalis
Tanager western	Piranga ludoviciana
Thrasher Bendire s	Toxostoma bendirei
Titmouse plain	Parus inornatus
Towhee brown	Pipilo fuscus
Vireo gray	Vireo vicinior
Warbler black throated gray	Dendroica nigrescens
Waxwing cedar	Bombycilla cedrorum
Wood-pewee western	Contopus sordidulus
Wren, Bewick s	Thryomanes bewickii
Wren rock	Salpinctes obsoletus

MAMMALS

Badger	Taxidea taxus
Chipmonk Colorado	Tamias quadrivittatus
Cottontail desert	Sylvilagus audobonii
Coyote	Canis latrans
Deer mule	Odocoileus hemionus
Gopher Botta s pocket	Thomomys bottae
Jackrabbit black tailed	Lepus californicus
Lion mountain	Felis concolor
Mouse brush	Peromyscus boylii
Mouse deer	Peromyscus maniculatus
Mouse hispid pocket	Peromyscus hispidus
Mouse, northern grasshopper	Onychomys leucogaster
Mouse pinyon	Peromyscus truei
Mouse, plains pocket	Perognathus flavescens
Mouse rock	Perognathus difficilis
Mouse silky pocket	Perognathus flavus

Mouse western harvest	Reithrodontomys megalotis
Mouse white footed	Peromyscus leucopus
Porcupine	Erethizon dorsatum
Rat banner tailed kangaroo	Dipodomys spectabilis
Rat Merriam s kangaroo	Dipodomys merriami
Rat Ord's kangaroo	Dipodomys ordii
Shrew dwarf	Sorex nanua
Shrew Merriam s	Sorex merriami
Skunk striped	Mephitis mephitis
Squirrel golden mantled ground	Spermophilus lateralis
Squirrel spotted ground	Spermophilus spilosoma
Squirrel rock	Spermophilus variegatus
Squirrel white tailed antelope	Ammospermophilus leucurus
Weasel long tailed	Mustela frenata
Woodrat Mexican	Neotoma mexicana
Woodrat Stephen s	Neotoma stephensi
Woodrat white throated	Neotoma albigula

REPTILES

Lizard collared	Crotaphytus collaris
Lizard sagebrush	Sceloporus graciosus
Lizard side blotched	Uta stansburiana
Lizard tree	Urosaurus ornatus
Rattlesnake western diamondback	Crotalus atrox
Whiptail little striped	Cnemidophorus inornatus
Whiptail plateau striped	Cnemidophorus velox

Geology

The Rio Grande depression a major north south trending basin in central New Mexico is flanked on either side by uplifts Bernalillo Watershed lies on the eastern border of this basin at the foot of the Sandia Mountains which have a core of pre Cambrian rocks locally exposed at the surface and overlain by sedimentary formations ranging in age from Cambrian through Tertiary (New Mexico Geological Society 1952)

The area of the proposed RNA is underlain by alluvial deposits The southern portion consists of valley fill and alluvial fan material With decreasing elevation to the north and west this material grades into terrace alluvium consisting of sand gravel, and alluvial fan material Kelley and Northrop (1975) describe this area in detail and provide a geological map

Soils

Undulating to rolling and hilly upland dissected by intermittent drainages and arroyos in the southeastern part of Sandoval County is categorized as Rough Broken Land Embudo association (NMSU 1971 13) The soils predominantly classified as fine loamy mixed and mesic Typic Haplustalfs are forming in unconsolidated old alluvium which is coarse to medium textured and gravelly Generally soils of this association are calcareous and have gravelly sandy loam or gravelly loamy fine sand surface layers Experience prior to 1950 indicates that the soils are highly subject to erosion

Lands

There are no known outstanding rights or rights-of way within the proposed boundaries

Cultural

There are no known cultural resource sites within the RNA Cultural information from similar areas nearby indicate moderate to high potential for presence of archeological sites, usually in the form of surface lithic and ceramic scatters

IMPACTS AND POSSIBLE CONFLICTS

Mineral Resources

No known mineral resources exist in this area As of 6/19/59, the area was withdrawn from mineral entry (Department Interior Withdrawal [EO 10355] BLM Serial No NM 034615) The RNA is covered by three existing oil and gas leases No activity concerning these leases has occurred Sufficient stipulations exist for protection of the surface

Grazing

Livestock have been permanently excluded from the area since 1950 No impacts or conflicts are expected as the area will remain closed to grazing The RNA has two cross fences separating it into four pieces of unequal size The perimeter, delineated by Forest Road 445 needs to be fenced to exclude unauthorized livestock including cattle and horses from private and Pueblo Indian lands nearby Approximately 4 9 miles (7 9 km) of fencing at an estimated cost of $14 700 (in 1987 dollars) will be required to complete the perimeter fence

Timber

This area is sparsely covered with pinyon-juniper woodland, primarily in stringers associated with drainages Removal of firewood and any other forest products has not been permitted since 1955 There are no commercial forest acres

Watershed Values

Bernalillo Watershed is located in the Middle Rio Grande Basin of New Mexico, on the western slope of the Sandia Mountains and bench lands east of the community of Bernalillo That portion contained within the National Forest is bounded by Cañon Agua Sarca on the north and Cañon del Agua on the south Both drainages flow directly into the Rio Grande within less than 3 miles (4 8 km) of the forest boundary The Bernalillo Watershed RNA is centrally located within the watershed Of the 4,422 acres (1789 5 hectares) of the Bernalillo watershed within the National Forest, the RNA occupies approximately 1030 acres (412 hectares) The RNA comprises about 10 per cent of the total watershed (9 050 acres or 3662 4 hectares)

The candidate RNA lies within the larger Bernalillo Watershed Project which was started in 1953 under the sponsorship of the Santa Fe-Sandoval Conservation District, working with the Forest Service and the Soil Conservation Service Project work, consisting of contour terracing, soil pitting, and reseeding with native grasses mostly above and outside the RNA, was completed in 1955 (USDA Forest Service, n d) The value of the soil stabilization achieved by this project was demonstrated many times in

later years when torrential rain storms failed to cause floods and erosion that prevailed on lands adjacent to the project area

Recreation Values

Recreation use in this area is diverse and ranges from jogging, hiking, and horseback riding to nature study, training for competitive dog trials", and pinyon picking Those who use the area include residents near the forest boundary, and others who come from farther away All of the watershed within the National Forest is closed to ORV travel except on designated roads Posting of the RNA perimeter and other appropriate closure devices will help attain compliance of the ORV closure within the RNA and will not impair recreation opportunities in areas outside of the RNA

Wildlife and Plant Values

The Bernalillo Watershed RNA contains known populations of the grama grass cactus Pediocactus papyracanthus (Engelm) Britt & Rose a New Mexico State listed threatened and endangered (T & E) plant species The presence of this species which is very sensitive to overgrazing and other forms of disturbance demonstrates that some portions of the RNA remain in an undisturbed condition This provides a valuable contrast to those portions which were highly disturbed during construction of erosion control measures No T & E animal species are known to occur in the area The proposed RNA lies within the Sandia Game Refuge

Wilderness, Wild and Scenic River, National Recreation Area Values

None of the above congressionally designated areas have been proposed for the Bernalillo Watershed RNA or vicinity

Transportation Plans

The entire watershed within the National Forest is administratively closed to off-road travel An obvious management need for protection of the RNA against damage from ORV s is to post the RNA Forest Road 445 which circumscribes the RNA can remain in place without adversely affecting the RNA

Utility Corridor Plans

A major electric power transmission line crosses the southeast portion of the RNA Periodic maintenance inspections are conducted from a vehicle using a primitive two-track road beneath the power line This access may continue for actual repair needs only Inspections can be conducted on foot

MANAGEMENT PLAN

The Cibola National Forest Plan prescribes that there will be no harvest of firewood and no assigned grazing capacity on Research Natural Areas The prescriptions also prohibit road or trail construction, new utility corridors off-road vehicle travel, open campfires and recreational use if degradation results However non-motorized dispersed recreation activities are permitted provided they do not sign ficantly modify the area or threaten or impair the research or educational value of the area No flora fauna or other materials may be collected other than for research approved by the Station Director Further watershed treatment activities are not allowed within the RNA until studies and determination are completed

1 Vegetation Management

The Forest Plan provides that prescribed fire using planned and unplanned ignitions will be allowed on the Bernalillo Watershed RNA to maintain fire dependent ecosystems Suppression action is limited to the use of hand tools, and fire retardant chemicals must not be used unless necessary to protect life and property outside the study area Vegetation manipulation is allowed only when necessary to preserve the grama galleta steppe vegetation for which the area is being studied

ADMINISTRATIVERECORDS AND PROTECTION

Administration and protection of the Bernalillo Watershed RNA will be the responsibility of the Cibola National Forest The District Ranger Sandia Ranger District Tijeras NM has direct responsibility

The Director of the Rocky Mountain Forest and Range Experiment Station or his designee will be responsible for any studies or research conducted in the area and requests to conduct research in the area will be referred to him He or his designee will evaluate research proposals and coordinate all studies and research in the area with the District Ranger All plant and animal specimens collected in the course of research conducted in the area will be properly preserved and maintained within university or federal agency herbaria and museums approved by the Rocky Mountain Station Director

Records for the Bernalillo Watershed RNA will be maintained in the following offices

Regional Forester Southwestern Region Albuquerque NM
Rocky Mountain Station Fort Collins CO
Cibola National Forest Albuquerque NM
District Ranger Sandia Ranger District Tijeras NM

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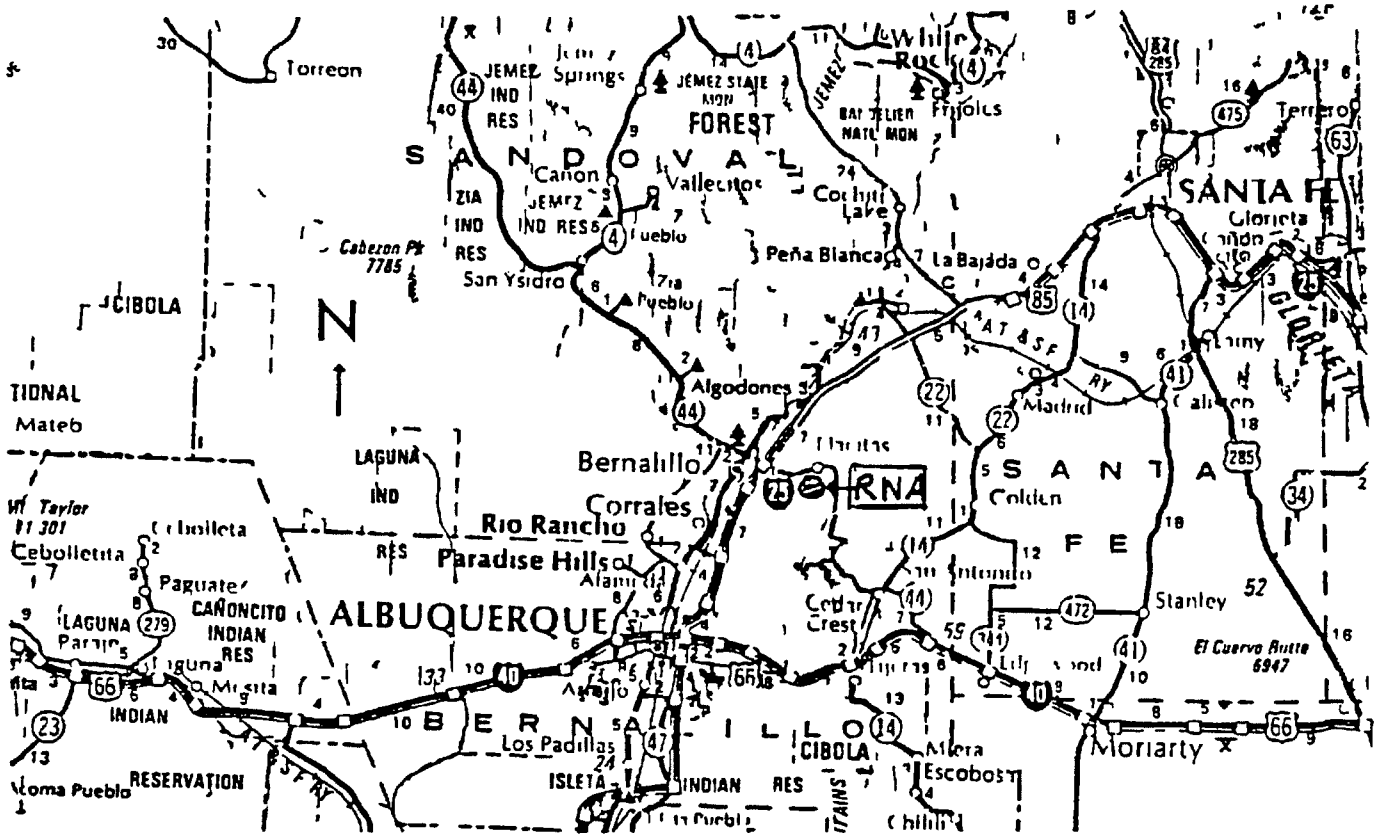
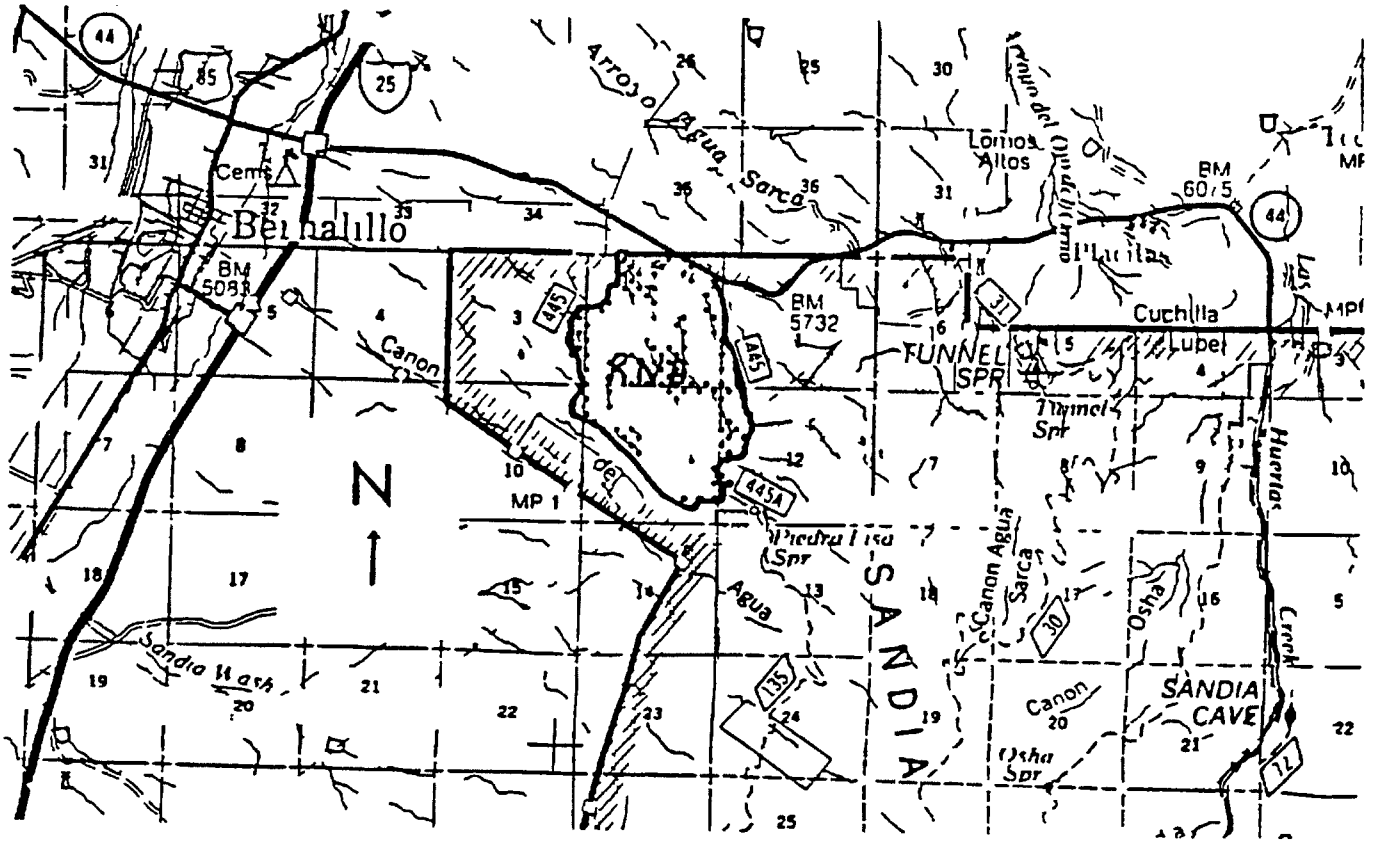
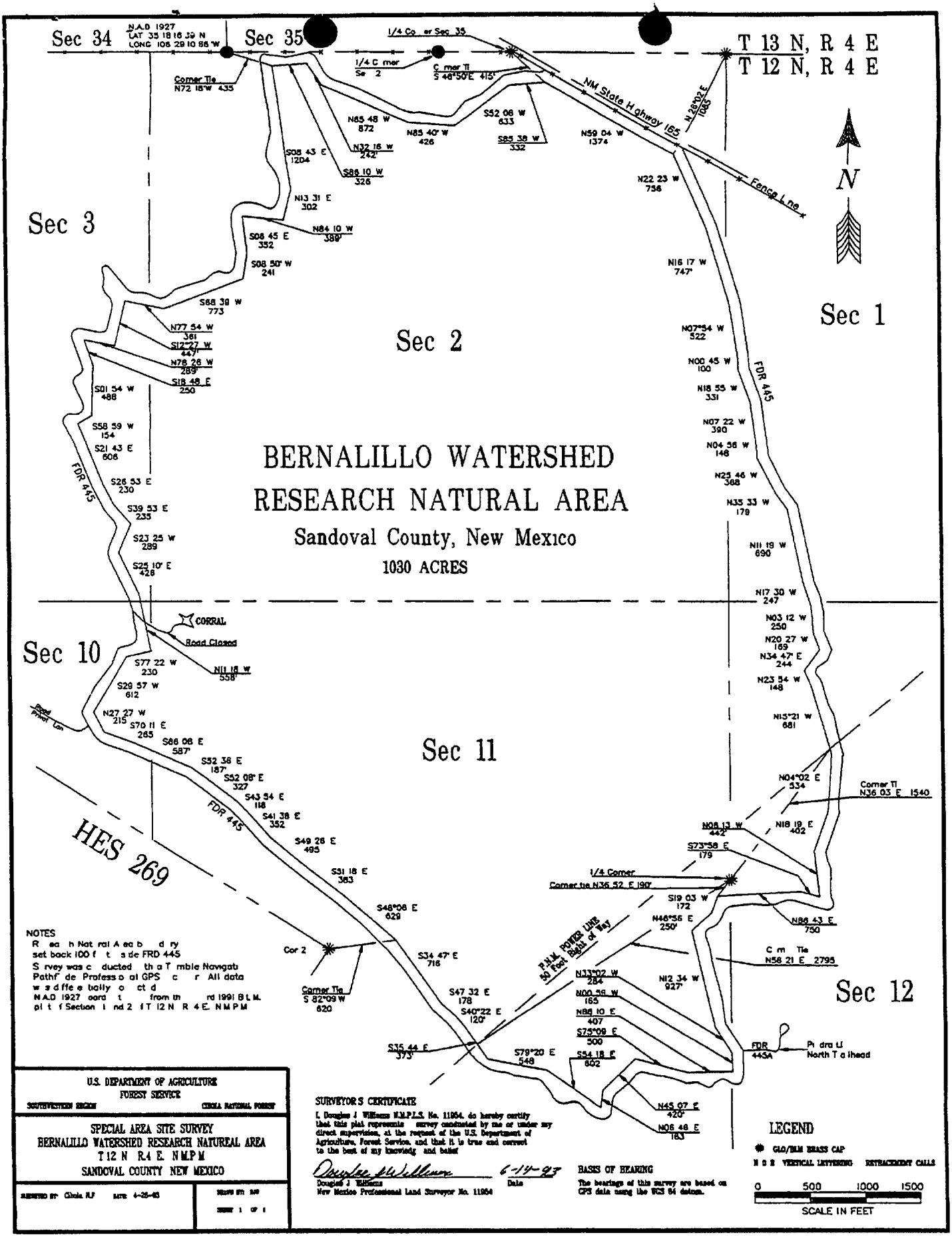
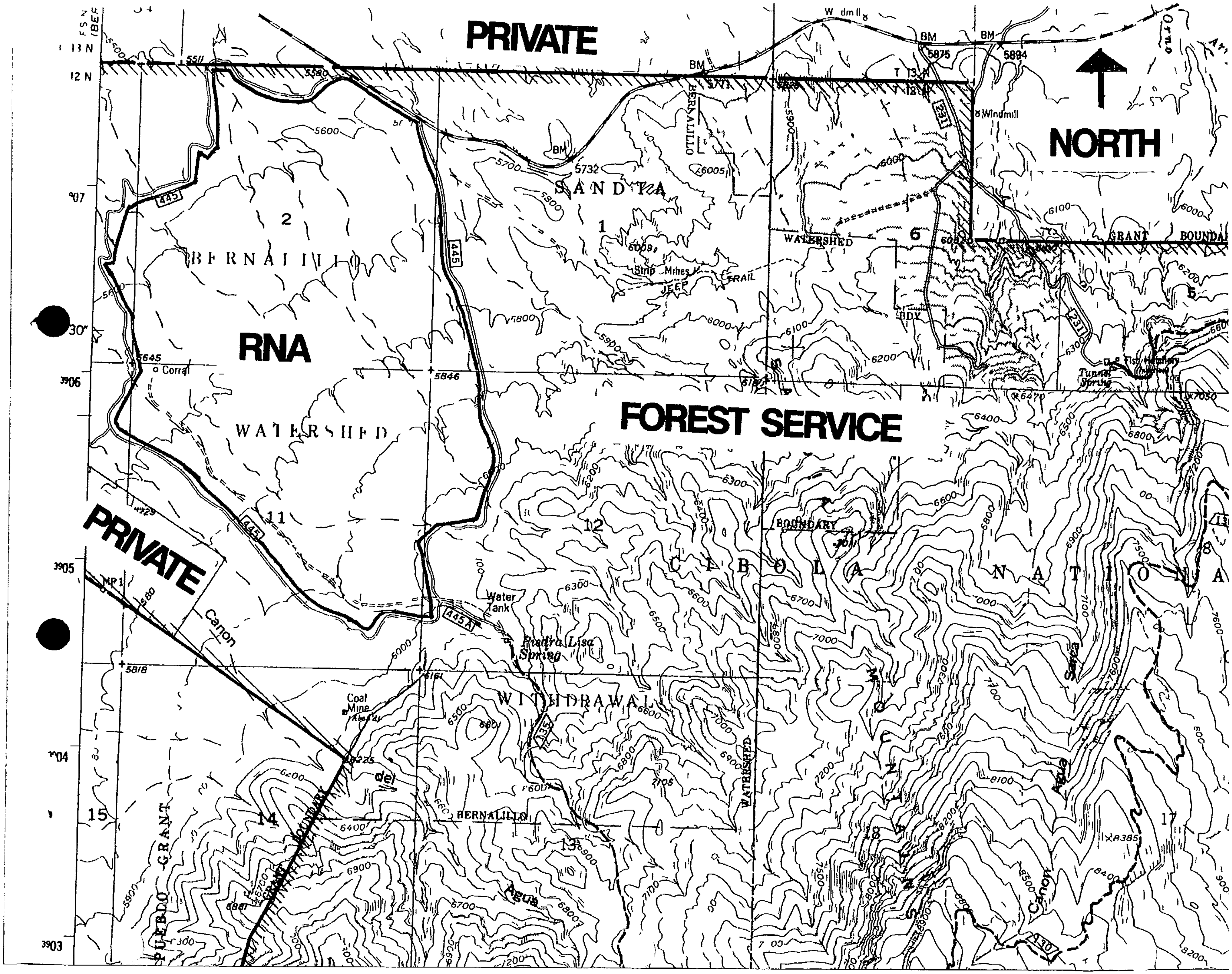


Map 1 Location of RNA (Central New Mexico)



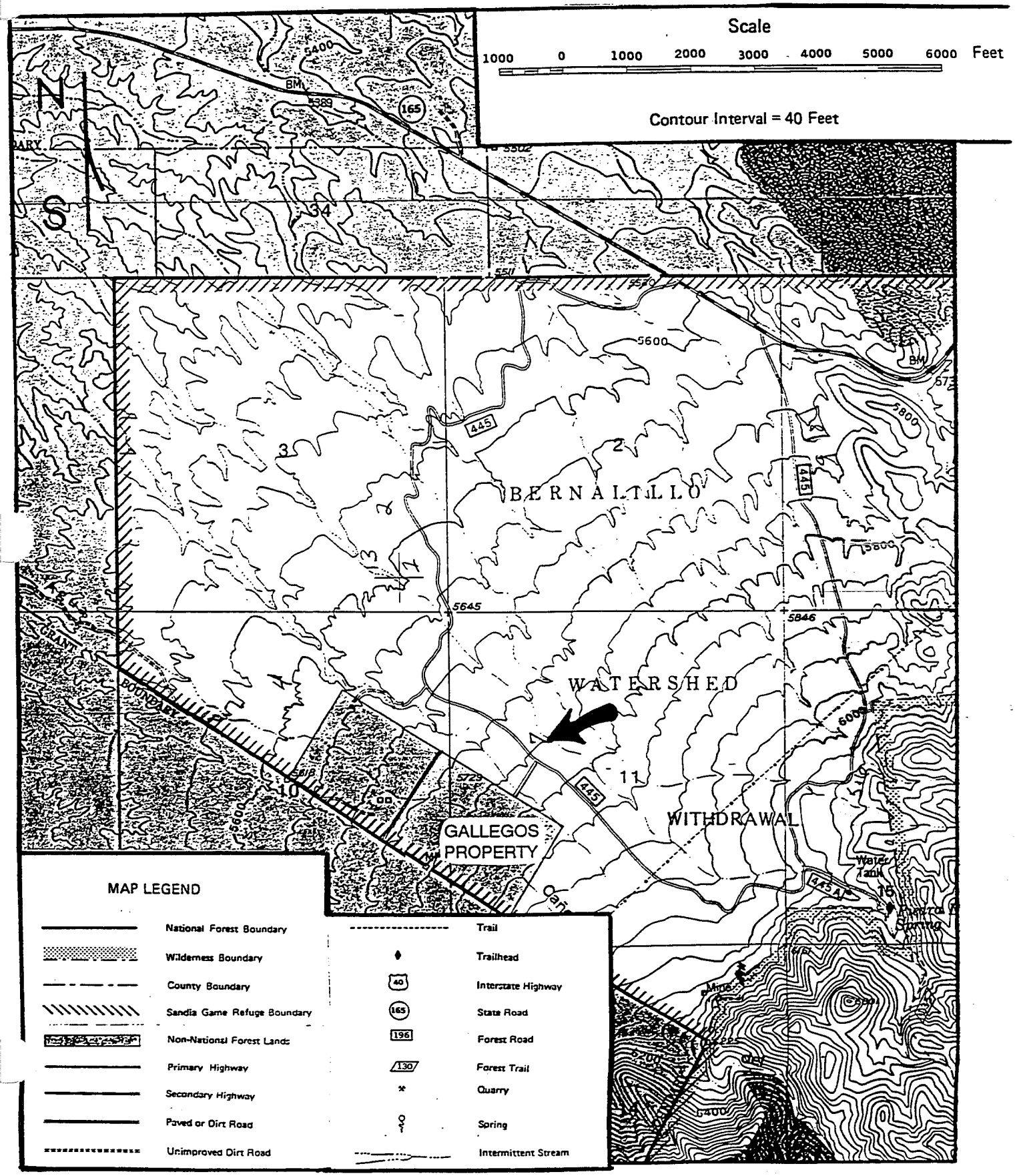
Map 2 Access Route to Bernalillo Watershed RNA


Sec 34
Sec 35
T 13 N, R 4 E
T 12 N, R 4 E
Sec 3
Sec 2
Sec 1
Sec 10
Sec 11
Sec 12
BERNALILLO WATERSHED
RESEARCH NATURAL AREA
Sandoval County, New Mexico
1030 ACRES
NM State Highway 165
Fence Line
FDR 445
HES 269
CORRAL
Road Closed
P.N.M. POWER LINE
50 Foot Right of Way
FDR 445A
Pi dra Li
North T a lhead
N
NOTES
SURVEYOR'S CERTIFICATE
I, Douglas J Williams N.M.P.L.S. No. 11964, do hereby certify that this plat represents survey conducted by me or under my direct supervision, at the request of the U.S. Department of Agriculture, Forest Service, and that it is true and correct to the best of my knowledg and belief
Douglas J Williams
New Mexico Professional Land Surveyor No. 11964
6-14-93
Date
BASES OF HEARING
The bearings of this survey are based on GPS data using the WGS 84 datum.
LEGEND
GLO/BLM BRASS CAP
N O S VERTICAL LETTERING
RETRACEMENT CALLS
0
500
1000
1500
SCALE IN FEET
U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
SOUTHWESTERN REGION
CIBOLA NATIONAL FOREST
SPECIAL AREA SITE SURVEY
BERNALILLO WATERSHED RESEARCH NATUREAL AREA
T 12 N R 4 E. N.M.P.M
SANDOVAL COUNTY NEW MEXICO



PRIVATE
NORTH
RNA
FOREST SERVICE
PRIVATE
BERNALILLO
WATERSHED
SANDIA
CIBOLA NATIONAL
WITHDRAWAL
PUEBLO GRANT
GRANT BOUNDARY
Water Tank
Piedra Lisa Spring
Coal Mine
Corral
Windmill
Strip Mines
JEEP TRAIL
Tunnel Spring
Canon

GALLEGOS ROAD
MAP OF THE PROPOSED LOCATION



PILOT WATERSHED PROJECT

COMPLETION REPORT

SANDIA MOUNTAINS TRIBUTARIES
(Bernalillo Watershed)

OF THE RIO GRANDE WATERSHED

Sandoval County, New Mexico

Prepared by

Soil Conservation Service
and
Forest Service

U. S. Department of Agriculture

Albuquerque, New Mexico
January 31, 1958

CONTENTS TABLE

PILOT WATERSHED PROJECT COMPLETION REPORT

SANDIA MOUNTAINS TRIBUTARIES
(Bernalillo Watershed)
Sandoval County, New Mexico
January 31, 1958

LOCATION AND DESCRIPTION

The project area is located in the Middle Rio Grande Basin of New Mexico on the western slope of the Sandia Mountains and bench lands east of the community of Bernalillo. The project area is 9,050 acres of which about 6,700 acres are in the flood source area, and 2,350 acres are bottom lands in the Rio Grande Valley benefitted from the project. Some 50 farms make up the valley area which is all in private ownership. Land ownership in the 6,700 acres comprising the flood source area is divided as follows: National Forest, 4,422 acres; private and State, 1,608 acres; public domain, 469 acres; and Indian, 201 acres.

Principal crops grown in the farming area include small grain, alfalfa, orchards, and vineyards. The New Mexico Timber Company, a large producer of lumber and ties, has a saw mill at Bernalillo which is the only industrial activity in this locality. Colored sections of Figure 1, Generalized Use Capability Map, show the project area.

HISTORY

The community of Bernalillo is one of the oldest settlements in New Mexico, having been occupied by some of the first Spanish settlers. Prior to that, Pueblo Indians lived in this locality. The A.T.& S.F. railroad was built through Bernalillo in 1880 and additional development has occurred since then adjacent to the railroad right-of-way. During the development of the urban and surrounding farming area no provision was made for the passage of flood runoff into the Rio Grande.

WATERSHED PROBLEMS (pre-project)

Heavy "downpours" of rain may occur on the watershed during the summer months. High intensity storms of short duration produce flash floods with high peaks but low volumes. These floods carry large quantities of debris and sediment. Unusually heavy rains and serious flash floods occur on the average of once in every three to five years. Prior to project installation, runoff from the flood source area flowed into the valley, covering highways, streets, urban property, irrigated farmland, canals, and drains with water and sediment. Adobe buildings which are prevalent in the developed area subject to inundation were especially vulnerable to damage.

Minor diversion works constructed at the lower end of the watershed above the developed area several years prior to project installation were entirely inadequate since there was no suitable point for disposal of flood runoff.

PROJECT DEVELOPMENT

This project was designated by the Chief of the Soil Conservation on August 25, 1953, as being eligible for Federal assistance in the installation of improvement measures under the Watershed Protection item in the appropriation bill for fiscal year 1954. Initially, a ceiling of $500,000 of Federal expenditure was established for this project.

During the period from September 1953 to February 1954 numerous meetings were held by the Board of Supervisors of the Santa Fe-Sandoval Soil Conservation District for the purpose of reaching an understanding with all interests concerned regarding project development. Initially, consideration was given to the inclusion of 10 floodwater retarding dams in the work plan in addition to land treatment measures planned for

National Forest and privately-owned lands.

The sponsor was unable to obtain commitments for cost-sharing funds needed to develop a work plan to include the ten structures initially considered. Commitments were obtained for local cost-sharing funds required to build one floodwater retarding dam and the work plan was completed including this structure and other program measures to be installed on National Forest and privately-owned lands.

PHYSICAL ACCOMPLISHMENTS

During the spring of 1954 the Forest Service began constructing stabilizing and sediment control structures and terraces on flat and steep slopes on the upper watershed. Some contour furrowing and pitting were also accomplished on this area. The Forest Service program also included continued exclusion of grazing on watershed lands which had been in effect since 1950. Program installation on National Forest lands was completed during the following two years except for some minor maintenance work carried out in 1957.

Land treatment measures, including range improvement, erosion control structures, land leveling, irrigation ditch and pipe line construction were installed during 1955, 1956, and 1957.

These measures were installed with technical services available through the regular program of the sponsoring soil conservation district.

The floodwater retarding dam was built during the spring and summer of 1955 and has a flood retarding capacity of 300 acre-feet.

The project was completed during fiscal year 1957 except for program evaluation which is scheduled to continue through fiscal year 1961.

Quantities of measures installed on National Forest and privately-

owned lands and cost incurred through fiscal year 1957 are shown on Table 1, Installation Cost for Total Program, dated January 2, 1958, which follows. The only costs anticipated for fiscal years 1958 through 1961 are those associated with program evaluation. Of the $14,638 shown for program evaluation, $11,200 will be utilized during fiscal years 1958 through 1961 which indicates an expenditure of $3,438 on this activity through fiscal year 1957. Of the $11,200 estimated cost of program evaluation in future years, it is anticipated that the Soil Conservation Service will utilize $10,000 and the Forest Service $1,200. Most of the funds allocated to the Soil Conservation Service will be used to reimburse the U. S. Geological Survey for inflow-outflow and sedimentation observations to be made at the floodwater retarding dam.

The total Federal cost of the program, including evaluation activities, is estimated at $148,628 of which $83,916 will be utilized on lands administered by the Forest Service.

Costs incurred by the Soil Conservation Service, exclusive of those associated with program evaluation, amount to $51,999. Contributions made toward program costs by local interests on "A" and "B" measures immediately prior to and during project installation, amount to $48,724 which represents about 49 percent of the cost of measures installed on non-Federal lands. The total Federal and non-Federal cost of program installation and evaluation is estimated at $185,502.

The program on both National Forest and privately-owned lands was carried out essentially as planned.

BENEFITS

When the work plan was developed, it was estimated that the program

Project: Sandia Mountain Tributaries (Bernalillo Watershed)

State: New Mexico

TABLE I
INSTALLATION COST

FOR Total Program

Date January 2, 1958

Measures	Unit	No. to be Applied	Estimated Cost			
			Federal	Non-Federal Public	Private	Total
A-Measures Primarily for Flood Prevention						
Soil Conservation Service						
Floodwater Retarding Structure	Each	1	$ 43,999	$6,900	$16,500	$ 67,399
SCS-Subtotal			$ 43,999	$6,900	$16,500	$ 67,399
Forest Service						
Stabilizing & Sediment Control Measures Structures	Each	410	$ 3,726			$ 3,726
Stabilization of Critical Runoff and Sediment Producing Areas:						
Special Purpose Terraces (Flat Slopes)	Mile	54.5	35,971			35,971
Special Purpose Terraces (Flat Slopes) (Maintenance Work)	Mile	6	4,500			4,500
Special Purpose Terraces (Steep Slopes)	Mile	6	12,779			12,779
Revegetation (Woody Plantings)	Acre	30	2,700			2,700
Revegetation (Grasses)	Acre	80	225			225
Gully Control	Acre	376	5,605			5,605
FS-Subtotal			$ 65,506			$ 65,506
Total A-Measures			$109,505	$6,900	$16,500	$132,905
B-Measures - for conservation of watershed lands that contribute directly to flood prevention						
Soil Conservation Service						
Land Leveling	Acre	154			$ 9,240	$ 9,240
Fencing	Mile	2.6			1,300	1,300
Irrigation Pipe Lines	L.F.	312			624	624
Small Irrigation Structures	Each	39			780	780
Improved Water Application	Acre	148			200	200
Ditch Construction	Mile	1.2			150	150
Range Improvement	Acre	680			680	680
Erosion Control Structures	Each	2			500	500
SCS-Subtotal					$13,474 1/	$ 13,474 1/
Forest Service						
Grazing Control						
Fences (Reconstruction)	Mile	6	$ 5,924			$ 5,924
Range Development and Improvement						
Contour Furrowing (Pitting)	Acre	1,153	5,550			5,550
Contour Furrowing (Chiseling)	Acre	374	1,470			1,470
Seeding Grasses	Acre	1,230	1,041			1,041
FS-Subtotal			$ 13,985			$ 13,985
Total B-Measures			$ 13,985		$13,474	$ 27,459
Total A and B Measures			$123,490	$6,900	$29,974	$160,364
Facilitating Measures						
Program Evaluation SCS & FS			$ 14,638 2/			$ 14,638
Work Plan Development SCS			8,000			8,000
Work Plan Development FS			2,500			2,500
Summary						
Total Watershed Protection Program SCS			$ 64,712	$6,900	$29,974	$101,586
Total Watershed Protection Program FS			$ 83,916			$ 83,916
Grand Total Watershed Protection			$148,628	$6,900	$29,974	$185,502
[illegible] Program (SCS)			$ 625			$ 625
[illegible] Program (FS)						
[illegible]						
Training Program (Extension Service)			$ 1,180	$1,180		$ 2,360

1/ Estimated that $2,750 of this amount will be provided by ACP Cost Sharing Assistance

2/ $1,713 - SCS; $1,925 - FS.

UNITED STATES
DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ALBUQUERQUE, N. M.

would provide flood damage reduction benefits and conservation benefits in the amounts of $9,990 and $3,460 respectively. As a result of the recent construction of the four-lane highway (U.S. 85) across the former floodplain below the floodwater retarding structure, the value of lands adjacent to the highway in the protected zone has increased immensely for use as business property. Also, the cost of drainage structures under this new highway was reduced by as much or more than $20,000.

The A.T.& S.F. Railway which experienced frequent delays in traffic through this zone prior to the construction of the dam and installation of other program measures, has not had similar experiences since the program was installed.

The flood threat to valuable farmland, urban property, the railroad, roads and associated property has been removed and it would appear that original benefit estimates were highly conservative.

TECHNICAL EVALUATION

The land treatment measures installed on upper watershed lands by the Forest Service have demonstrated the effectiveness of the measures in improving vegetative cover, reducing erosion and sediment movement downstream into the floodwater retarding structure and areas not protected by the retard dam. The overall project has served as a "pilot" project in the truest sense of the word since people have come to the area from all parts of the State to view the structures and measures established. It has helped in developing interest in the P.L. 566 small watershed program and served as a training vehicle for Soil Conservation Service and Forest Service personnel and the local sponsor in program planning and execution. It is the general consensus that a well

balanced program was installed that will provide lasting benefits in the years to come.

EVALUATION OF LOCAL COOPERATION

The Board of Supervisors of the Santa Fe-Sandoval Soil Conservation District has provided outstanding leadership in carrying this project forward to completion.

During public meetings project objectives were explained and agreement was reached on the program which local interests could support with cost-sharing funds. Monetary contributions toward the construction cost of the floodwater retarding structures were made by the A.T.& S.F. Railway and New Mexico Timber Company. The City of Bernalillo executed a joint agreement with the Santa Fe-Sandoval Soil Conservation District to assume maintenance responsibility for the structure.

The sponsor experienced considerable difficulty in obtaining an easement on one piece of property required for the dam and reservoir site. Local interests worked together in resolving this problem.

The district supervisors and people throughout the area benefitted are pleased with the project as completed. No runoff into the retarding structure occurred during 1957, but in 1956 the structure controlled runoff from a storm that occurred on July 19th which would have caused extensive damage had not the structure been in place to provide protection.

Land treatment and stabilization measures installed on National Forest lands have performed very satisfactorily with a minimum amount of maintenance.

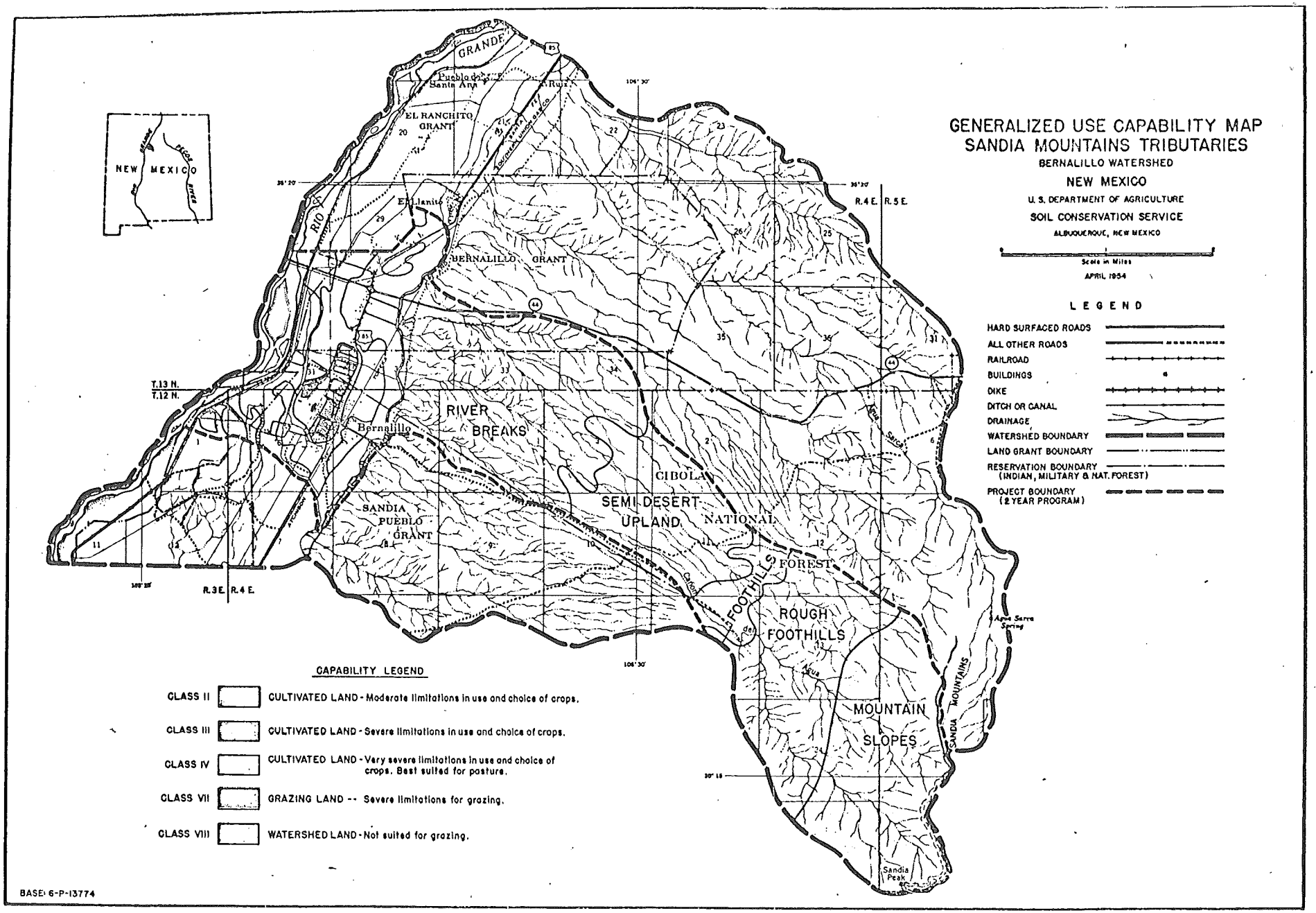

GENERALIZED USE CAPABILITY MAP
SANDIA MOUNTAINS TRIBUTARIES
BERNALILLO WATERSHED
NEW MEXICO
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ALBUQUERQUE, NEW MEXICO
Scale in Miles
APRIL 1954
LEGEND
HARD SURFACED ROADS
ALL OTHER ROADS
RAILROAD
BUILDINGS
DIKE
DITCH OR CANAL
DRAINAGE
WATERSHED BOUNDARY
LAND GRANT BOUNDARY
RESERVATION BOUNDARY (INDIAN, MILITARY & NAT. FOREST)
PROJECT BOUNDARY (2 YEAR PROGRAM)
NEW MEXICO
RIO GRANDE
Pueblo of Santa Ana
EL RANCHITO GRANT
BERNALILLO GRANT
Bernalillo
RIVER BREAKS
SANDIA PUEBLO GRANT
CIBOLA
SEMI-DESERT UPLAND
NATIONAL FOREST
FOOTHILLS
ROUGH FOOTHILLS
MOUNTAIN SLOPES
SANDIA MOUNTAINS
Agua Sarca Spring
Sandia Peak
T.13 N.
T.12 N.
R.3E.
R.4 E.
R.5 E.
CAPABILITY LEGEND
CLASS II CULTIVATED LAND - Moderate limitations in use and choice of crops.
CLASS III CULTIVATED LAND - Severe limitations in use and choice of crops.
CLASS IV CULTIVATED LAND - Very severe limitations in use and choice of crops. Best suited for pasture.
CLASS VII GRAZING LAND -- Severe limitations for grazing.
CLASS VIII WATERSHED LAND - Not suited for grazing.
BASE: 6-P-13774
A&R-SCS-ALBUQUERQUE, N. MEX. N 818 APRIL 1954

Figure 1

APPENDIX

PILOT WATERSHED PROJECT

COMPLETION REPORT

SANDIA MOUNTAINS TRIBUTARIES
(Bernalillo Watershed)

OF THE RIO GRANDE WATERSHED

Sandoval County, New Mexico

The Bernalillo "Land Treated"

Watershed in Action

by

E. J. Dortignac, Leader, Forest Service,
Albuquerque Unit, Rocky Mountain Forest
& Range Experiment Station, Forest Service

and

Harlan Johnson, Ranger, Forest Service,
Tijeras District, Cibola National Forest

On July 27, 1955, the Bernalillo watershed was subjected to a series of intense rainstorms. These storms occurred during three distinct or separate periods:

Time Interval		Duration
3:40 AM to 7:00 AM	--	3 hours and 20 minutes
12:00 Noon to 1:00 PM	--	1 hour
3:30 PM to 4:35 PM	--	1 hour and .5 minutes

Yet, 96 percent of the total rainfall occurred in four hours' time: 140 minutes in the first storm; 60 minutes in the second; and 40 minutes in the final storm period as shown in Table 1.

Antecedent rainfall (measured by the recording gage) during June and July is given in Table 2. The June 13th and July 11th storms were the largest summer storms between May 1954 and July 26, 1955, occurring on the treated Bernalillo watershed. A memorandum by Ranger Harlan Johnson, dated July 13th, reports his examination of the watershed shortly after the July 11th storm.

The July 27th storm which fell between 3:40 and 7:00 AM was the same storm that caused more than $1 million flood damage in the Albuquerque flood plain zone. As shown in Table 1, the high intensities occurring in the first storm burst of one hour's duration accounted for 0.66 inch of rain.

Another high intensity period occurred between 12 noon and 12:45 PM accounting for three-fourths of an inch of rainfall.

Some idea of the rainfall pattern by storm periods over the treated and untreated watershed on National Forest land is given in Table 3.

A map of the Bernalillo watershed showing rain gage locations follows Table 3.

The approximately 1,300 acres of National Forest land treated with terraces, pitting and chiseling proved very effective during this July 27th storm period. Very little surface runoff reached the partially constructed Soil Conservation Service Dam. The runoff (less than two acre feet) that reached the dam was contributed from a small area directly above this structure; the major portion, no doubt, from the channel itself.

Between 2 and 2:30 PM, it was estimated that the maximum discharge of any of four drainages (arroyos) was about 10 second-feet. None of this flow, however, reached the dam; being absorbed in the channel sands and gravel in transit downstream. All of the runoff in the drainages originated in the Front Range above the treated mesa land. No surface runoff was contributed from the treated mesa land nor from the steep terraced foothills during any rain falling on July 27th.

A birds-eye view of the effectiveness of the structures in holding back runoff water is shown in Figure 2 (Completion Report). A close-up view of terraces partially filled with water on the steeply sloping land of the foothills is given in Figure 3 (Completion Report). A close inspection of these structures between 1 and 1:30 PM after the second storm period indicated they were very effective in holding back all of the water that fell on this treated zone. There were no failures in the examined terraces and it was estimated that an additional inch of rainfall could have been safely stored. The maximum depth of standing water measured in these terraces was 15 inches and in a few terraces only a few inches depth of water remained. It was noted that runoff occurred between terraces (untreated zone) in about a half dozen places in sufficient quantity to cause soil erosion and rilling. Yet, water and washed soil were trapped in these basins.

In checking the performance of structures on the lower mesa land between 1:30 and 2:30 PM a number (about 10) structural failures (mainly terraces) were noted. In most cases, the cause of failure was due to inadequate earth-fill on downslopes or inability to remain on the contour. Most failures occurred adjacent to the road resulting in water flowing down the road system. However, this runoff water was trapped in the lower elevation terraces. We were able to check all of the "breaks" by hand shoveling within less than one-half hour, which emphasizes the minor extent of damages.

Standing water in terraces between 1:30 and 2:00 PM measured from 8 to 15 inches in depth but the most frequent depth of water varied between 11 to 13 inches.

Standing water in the small basins or pits prepared with the eccentric disc varied from 1 to 2-1/2 inches between 1 PM and 2 PM with the average depth about 1-3/4 inches (Figure 4 - Completion Report). An idea of the infiltration rate in these pits is given by the depth of soil wetting in the pits as contrasted to intervening untreated mesa land. The average depth of wetting on the untreated land was about 8 inches; whereas, moisture penetrated about 7 or 8 inches below the soil surface in the pits. In other words, the infiltration rate in the pits almost equalled that on untreated land. In addition, pits held from 1-1/2 to 2 inches additional water. It may be well to mention here that depth of moisture penetration in the pits was effected by rainfall antecedent to the July 27th storm.

The disc pitted zone was filled to near capacity immediately following the second storm period and could have held only a little more water. However, by 3:30 PM, two hours and a half later, these small basins were able to hold an additional 0.38 inch of rain that fell in one hour's time at intensities of 1.4, 0.6 and 0.2 inches per hour (see Table 1).

The effectiveness of the "chiseled" land is shown in Figure ~~6~~ 9 (completion report) This photo taken about one-half hour after termination of the second storm period contrasts the performance of these two types of treatment. Pits shown between the chiseled zone held between 1 and 2 inches of water and were unable to temporarily store much more water at this time. In contrast, the "chiseled" soil prepared with a "ripper" (similar to a subsoiler) had absorbed all of the rain and runoff water and was in a position to absorb additional quantities of water. The high rate of water absorption in the chiseled soil is further evidenced by the depth of moisture penetration as measured between 1:30 and 2:15 PM. Moisture in chiseled soil penetrated from 13 to 17 inches below the soil surface with the most frequent depth encountered between 14 and 15 inches. The soil was extremely porous and it easily absorbed the high intensity rain occurring later in the afternoon.

To date, there has been no evidence of sealing of the soil surface on chiseled areas through rainfall impact. As shown in Tables 1 and 2, a considerable portion of the July rainfall has been received at high intensities.

It should be mentioned, here, that one of the main reasons why the land treatment measures are performing so well on the Bernalillo watershed is due to removal of livestock from the watershed in 1950. Protection from grazing during the past five years has resulted in an increased porosity in the surface soil. The porous nature of the upper inches of soil was extremely apparent while walking over the area after the second and third storm periods.

Under grazing by livestock, the upper inches of soil would become compacted with reduced infiltration rates, capacities of pits and terraces would be reduced and chiseled areas might become sealed at the surface, reducing their effectiveness.

It is estimated that over 200 acre-feet of water was retained on the 1,300 acres of treated land. This amount of water approaches the designed capacity of the Soil Conservation Service Dam which is 300 acre-feet.

Table 1. Bernalillo Watershed Rainfall Intensities on July 27, 1955.

Rain Gage No. 1 - Recording

Time	Duration		Amount of Ppt.	Intensity	Cumul. Storm Total	Cumul. Daily Total
	Mins.	Hrs.	In.	In./Hr.	In.	In.
3:40 A	-					
3:42 A	2	.033	.11	3.30	.11	.11
3:50 A	8	.13	.05	.38	.16	.16
4:25 A	35	.58	.22	.38	.38	.38
4:40 A	15	.25	.15	.60	.53	.53
4:45 A	5	.08	.13	1.56	.66	.66
6:00 A	75	1.25	.50	.40	1.16	1.16
7:00 A	60	1.00	.09	.09	1.25	1.25
12 N	-					
12:05 P	5	.08	.17	2.04	.17	1.42
12:15 P	10	.17	.23	1.38	.40	1.65
12:30 P	15	.25	.10	.40	.50	1.75
12:40 P	10	.17	.13	.77	.63	1.88
12:45 P	5	.08	.12	1.44	.75	2.00
1:00 P	15	.25	.05	.20	.80	2.05
3:30 P	-					
3:50 P	20	.33	.05	.15	.05	2.10
4:15 P	-					
4:25 P	10	.17	.10	.60	.10	2.20
4:35 P	10	.17	.23	1.38	.33	2.43

Table 2. Bernalillo Watershed Rainfall Intensities by Storms (6/1/55 to 7/27/55)

Rain Gage No. 1 - Recording

Time	Duration Mins.	Duration Hrs.	Amount of Ppt. In.	Intensity In/hr.	Cumul. Storm Total In.
1955					
June 13					
6:55 P					
7:08 P	13	.217	.12	.55	.12
7:39 P	31	.516	.08	.15	.20
7:47 P	8	.133	.10	.75	.30
7:58 P	11	.183	.06	.32	.36
8:05 P	7	.117	.06	.51	.42
8:10 P	5	.083	.03	.36	.45
8:15 P	5	.083	.05	.60	.50
July 4					
2:30 P					
2:40 P	10	.167	.18	1.08	.18
July 6					
1:50 P					
2:20 P	30	.500	.05	.10	.05
2:45 P					
3:05 P	20	.333	.02	.06	.07
July 11					
1:25 P					
1:35 P	10	.167	.40	2.40	.40
1:40 P	5	.083	.10	1.20	.50
July 14					
3:40 P					
3:45 P	5	.083	.15	1.80	.15
3:50 P	5	.083	.05	.60	.20
July 18					
10:45 P					
10:50 P	5	.083	.20	2.40	.20
July 25					
8:10 P					
8:20 P	10	.167	.06	.36	.06

Table 3. Rainfall Totals by Storm Periods on July 27, 1955 over the Upper Bernalillo Watershed.

Rain Gage No. 1/	Type	Location	Elevation (Approx.)	Storm Period - 7/27/55			
				First	Second	Third	Total
			Feet	Inches	Inches	Inches	Inches
1	Recording	Base of Front Range	6,000	1.25	0.80	0.38	2.43
2	Standard	Alluvial Fan (North)	5,600	1.12	0.50	0.42	2.04
3	Standard	Alluvial Fan (South)	5,500	1.24	← 0.18 →		1.42
4	Standard	Front Range	7,000	1.86	← 0.50 →		2.36
-	Recording	Sandia Crest	10,675	2.25	← 0.90 2/ →		3.15

1/ See map for location.

2/ 10:30 AM - 11:00 AM = 0.20"
11:00 AM - 5:30 PM = 0.30"
5:30 PM - 6:00 PM = 0.40"

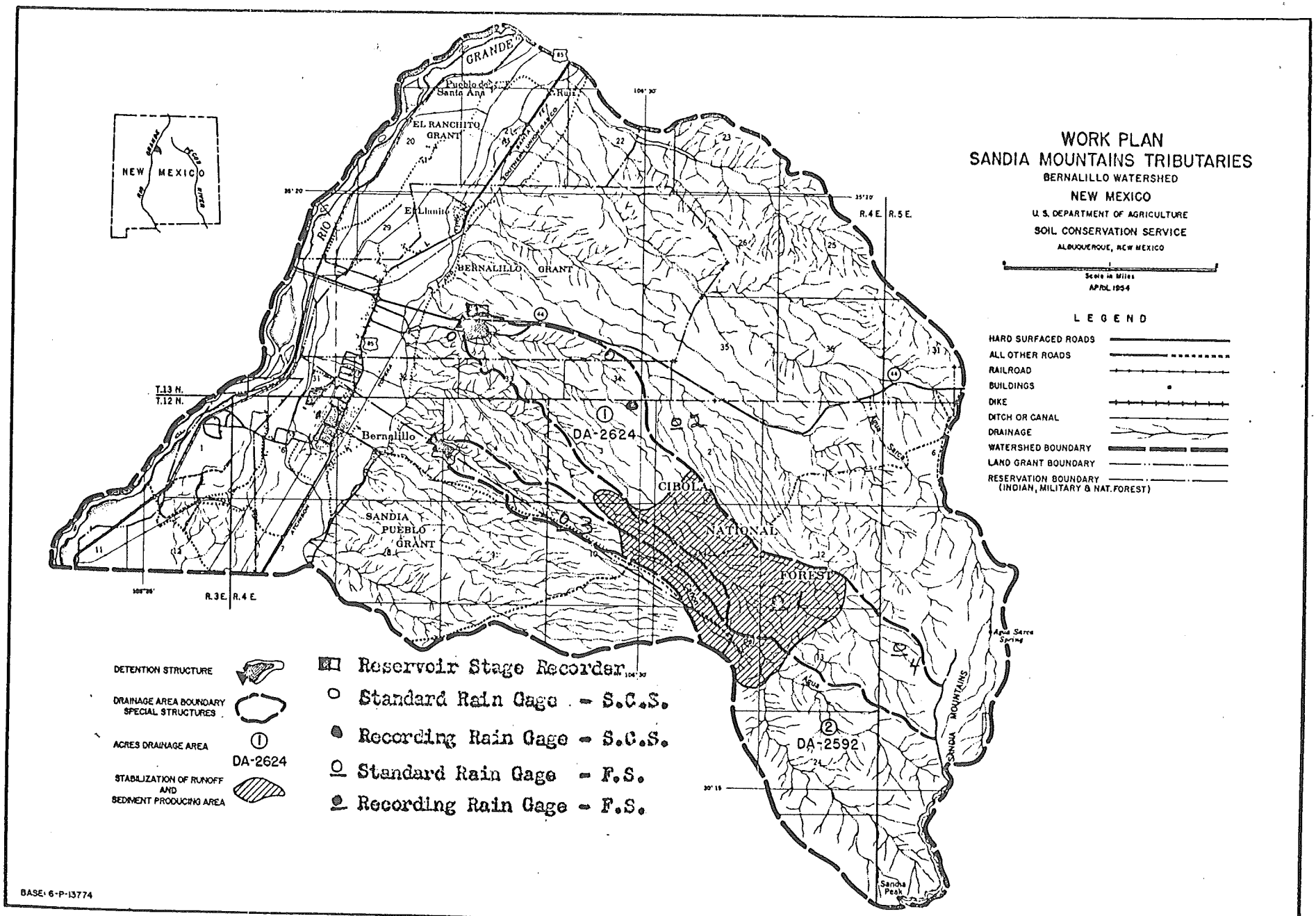


Figure 3

AGR-SCS-ALBUQUERQUE, N. MEX. M 816 APRIL 1954

Albuquerque, New Mexico
February 18, 1957

ANNUAL REPORT

EVALUATION STUDIES

SANDIA MOUNTAINS TRIBUTARIES (BERNALILLO WATERSHED)

of

The Rio Grande Watershed, Sandoval County, New Mexico

This is the report for 1956 on evaluation studies being carried out on the Sandia Mountains Tributaries.

Structural Measures

All structural measures that were planned have been constructed. This includes one earth fill floodwater retarding dam, with a four wire barbed wire fence around the dam and emergency spillway, and a mesh wire screen around the ungated riser to prevent clogging of ports where the water enters. A Stevens water-stage recorder has been located near the riser at the inlet end of the principal spillway. Seven rain gages have been located on the watershed area or very near the boundary of the area. Five of the gages are standard type and two are recording type. The U. S. Forest Service owns four of the gages, three standard and one recording, while the Soil Conservation Service owns the other three. All of the gages are read, and rainfall data tabulated by Soil Conservation Service personnel.

A permanent grid system has been established on the reservoir area so that accurate amounts of water and/or sediment can be determined when desired.

Information and Evaluation

The U. S. Geological Survey, under an agreement with the Soil Conservation Service, has performed the following items of work during the past year in connection with the information and evaluation studies.

1. Checked, maintained and operated the Stevens Water Level Recorder and supplied the necessary charts for it.

2. Measured the discharge at the outlet of the dam and related the actual discharge to the theoretical discharge.

3. Computed inflow into the reservoir from the water level recorder graph and reservoir capacity table, and prepared hydrographs, field data and forms as requested.

4. Constructed a sediment-load station on the outlet end of the principal spillway, and obtained inflow and outflow samples to determine trap efficiency of the reservoir.

The recording of evaluation information has thus been started.

A report on a storm which occurred July 19, 1956, has been sent previously. This report covered the damage done and what probably would have been done had not the installation been made. It also gave amounts of rainfall, run-off and sedimentation that occurred. This is the only storm of any consequence that has occurred on the watershed since the works were completed.

Land Treatment Measures

Of the total of 4.1 square miles of area in the watershed, approximately 2.0 square miles were treated with various types of land treatment measures. The remaining 2.1 square miles were not suitable for treatment. All of the land treatment was done on Forest Service land by the Forest Service.

The various measures and the approximate amounts of each are as follows:

Stabilizing Structures	410 each
Woody Plantings	30 acres
Terraces (flat slope)	54.5 miles
Terraces (steep slope)	6 miles
Revegetation (grasses)	80 acres
Gully Control	376 acres
Pitting	1153 acres
Chiseling	374 acres
Seeding Grasses	1230 acres
Fences	6 miles

The Forest Service maintains total exclusion of livestock on all of its land on the watershed which amounts to 3.0 square miles out of the total of 4.1.

The grass in the reseeded and revegetated areas has made satisfactory growth, however, and the other measures were no doubt effective in retarding the run-off. The only storm of any consequence on the watershed since the works have been completed produced a rainfall of 1.87 inches (avg.) in one hour over the entire area and the runoff was 0.29 inches. If the land treatment work had not been done, the runoff would have been much greater. In addition to the land treatment measures enumerated, the Forest Service has established nine range transects and a number of camera points. These transects are marked with steel stakes so they can be located. The transects are installed in various areas so that the effects on vegetation of different kinds of land treatment can be checked and compared with vegetative conditions in areas that were not treated.

Maintenance

A small amount of damage was done the first year of operation to some of the land treatment measures, such as stabilizing structures, terraces and gully plugs. The damages were not severe, however, and immediate repairs were made by the Forest Service.

A small amount of erosion has occurred on the side slopes of the retarding dam, but not enough to warrant maintenance work at the present time. A hole has been made at the outlet end of the principal spillway by the discharge of water through it. This was expected however since the outlet is of the cantilever type. It is impossible to say at the present time how far this will head-cut back towards the dam and at what rate. The condition will be observed closely, however, and if it appears to be progressing and increasing in size too rapidly, maintenance measures will be taken by the District.

Conclusion

We are of the opinion the project has proven satisfactory thus far. The watershed is typical of others within the State on which we work in respect to size, soil conditions, and vegetative cover. We are therefore very much interested in securing the type of information we are now getting from this station. It is not only of value to the Soil Conservation Service and the Forest Service, but to many other agencies as well.

Albuquerque, New Mexico
February 7, 1958

Prepared by:
Fletcher L. Short,
Engineer, SCS

ANNUAL REPORT
EVALUATION STUDIES

SANDIA MOUNTAIN TRIBUTARIES
(Bernalillo Watershed)
of
The Rio Grande Watershed, Sandoval County, New Mexico

This is the report for 1957 on the evaluation studies of Sandia Mountain Tributaries (Bernalillo Watershed) Pilot Watershed Protection Project in New Mexico. The first annual evaluation report for this project was submitted for the calendar year 1956. A special storm report was also submitted in July 1956.

Structural Measures

All structural measures that were planned have been constructed. They were described in the report for 1956.

Land Treatment Measures

Of the total of 4.1 square miles of drainage area in the watershed, approximately 2.0 square miles were treated with various types of land treatment measures. The remaining 2.1 square miles were not suitable for treatment. All of the land treatment was done on Forest Service land by the Forest Service. Land treatment measures were described in the report for 1956. The Forest Service continues to maintain total exclusion of livestock on all of its land on the watershed which amounts to 3.0 square miles out of a total of 4.1 square miles.

Information Evaluation

The U. S. Geological Survey, under an agreement with the Soil Conservation Service, has performed the following items of work since the project was completed.

1. Checked, maintained, and operated the Stevens Water Level Recorder, and supplied the necessary charts for it.

2. Measured the discharge at the outlet of the dam and related the actual discharge to the theoretical discharge.

3. Computed inflow into the reservoir from the water level recorder graph and reservoir capacity table, and prepared hydrographs, field data, and forms, as requested.

4. Obtained inflow and outflow samples to determine trap efficiency of the reservoir.

Only a very small amount of runoff occurred from the drainage area into the reservoir in 1957. Personnel of the Geological Survey on two or three occasions during the year succeeded in measuring some very small amounts of inflow and outflow. Results have not yet been submitted, but it is believed they will not show any worth while data for 1957.

The information being submitted at this time was compiled for the year 1956, and is based on surveys made by the Soil Conservation Service, and measurements made by the Geological Survey. It was not available at the time the previous report was made, so is being submitted now.

Maintenance

The Forest Service has maintained the land treatment measures constructed on its land. Such measures as stabilizing structures, terraces, water-spreading dikes and gully plugs, are in good condition.

There is no damage to the retarding dam that would warrant maintenance work at this time.

Conclusion

A start has been made in obtaining precipitation, runoff, sedimentation, and trap efficiency data. As time goes on, this will become increasingly more valuable to us in the planning offlood control and watershed protection projects.

The land treatment practices have been successful, and grasses in the reseeded areas have made a good growth.

Albuquerque, New Mexico
February 7, 1958

Prepared by:
Fletcher L. Short,
Engineer

EVALUATION STUDIES

SANDIA MOUNTAIN TRIBUTARIES
(Bernalillo Watershed)

Bernalillo Floodwater Retarding Dam No. 1

S U M M A R Y

Date of Survey	January 9, 1957
Original Capacity of Reservoir	320 Ac. Ft.
Period of Record	1.75 Years
Inflow to Reservoir to Date	73.7 Ac. Ft.
Sediment Inflow to Reservoir, to Date	11.69 Ac. Ft.
Sediment Inflow to Reservoir, to Date	16.0 percent of Total Volume
Sediment Deposited in Reservoir Between Surveys	11.40 Ac. Ft.
Sediment Deposited in Reservoir Between Surveys	24,339 Tons
Accumulative Deposition to Date	11.40 Ac. Ft.
Accumulative Deposition to Date	24,339 Tons
Sediment Carried Through Principal Spillway, to Date	.29 Ac. Ft.
Sediment Carried Through Principal Spillway, to Date	613 Tons
Trap Efficiency of Reservoir	97.5 percent
Capacity Loss to Sediment, to date	3.56 percent
Rate of Deposition in Reservoir	1.60 Ac. Ft. per Sq. Mi. per Year
Rate Delivered to Reservoir	1.63 Ac. Ft. per Sq. Mi. per Year
Average Dry Weight of Sediment	98.05 Lbs. per Cu. Ft.

Total precipitation for 1956 is not known. The data shown above resulted almost entirely from the runoff from one storm which produced 1.87 inches rainfall within one hour.

SANDIA MOUNTAINS TRIBUTARIES (BERNALILLO WATERSHED) PROJECT

Analyses by Geological Survey,
United States Department of the Interior
(parts per million)

LABORATORY NUMBER	34290	34291	34293	34292	34294
Date of collection	7/19/56 8:40 pm	7/20/56 2:00 am	8/2/56 4:55 pm	8/2/56 9:30 pm	8/2/56 5:40 pm
Calcium (Ca)	44	38	39	54	58
Magnesium (Mg)	5.7	3.8	5.0	6.2	6.2
Sodium (Na)	8.1	7.8	6.0	13	9.0
Dissolved Solids Residue on evaporation at 180° C	206	176	183	248	272
Hardness as $CaCO_3$	134	110	118	160	170
Specific Conductance (michromhos at 25°C)	288	253	260	362	397
pH	7.8	8.3	7.8	8.3	8.0
Percent Sodium	12	13	10	15	10
Sodium Adsorption Ratio	.3	.3	.2	.5	.3

Lab. No. 34290. Location: Piedra Lisa Arroyo (Bernalillo Reservoir No. 1) near Bernalillo, N.M. Sandia Mountain Tributaries (Bernalillo Watershed) Project.

Lab. No. 34291. Location: Piedra Lisa Arroyo (Bernalillo Reservoir No. 1) near Bernalillo, N.M. Sandia Mountain Tributaries (Bernalillo Watershed) Project.

Lab. No. 34293. Location: Piedra Lisa Arroyo (Bernalillo Reservoir No. 1) near Bernalillo, N.M. Sandia Mountain Tributaries (Bernalillo Watershed) Project.

Lab. No. 34292. Location: Piedra Lisa Arroyo (Bernalillo Reservoir No. 1) near Bernalillo, N.M. Sandia Mountain Tributaries (Bernalillo Watershed) Project.

Lab. No. 34294. Location: Piedra Lisa Arroyo (Bernalillo Reservoir No. 1) near Bernalillo, N.M. (Inflow from south tributary.) Sandia Mountain Tributaries Project (Bernalillo Watershed).

UNPUBLISHED RECORDS, SUBJECT TO REVISION

COPY
2/7/58

UNITED STATES DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY WATER RESOURCES DIVISION
Piedra Lisa Arroyo (Bernalillo Reservoir No. 1) Near Bernalillo, N. Mex.
SANDIA MOUNTAIN TRIBUTARIES (BERNALILLO WATERSHED) PROJECT
Particle - size analyses of suspended sediment, water year October 1955 to September 1956
(Methods of analysis: B. bottom withdrawal tube; D, decantation; P, pipette; S, sieve; N, in native
W, in distilled water; C, chemically dispersed; M, mechanically dispersed; V, visual accumulation

Date	Time	Water Discharge (cfs)	Water Temperature (°F)	Suspended Sediment: Concentration of Sample (ppm)	Suspended Sediment: Concentration of Suspension Analyzed (ppm)	Suspended Sediment: Percent finer than indicated size: 0.002	0.004	0.008	0.016	0.031	0.062	0.125	C
					OUTFLOW								
7/19/56	8:40 pm	47	53	16,700	3,720	5	22	68	05	100	--	--	
7/19/56	8:40 pm	47	53	16,700	3,120	44	62	81	95	99	100	--	
7/20/56	2:00 am	41	52	2,820	2,600	8	32	99	100	--	--	--	
7/20/56	2:00 am	41	52	2,820	2,460	87	97	99	99	99	100	--	
8/2/56	4:55 pm	23	66	10,700	4,020	4	19	74	96	99	100	--	
8/2/56	4:55 pm	23	66	10,700	3,950	49	69	86	97	100	--	--	
8/2/56	9:30 pm	13	66	6,400	4,100	4	17	29	39	59	85	97	
8/2/56	9:30 pm	13	66	6,400	3,820	30	35	42	48	62	85	97	
					INFLOW								
8/2/56	5:40 pm	20	--	238,000	4,210	2	8	21	29	39	53	62	
8/2/56	5:40 pm	20	--	238,000	4,180	15	18	24	29	38	53	62	

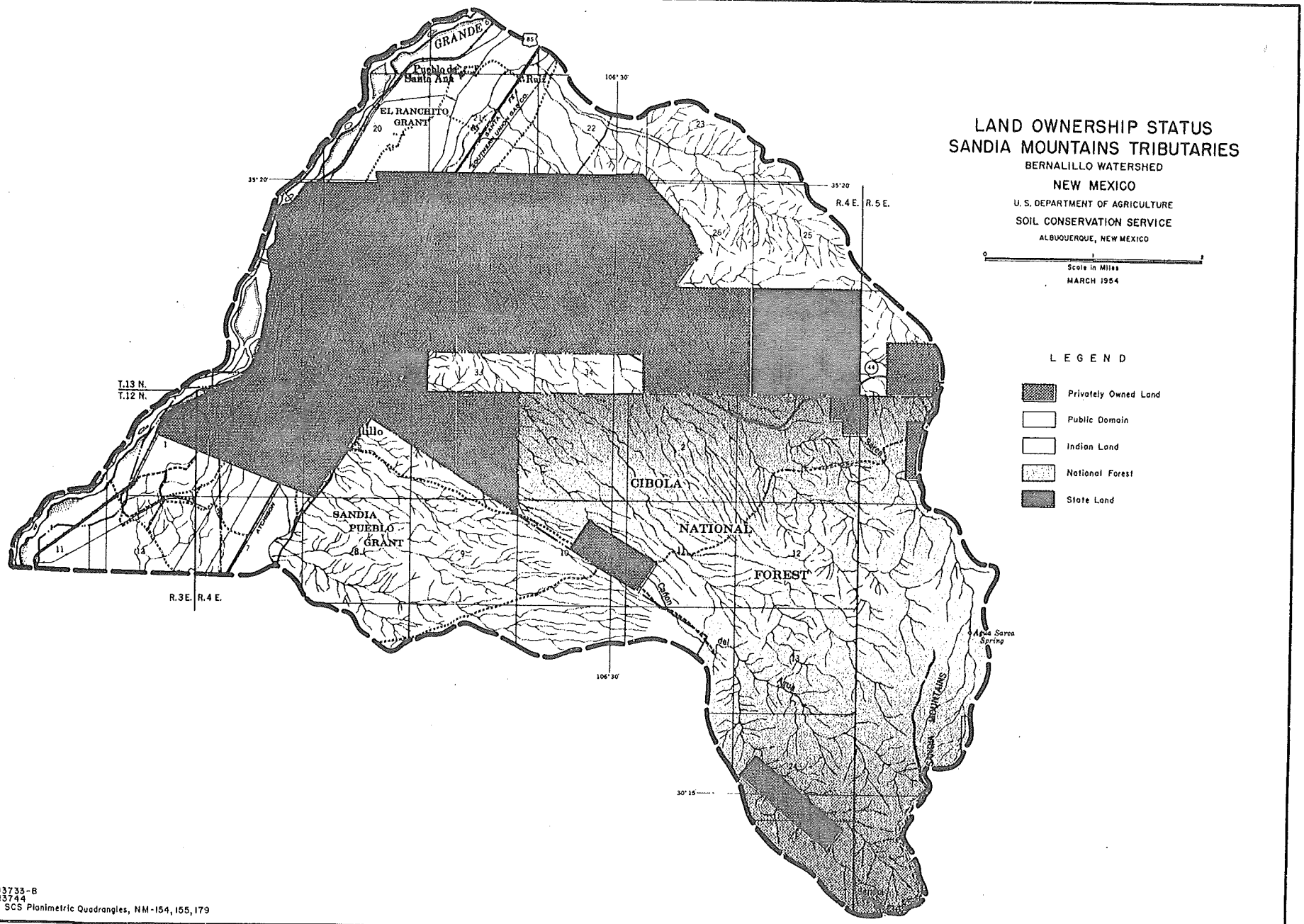
UNPUBLISHED RECORDS, SUBJECT TO REVISION

UNITED STATES DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY WATER RESOURCES DIVISION
Piedra Lisa Arroyo (Bernalillo Reservoir No. 1) Near Bernalillo, N. Mex.
SANDIA MOUNTAIN TRIBUTARIES (BERNALILLO WATERSHED) PROJECT
:le - size analyses of suspended sediment, water year October 1955 to September 1956
alysis: B. bottom withdrawal tube; D, decantation; P, pipette; S, sieve; N, in native water;
lled water; C, chemically dispersed; M, mechanically dispersed; V, visual accumulation tube)

Water Tempera-ture (°F)	Suspended Sediment: Concentration of Sample (ppm)	Concentration of Suspension Analyzed (ppm)	Percent finer than indicated size, in millimeters: 0.002	0.004	0.008	0.016	0.031	0.062	0.125	0.250	0.500	1.000	2.000	Methods of Analysis
		OUTFLOW												
53	16,700	3,720	5	22	68	05	100	--	--	--	--	--	--	SPN
53	16,700	3,120	44	62	81	95	99	100	--	--	--	--	--	SPWCM
52	2,820	2,600	8	32	99	100	--	--	--	--	--	--	--	SPN
52	2,820	2,460	87	97	99	99	99	100	--	--	--	--	--	SPWCM
66	10,700	4,020	4	19	74	96	99	100	--	--	--	--	--	SPN
66	10,700	3,950	49	69	86	97	100	--	--	--	--	--	--	SPWCM
66	6,400	4,100	4	17	29	39	59	85	97	100	--	--	--	VPN
66	6,400	3,820	30	35	42	48	62	85	97	100	--	--	--	VPWCM
		INFLOW												
--	238,000	4,210	2	8	21	29	39	53	62	67	73	79	86	(Contd)
											4.000 m.m.	8.000 m.m.	16.000 m.m.	
											94	99	100	SPN
--	238,000	4,180	15	18	24	29	38	53	62	67	73	79	86	(Contd)
											4.000 m.m.	8.000 m.m.	16.000 m.m.	
											94	99	100	SPWCM

UNPUBLISHED RECORDS, SUBJECT TO REVISION

Copied: E.R.H. 12/5/56



6-L-13733-B
6-P-13744
BASE: SCS Planimetric Quadrangles, NM-154, 155, 179

Figure 2

AGR-SCS-ALBUQUERQUE, N. MEX. M 512 MARCH 1954

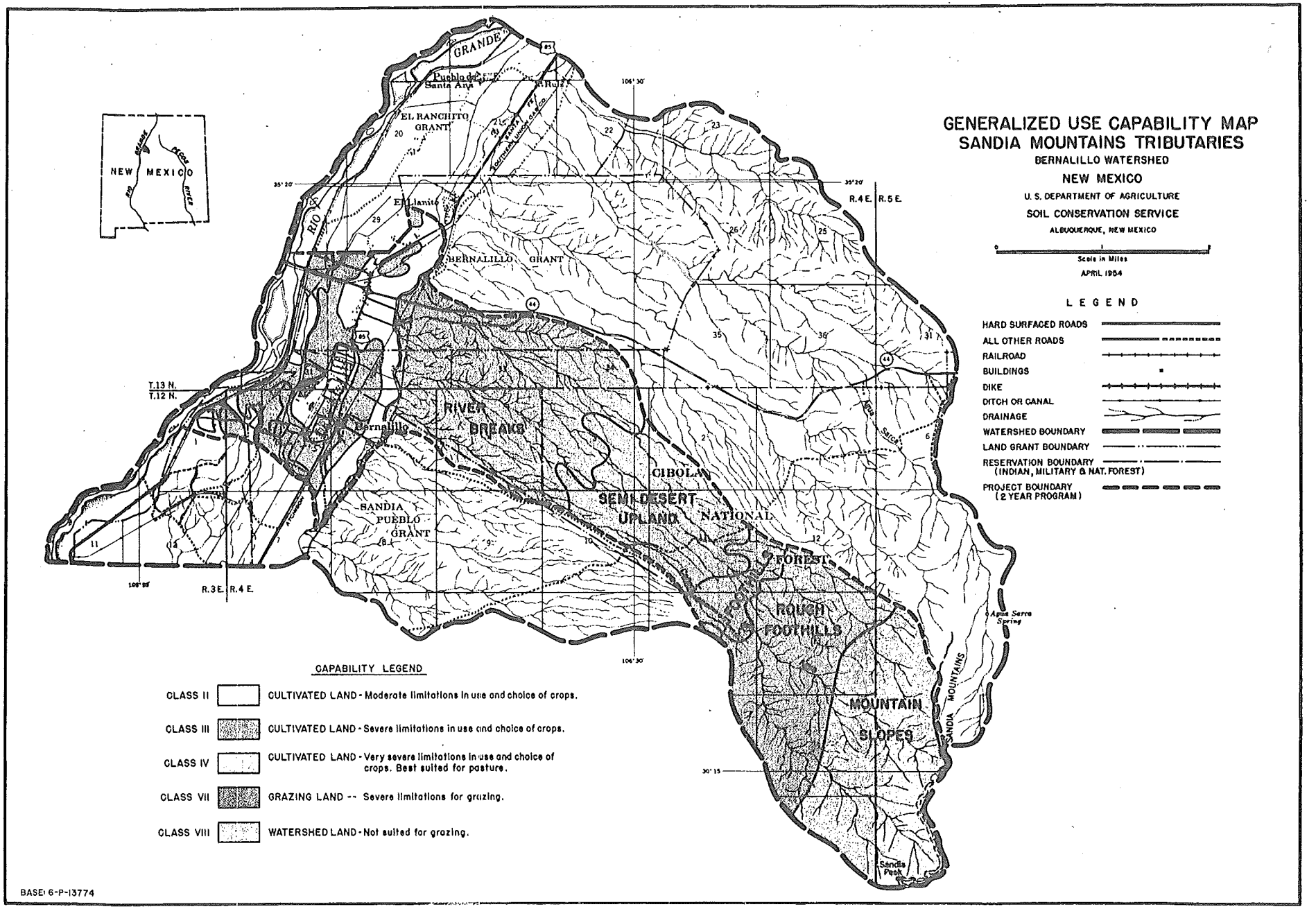

GENERALIZED USE CAPABILITY MAP
SANDIA MOUNTAINS TRIBUTARIES
BERNALILLO WATERSHED
NEW MEXICO
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ALBUQUERQUE, NEW MEXICO
Scale in Miles
APRIL 1984
LEGEND
HARD SURFACED ROADS
ALL OTHER ROADS
RAILROAD
BUILDINGS
DIKE
DITCH OR CANAL
DRAINAGE
WATERSHED BOUNDARY
LAND GRANT BOUNDARY
RESERVATION BOUNDARY (INDIAN, MILITARY & NAT. FOREST)
PROJECT BOUNDARY (2 YEAR PROGRAM)
NEW MEXICO
EL RANCHITO GRANT
BERNALILLO GRANT
SANDIA PUEBLO GRANT
RIVER BREAKS
CIBOLA NATIONAL FOREST
SEMI-DESERT UPLAND
ROUGH FOOTHILLS
MOUNTAIN SLOPES
SANDIA MOUNTAINS
Agua Serra Spring
Sandia Peak
T.13 N.
T.12 N.
R.3 E.
R.4 E.
R.5 E.
CAPABILITY LEGEND
CLASS II CULTIVATED LAND - Moderate limitations in use and choice of crops.
CLASS III CULTIVATED LAND - Severe limitations in use and choice of crops.
CLASS IV CULTIVATED LAND - Very severe limitations in use and choice of crops. Best suited for pasture.
CLASS VII GRAZING LAND -- Severe limitations for grazing.
CLASS VIII WATERSHED LAND - Not suited for grazing.
BASE: 6-P-13774
AGR-SCS-ALBUQUERQUE, N. MEX. M 515 APRIL 1984

Figure 1

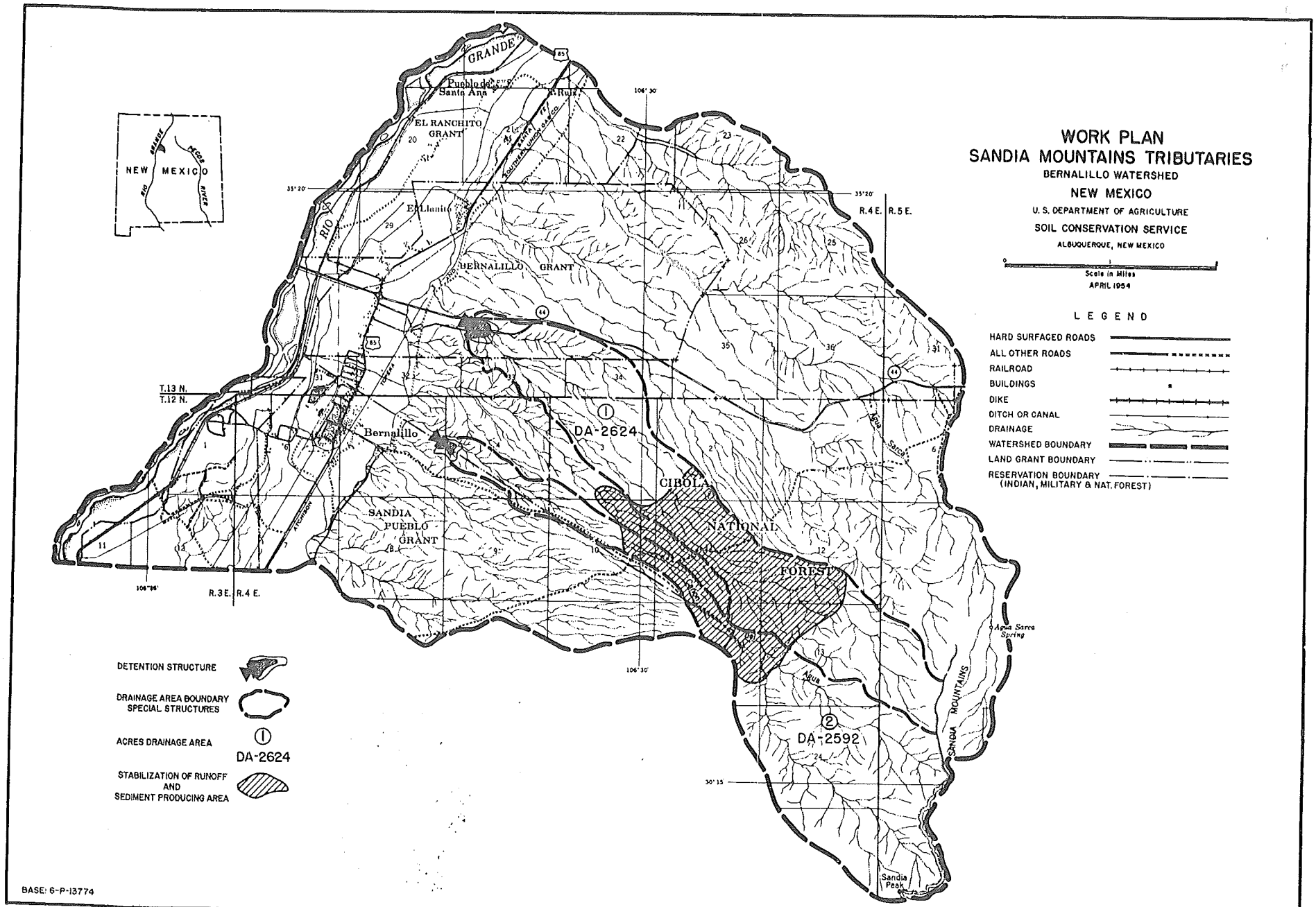

WORK PLAN
SANDIA MOUNTAINS TRIBUTARIES
BERNALILLO WATERSHED
NEW MEXICO
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ALBUQUERQUE, NEW MEXICO
Scale in Miles
APRIL 1954
LEGEND
HARD SURFACED ROADS
ALL OTHER ROADS
RAILROAD
BUILDINGS
DIKE
DITCH OR CANAL
DRAINAGE
WATERSHED BOUNDARY
LAND GRANT BOUNDARY
RESERVATION BOUNDARY (INDIAN, MILITARY & NAT. FOREST)
NEW MEXICO
RIO GRANDE
EL RANCHITO GRANT
BERNALILLO GRANT
SANDIA PUEBLO GRANT
CIBOLA NATIONAL FOREST
Bernalillo
DA-2624
DA-2592
T.13 N.
T.12 N.
R.3E.
R.4E.
R.5E.
Agua Sarca Spring
Sandia Peak
SANDIA MOUNTAINS
DETENTION STRUCTURE
DRAINAGE AREA BOUNDARY SPECIAL STRUCTURES
ACRES DRAINAGE AREA
STABILIZATION OF RUNOFF AND SEDIMENT PRODUCING AREA
BASE: 6-P-13774
AGR-SCS-ALBUQUERQUE, N. MEX. N 816 APRIL 1954

Figure 3

NEW MEXICO NATURAL HERITAGE PROGRAM
UNIVERSITY OF NEW MEXICO
2500 Yale Blvd. SE, Suite 100
Albuquerque, New Mexico 87131-1091
(505) 277-1991 • FAX # (505) 277-7587

January 6, 1993

Jim Hibbets
Cibola National Forest
10308 Candelaria, NE
Albuquerque, NM 87112

RE: Research Natural Area Boundary Review

Dear Mr. Hibbets,

Attached is the boundary descriptions for the proposed Little Water Canyon and Bernallio Watershed RNS's for your review, and a prototype of the Legal Description Review form required to complete the Establishment Reports. Please forward the completed Legal Description Reviews directly to Reggie Fletcher, Regional Ecologist, USFS, 510 Gold Ave., N.W., Albuquerque NM. If you have any questions, please contact me.

Sincerely,

Esteban Muldavin
Ecologist

A boundary description of the proposed Bernalillo Watershed RNA is as follows:

Beginning at a point where State Highway 44 intersects U.S. Forest Service Road a distance more or less of 445 at lat. 35 deg. 18 min. 7 sec., long. 106 deg. 28 sec. 22 min., the beginning point for this tract;
THENCE, S 20 E, following U.S. Forest Service Road a distance more or less of 6,240 ft to a point at lat. 35 deg. 17 sec. 9 min., long. 106 deg. 28 min. 31 sec.;
THENCE, S 20 W, following said road a distance more or less of 1,345 ft to a point at lat. 35 deg. 16 sec. 57 min., long. 106 deg. 28 min. 37 sec.;
THENCE, West, following said road a distance more or less of 625 ft to a point at lat. 35 deg. 16 sec. 58 min., long 106 deg. 28 min. 44 sec.;
THENCE, S 42 W, following said road a distance more or less of 490 ft to a point at lat. 35 deg. 16 sec. 53 min., long 106 deg. 28 min. 48 sec.;
THENCE, S 22 E, following said road a distance more or less of 1,020 ft to a point at the intersection with U.S Forest Service Road 445a at lat. 35 deg. 17 sec. 14 min., long 106 deg. 28 min. 14 sec.;
THENCE, S 6 W, following said U.S. Forest Service Road 445 a distance more or less of 230 ft to a point at lat. 35 deg. 16 sec. 42 min., long. 106 deg. 28 min. 45 sec.;
THENCE, S 84 W, following said road a distance more or less of 660 ft to a point at lat. 35 deg. 16 sec. 40 min., long. 106 deg. 28 min. 53 sec.;
THENCE, S 28 W, following said road a distance more or less of 525 ft to a point at lat. 35 deg. 16 sec. 36 min., long. 106 deg. 28 min. 53 sec.;
THENCE, N 55 W, following said road a distance more or less of 6,400 ft to a point at lat. 35 deg. 17 sec. 13 min., long. 106 deg. 29 min. 55 sec.;
THENCE, N 28 E, following said road a distance more or less of 1,180 ft to a point at lat. 35 deg. 17 sec. 25 min., long. 106 deg. 29 min. 51 sec.;
THENCE, N 26 W, following said road a distance more or less of 1,840 ft to a point at lat. 35 deg. 17 sec. 40 min., long. 106 deg. 29 min. 59 sec.;
THENCE, N 77 E, following said road a distance more or less of 230 ft to a point at lat. 35 deg. 17 sec. 40 min., long. 106 deg. 29 min. 60 sec.;
THENCE, N 14 W, following said road a distance more or less of 790 ft to a point at lat. 35 deg. 17 sec. 48 min., long. 106 deg. 29 min. 57 sec.;
THENCE, N 86 E, following said road a distance more or less of 300 ft to a point at lat. 35 deg. 17 sec. 48 min., long. 106 deg. 29 min. 54 sec.;
THENCE, N 6 W, following said road a distance more or less of 790 ft to a point at lat. 35 deg. 17 sec. 57 min., long. 106 deg. 29 min. 54 sec.;
THENCE, N 39 E, following said road a distance more or less of 425 ft to a point at lat. 35 deg. 17 sec. 53 min., long. 106 deg. 29 min. 51 sec.;
THENCE, N 82 E, following said road a distance more or less of 1,080 ft to a point at lat. 35 deg. 17 sec. 58 min., long. 106 deg. 29 min. 41 sec.;
THENCE, North, following said road a distance more or less of 330 ft to a point at lat. 35 deg. 18 sec. 2 min., long. 106 deg. 29 min. 40 sec.;
THENCE, S 88 E, following said road a distance more or less of 330 ft to a point at lat. 35 deg. 18 sec. 1 min., long. 106 deg. 29 min. 35 sec.;
THENCE, N 8 W, following said road a distance more or less of 1,350 ft to a point at lat.

35 deg. 18 sec. 15 min., long. 106 deg. 29 min. 37 sec.;
THENCE, East, following said road a distance more or less of 425 ft to a point at lat. 35 deg. 18 sec. 15 min., long. 106 deg. 29 min. 31 sec.;
THENCE, S 41 E, following said road a distance more or less of 400 ft to a point at lat. 35 deg. 18 sec. 12 min., long. 106 deg. 29 min. 27 sec.;
THENCE, East, following said road a distance more or less of 755 ft to a point at lat. 35 deg. 18 sec. 12 min., long. 106 deg. 29 min. 16 sec.;
THENCE, N 26 E, following said road a distance more or less of 295 ft to a point at lat. 35 deg. 18 sec. 13 min., long. 106 deg. 29 min. 13 sec.;
THENCE, East, following said road a distance more or less of 525 ft to a point at the intersection with State Highway 44 lat. 35 deg. 18 sec. 14 min., long. 106 deg. 29 min. 7 sec.;
THENCE, S 60 E, following State Highway 44 a distance more or less of 1,640 ft to a point at the intersection with U.S. Forest Service Road a distance more or less of 445 ft at lat. 35 deg. 18 sec. 7 min., long. 106 deg. 28 min. 22 sec., the point of beginning of said tract.

Post-It™ brand fax transmittal memo 7671 | # of pages ▸ 2

To Jim Hibbets	From Muldavin
Co. Cibola W.F.	Co. NM. Nat. Herit. Prog.
Dept.	Phone # 277-7587
Fax # 761-4663	Fax #

DESIGNATION ORDER

By virtue of the authority vested in me by the Secretary of Agriculture under regulations at 7 CFR 2.42, 36 CFR 251.23, and 36 CFR Part 219, I hereby establish the Bernalillo Watershed Research Natural Area (RNA). It shall be comprised of approximately 990 acres of land in Sandoval County, New Mexico, on the Sandia Ranger District of the Cibola National Forest, as described in the section of the Establishment Record entitled "Location."

The Regional Forester recommended the establishment of an RNA ("Bernalillo Watershed") in the Record of Decision for the Cibola National Forest Land and Resource Management Plan (Forest Plan) in 1985. That recommendation was the result of an analysis of the factors listed in 36 CFR 219.25 and Forest Service Manual 4063.41. Results of the Regional Forester's analysis are documented in the Forest Plan and Final Environmental Impact Statement which are available to the public.

The Regional Forester has reexamined the Bernalillo Watershed area to examine whether the environmental effects of establishing the area as an RNA have not changed since 1985. This analysis is documented in the attached environmental assessment. Based on the analysis in the environmental assessment, it is my decision to adopt Alternative A, to establish Bernalillo Watershed as an RNA. Alternative A is selected because it provides long-term protection and recognition of a grama-galleta steppe and juniper-grassland ecosystems. The Bernalillo Watershed RNA will be managed in compliance with all relevant laws, regulations, and Forest Service Manual direction regarding RNA's, and in accordance with the management direction identified in the Forest Plan.

The alternative considered was Alternative B, the "No Action" alternative which would continue management of Bernalillo Watershed as a "proposed" RNA. Alternative B was not selected because it would only provide short-term protection of the Bernalillo Watershed area.

Alternative B is consistent with the Forest Plan. Although the proposed action (Alternative A) is consistent with the management direction, it is not consistent with the land allocation for the Bernalillo Watershed Area in the Forest Plan. The Cibola Forest Plan is hereby amended to change the allocation of the Bernalillo Watershed area from "Proposed" to Established RNA. This is a nonsignificant amendment of the Forest Plan (36 CFR 219.10(f)).

Legal notice of this decision will appear in the Federal Register. The Forest Supervisor of the Cibola National Forest shall notify the public of this decision and mail a copy of the Decision Notice and Designation Order to all persons on the Cibola Forest Plan mailing list.

It has been determined through the environmental assessment that the proposed action is not a major Federal action that would significantly affect the quality of the human environment; therefore, an environmental impact statement is not needed. This determination is based on the following factors (40 CFR 1508.27):

Finding of No Significant Impact

A. Context.

Although this is an addition to the national system of RNA's, both short-term and long-term physical and biological effects are limited to the local area.

B. Intensity

1. There are no known effects on public health and safety.

2. There are no known effects on historic or cultural resources, actual or eligible National Register of Historic Places sites, park lands, prime farmlands, wetlands, or wild and scenic rivers. Effects on ecologically critical areas are minimal.

3. Effects on the human environment are not uncertain, do not involve unique or unknown risks, and are not likely to be highly controversial.

4. The action is not likely to establish a precedent for future actions with significant effects.

5. There are no known cumulative effects.

6. The proposed action would not adversely affect an endangered or threatened species or its critical habitat.

7. The proposed action is consistent with Federal, State, and local laws and requirements for the protection of the environment.

This decision is subject to appeal pursuant to 36 CFR Part 217. Two (2) copies of the Notice of Appeal must be in writing and submitted to:

The Secretary of Agriculture
14th & Independence Ave., S.W.
Washington, D.C. 20250

The Notice of Appeal prepared pursuant to 36 CFR 217.9(b) must be submitted within 45 days from the date of legal notice of this decision. Review by the Secretary is wholly discretionary. If the Secretary has not decided within 15 days of receiving the Notice of Appeal to review the Chief's decision, appellants will be notified that the Chief's decision is the final administrative decision of the U.S. Department of Agriculture (36 CFR 217.17(d)).

_____ _____

Chief Date

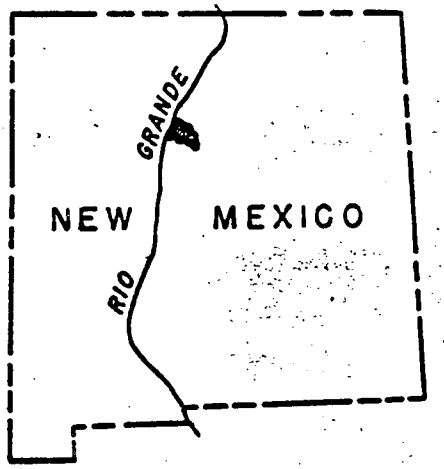
WORK PLAN

SANDIA MOUNTAINS TRIBUTARIES

(BERNALILLO WATERSHED)

OF THE RIO GRANDE WATERSHED

SANDOVAL COUNTY, NEW MEXICO



Prepared by

SOIL CONSERVATION SERVICE

and

FOREST SERVICE

U. S. DEPARTMENT OF AGRICULTURE

ALBUQUERQUE, NEW MEXICO

FEBRUARY 1955

SANTA FE-SANDOVAL SOIL CONSERVATION DISTRICT
P.O. Box 1461 Santa Fe, New Mexico

February 8, 1955

Mr. L. K. Sandoval
Work Unit Conservationist
Soil Conservation Service
Santa Fe, New Mexico

Dear Mr. Sandoval:

The supervisors of the Santa Fe-Sandoval Soil Conservation District have reviewed the Work Plan prepared for flood preventive measures for the Bernalillo Watershed Project.

This, we know, was made possible through the efforts and cooperation received by the supervisors from local groups and personnel from the Forest Service and Soil Conservation Service.

We are happy that the progress made is now at the stage where, in addition to conservation measures already applied, the construction of the flood retention structure should start in the very near future.

Very truly yours,

/s/ William Kiesov
William Kiesov
Chairman, Board of Supervisors
Santa Fe-Sandoval Soil Conservation District

WORK PLAN
SANDIA MOUNTAIN TRIBUTARIES WATERSHED PROTECTION PROJECT
(BERNALILLO WATERSHED)
SANDOVAL COUNTY

INTRODUCTION

Authority

The Federal participation outlined in this work plan is expected to be performed under authority of the Soil Conservation Act of 1935 (Public Law 46, 74th Congress) as implemented by the Watershed Protection item in the Department of Agriculture Appropriation Act, 1954. Local sponsorship by the Santa Fe-Sandoval Soil Conservation District was agreed to by a resolution adopted at a Board meeting held August 13, 1953.

Purpose and Scope of Plan

The purpose of this plan is to outline practices and measures needed and feasible and how they will be carried out to achieve a substantial reduction of erosion, floodwater and sediment damages. The application of practices and measures included in the plan will provide protection to an area of irrigated farm land and associated property, in the community of Bernalillo, New Mexico, and to transportation facilities including the main line of the Santa Fe Railway and U. S. Highway 85.

It was determined by the Santa Fe-Sandoval Soil Conservation District, hereafter called the "District", and other local interests, that the entire watershed outlined on Figures 1 to 3, about 21,000 acres, is critical with respect to agricultural and other property damages caused by flash floods. However, local interests concerned agree that it is impractical at this time to attempt treatment of this entire watershed area. The limitation of available funds and other practical considerations led to the decision that this work plan should cover the treatment of the flood source area shown on Figure 3 as areas 1 and 2. These two areas contain about 6,700 acres or 10.5 square miles. The treatment of these areas, considered to be the most critical sources of floodwater and sediment, will be carried out during a two-year period which includes parts of three fiscal years. If conditions should change before treatment of these two watersheds is completed and it becomes feasible to treat other parts of the larger watershed area shown on Figures 1 to 3, the sponsor of this project will consider amending this work plan to cover such an expanded program. The watershed considered in this work plan, including both the flood-source and flood-damage areas, is entirely within Sandoval County and contains about 9,050 acres, or 14.1 square miles.

SUMMARY OF PLAN

This plan includes a combination of soil conservation practices and special structural measures to stabilize critical runoff and sediment producing areas. These measures applied in combination will bring about an improvement in the vegetative cover on watershed lands, will aid in protecting these lands from excessive erosion and will check movement of floodwater and sediment downstream into the irrigated valley.

CONTENTS

CONTENTS (Continued)

Figures

One floodwater retarding structure is to be constructed in the main arroyo immediately above valley areas now subject to damage resulting from flash floods originating on upper watershed lands of this particular tributary.

The practices and measures listed in Table 1 are planned to be completed during fiscal years 1954, 1955, and 1956, at an estimated total cost of $174,850, which is to be shared $39,720 by local non-Federal interests and $135,130 by the Federal Government.

The Santa Fe-Sandoval Soil Conservation District assumes overall responsibility for the future operations and maintenance of the project except for those measures applied on National Forest land which will be maintained by the Forest Service, within the limits of funds available for this purpose. The District will arrange with the Town of Bernalillo to assume specific responsibility for periodic inspection and required maintenance of the floodwater retarding structure at an estimated annual cost of $200. The land owners and operators will be responsible for the maintenance of land treatment measures installed on their lands in accordance with their cooperative agreements with the District.

Comparison of Benefit and Cost

When the watershed improvement program is applied and operating at full effectiveness, the ratio of the estimated average annual benefit ($13,450) to the estimated average annual value of the cost ($7,690), is 1.7 to 1, based on current price levels for costs and long term prices for benefits.

DESCRIPTION OF THE WATERSHED PROTECTION AREA

The project area considered by this plan consists of about 9,050 acres located in north-central New Mexico, in the vicinity of Bernalillo. It is in the Upper Rio Grande Basin. The town of Bernalillo and irrigated farm land subject to floodwater and sediment damages lie between the Sandia Mountains on the east and the Rio Grande on the west. The project is entirely within the Santa Fe-Sandoval Soil Conservation District with approximately 4,400 acres of Federally-owned land within the Cibola National Forest. The irrigated valley lands are within the Middle Rio Grande Conservancy District. Of the 9,050 acres in the subwatershed, about 6,700 acres or 10.5 square miles are in the flood source area, and 2,350 acres are bottom lands in the Rio Grande Valley subject to floodwater and sediment damages.

Elevations in the area range from 5,000 feet along the Rio Grande to 10,400 feet near Sandia Peak (Figure 1). In the valley portion of the area, which is devoted to irrigated farming, mean temperatures range from 75 degrees Fahrenheit in summer to 34 degrees in winter, with recorded extreme temperatures ranging from a high of 104 degrees to a low of 10 degrees below zero. The average date of the last killing frost in the spring is April 10, and that of the first killing frost in the fall is October 25, or a normal frost free period of 192 days.

Average annual precipitation ranges from about 9 inches in the valley to an estimated 30 inches at the crest of the Sandia Mountains. More than half of the annual precipitation usually comes in sudden storms of high intensity and short duration, during the summer. These summer storms produce flash floods with high peaks which damage irrigated crops and other valley property almost every year.

The topography from west to east ranges from nearly flat slopes in the irrigated areas along the Rio Grande to very steep mountain slopes. Between these extremes are dissected terrace badlands and rugged foothills.

Of the 2,350 acres of bottom lands subject to damage, 1,930 acres are in irrigated crops, 160 acres are in irrigated native pasture and 260 acres are in the townsite, roads and canals. The acreage of cultivated and pasture land in land capability Class II, III and IV respectively is as follows: 880,470 and 740 (Figure 1). Irrigation is required for successful crop production and water is available from the Rio Grande. Very high crop yields can be obtained on these lands, but shortages of irrigation water often develop late in the growing season, which reduces production when this occurs. Principal crops grown are small grain and alfalfa.

Class II lands are characterized by deep to moderately deep alluvial soils of medium to heavy texture. Occasional areas are underlain with light texture materials. Limitations which place this land in Class II include slow permeability and slope, which requires grade adjustment to prevent erosion by irrigation water. Good management practices, including crop rotation and the use of fertilizers are essential for maximum production.

Class III lands consist of moderately deep soil underlain by river sand. The surface texture is variable from light to heavy. Limitations affecting use and crops include slope and high water table over most of the area.

Class IV lands are suitable for occasional cultivation and are characterized by shallow to very shallow light textured soil, underlain by river sand.

Watershed lands in the flood-source area are above the main canal which serves the irrigated lands. Most of these lands are in Class VII, adapted only to limited grazing by livestock, wildlife, and some cutting of firewood. Despite their low economic value, they are extremely important from a watershed standpoint. The management of these lands affects vegetative and soil condition. Range depletion and deterioration has produced the floodwater and sediment problems of the highly-developed irrigated valley near Bernalillo.

There are five range sites in the watershed which contribute damaging runoff (Figure 1). Moving progressively upstream from the irrigated land to the Sandia Mountains, these sites are: River Breaks, Semi-desert, Upland, Foothills, Rough Foothills, and Mountain Slopes. All sites are in Capability Class VII, except Mountain Slopes, which are not suited for grazing and consequently fall in Class VIII.

The River Breaks site is characterized by low gravelly hills adjacent to the Rio Grande Valley with slopes ranging from nearly flat to about 50 percent. Soils are very coarse, gravelly and variable in depth. Erosion activity has been high over much of the site, and potential forage production is limited by depleted soils and low precipitation. Range condition is predominately poor, with some areas of fair and good condition. Vegetation includes Black Grama, Galleta, Sand Dropseed, Ring Grass, Three Awn and Yucca.

The Semi-desert Upland site is potentially the best site on the watershed from the standpoint of grazing use. Slopes are gentle to moderate and the soils are generally deep with loamy or sandy surface textures. Range condition is predominately poor and vegetation includes Grama, Galleta, Ring Grass and Rabbitbrush.

The Foothills site represents a gradual transition from Semi-desert Upland to Rough Foothills. Soils vary in depth, but are generally shallow with deposition of a rocky mantle over much of the surface. Alluvial fan development is noticeable where drainageways from the higher sites spill out in these areas having gentle to moderate slopes. Range condition is poor to fair. Vegetation consists of Blue, Side Oats, Black and Hairy Gramas and Galleta on the slopes with Apache Plume in the drainages. Juniper is intermingled with other vegetation.

The Rough Foothill site is characterized by steep, rough topography, generally with shallow medium textured soils. It is especially adapted for use by wildlife. Range condition over most of the area is fair with some areas being classified as good. Vegetation is similar to that described for the Foothill site except that there is a higher percentage of Side Oats and Hairy Grama and Juniper in the composition.

Within the Mountain Slopes site are included both deep soils and shallow or rocky soils. Slopes are steep and in some places exceed 75 percent. The mountain area has little value for the grazing of livestock, but affords fair grazing for wildlife. The vegetative condition varies from fair to good. Some areas of steep, rocky cliffs have a sufficient soil mantle to support a growth of trees. Spruce, fir and pine are the principal varieties. Some mountain bunch grass and mountain browse is also present in the area.

Land ownership in the 6,700 acres of the flood source area is divided as follows: National Forest, 4,422 acres; private and State, 1,608 acres; Public Domain, 469 acres; and Indian 201 acres. National Forest lands are located in the Cibola National Forest and have not been grazed by livestock during the past few years. As a result, watershed conditions are improving in this part of the watershed. The lower lying range lands near the Rio Grande Valley have been heavily grazed since the valley was first settled in the 16th century. Presently, they produce so little forage that there is only intermittent grazing and little income is realized from them.

Most of the irrigated farm land is in small holdings. Many are only three to five acre tracts. The operators supplement their income from farming

through employment in nearby towns, on both full-time and seasonal basis. One main line of the A. T. & S. F. Railway and U. S. Highway 85 cross the lower part of this watershed. These facilities and the Town of Bernalillo have sustained substantial damages from floodwater and debris in recent years. A main supply canal and the Riverside Drain of the Middle Rio Grande Conservancy District, which serve a long reach of the valley, and laterals delivering water to the irrigated farms in this watershed and to the Sandia Indian Pueblo, have also been damaged.

FLOOD AND EROSION PROBLEMS AND DAMAGES

Heavy "downpours" of rain may occur on the watershed any time during the summer months. High intensity storms of short duration produce flash floods with high peaks but low volumes. These floods carry large quantities of debris and sediment. Unusually heavy rains and serious flash floods occur on the average of once in every three to five years. Runoff from rains which fall on the Sandia Mountain watershed flows down into the valley, covering highways, roads, streets, urban property, irrigated farm land, irrigation canals and drains with water and sediment. Damage to adobe buildings, which are prevalent in the area, is great when these flash floods occur. At present, flood water remains in low places until it evaporates. Virtually none of these flood waters reach the Rio Grande to flow downstream.

During the summer of 1949 damages aggregating more than $100,000 occurred in the flood damage area being considered in this report. Damages of a lesser amount occurred again in 1951. In addition to damages sustained by land, crops, and improvements, the interruption of transportation and community services caused by floods is of considerable importance. Traffic on U. S. Highway 85. between Santa Fe and Albuquerque, New Mexico, is often held up until flood flows recede and heavy deposits of sand and rocks are removed. Irrigation canals are filled with coarse sediment, causing overflow and breaking of the canal back of these deposits. Repairing these canal damages is a heavy expense to the water users. Since the floods occur during the growing season, the interruption of irrigation service caused by breaks in canals often causes more crop damage than is caused by inundation and sediment damage.

Floods also seriously affect the health and sanitary conditions of the area and retard economic development. Damage to power and telephone lines occurs occasionally and unusually heavy runoff could damage the gas line that traverses the northern edge of the area subject to overflow.

The total direct primary floodwater damage is estimated to average $10,080 annually, of ehich some 50 percent is damage to crops and other agricultural values. In addition, there are important indirect primary damages such as the reduction of crop production resulting from the interruption in the delivery of irrigation water while canals are being repaired and the delay in travel through the area during the periods when floods occur. The estimated annual value of the indirect primary damages is $4,320 (Table 4).

Erosion Damage

The deterioration of plant cover over the flood-source area caused by heavy grazing use has exposed the soil to the forces of erosion. Erosion is prevalent in slight to moderate degree over all of the area. The large amount of rock and gravel contained in the soils has helped to minimize excessive damage to the land from erosion. The productivity of grazing lands has not been permanently impaired because of erosion, and with improved grass management on lands now being grazed, along with land treatment measures, forage production can be increased. Grazing use on lands in the National Forest has been gradually reduced over the years since being placed under management by the Forest Service. In 1951, because of the importance of the watershed in flood prevention, the remaining permits were terminated and all grazing eliminated. The area is showing some recovery and erosion is becoming less active/ On-site erosion damage has not been evaluated since the productive capacity of the watershed has not been severely lowered. Benefits in the form of increased forage production which are expected to result from the watershed program are evaluated.

Sediment Damage

Debris and sediment carried by flash floods lodge in canals and are deposited on farm lands, roads and streets. Some farm lands have to be releveled after each flood and the annual expense incurred in cleaning debris from canals and roads is considerable. Since virtually none of the floodwaters flow into the Rio Grande, sediment from this watershed contributes only slightly to sedimentation of downstream reservoirs. It is estimated that the average annual sediment damage amounts to $2,550.

EXISTING OR PROPOSED WATER MANAGEMENT PROJECTS

Residents of the area have long been attempting to work out a solution to the problem presented by flood flows originating in the Sandia Mountains watershed. An intensive land treatment program on non-Federal lands to be carried out as a part of the regular soil conservation district program was considered, but was not attempted since such a program would not provide the positive type protection considered necessary. Also, prior to the authorization of the watershed protection project, funds were not available to the Forest Service to install measures needed to improve critical watershed areas within the National Forest.

Accomplishments to date include the application of a limited amount of land treatment measures to reduce erosion, fencing, exclusion of the grazing on National Forest lands and other improvements in management to bring about better watershed cover conditions.

FLOOD PREVENTION WORKS OF IMPROVEMENT TO BE INSTALLED

General

Investigations show that the reduction of floodwater and sediment damages can best be accomplished in the area through the installation of a complete watershed program, including the following: (1) Floodwater retard-

ing structures on the main tributaries a short distance above the flood damage area (Figure 3), (2) structural measures to aid in stabilizing critical runoff and sediment producing areas, and (3) conservation practices and measures on the flood source area. Although several retarding structures appear feasible, only one is included in the work plan because of financial limitations.

Measures Primarily for Flood Prevention

The floodwater retarding structure and other measures to provide flood protection for farm lands, urban improvements, highways and the railroad are listed with the cost and the distribution of the cost in Table 1.

Measures for flood prevention include: one floodwater retarding structure, 356 stabilization and sediment control structures, revegetation of 130 acres of critical runoff and sediment producing area, 53 miles of special purpose terraces and 560 acres of gully control to be accomplished with rock and brush stabilizers and woody plantings. Figure 3 shows the critical watershed areas to be treated. This map also shows the two floodwater retarding structures which were originally proposed for this project. Because of inability to finance both, only the northerly structure, in Subwatershed No. 1, will be built under this plan. The treatment to be applied on critical runoff and sediment producing areas in the Cibola National Forest will aid in retarding runoff and the movement of sediment thus reducing damage to urban and farm property situated below them. Data concerning the floodwater retarding structure is summarized in Table 6.

The earth fill retarding structure is designed to regulate the maximum flow expected from a storm which might occur not more than once in 100 years on the average. The structure will have an ungated outlet and a cut spillway. The maximum rate of discharge from the outlet will be approximately 50 cubic feet per second, which will not cause damage to areas below. The outlet will drain the runoff from a 100 year storm in about 48 hours. Sufficient storage is provided for sediment accumulation to allow the structure to operate unimpaired for 50 years before sediment encroaches on the detention capacity.

Measures for Conservation of Watershed Lands that Contribute Directly to Flood Prevention

The improvement of grazing management to bring about better watershed cover conditions is considered to be the most important conservation practice included in the program for conservation of watershed lands.

In addition to continuing the improvement of cover conditions on National Forest lands, some 1,700 acres of other watershed lands require improved grazing management practices. Private, State, Public Domain and Indian lands are included in the foregoing figure. Officials of the Bureau of Land Management and Bureau of Indian Affairs have pledged their support to the objectives of the watershed protection project.

In addition to improved grazing management, the following conservation measures will be installed on lands now contributing flood flows to retard storm runoff and reduce sediment movement: rock-brush and earth erosion control structures, contour furrowing and pitting, stock pond construction range seeding, fencing and land leveling. Irrigated cropland located in the upper portion of the cultivated area will be leveled to prevent runoff from these lands damaging lower lying farm lands. The quantities of measures to be installed and their costs are summarized in Table 1.

Measures for Evaluating the Effects of the Program

The hydrologic, economic and other effects of the watershed protection program will be measured on a limited basis in the future. A plan for the installation and procedures required to evaluate the results of the program will be developed in cooperation with other interested fact finding agencies. This plan will be prepared for distribution as a supplement to this work plan.

Effect of These Measures on Damages and Benefits

The measures heretofore described will prevent damage from the maximum runoff that can be expected to occur only once in 100 years on the sub-watershed on which the retarding structure will be built. Flows from other arroyos will be reduced to a lesser degree. The floodwater damage reduction benefit is estimated to be $9,990 annually (Table 4). The distribution of flood prevention benefits among measures is shown in Table 5.

Since no significant change in land use is expected after program installation, land enhancement has not been considered in evaluating program benefits.

Annual conservation benefit is estimated at $3,460, of which $2,050 is the value of increased forage production and $1,410 is the value of increased crop production on irrigated land. In addition to the monetary benefits that have been evaluated, other substantial values will accrue from the program, including the improvement of the wildlife habitat on watershed lands, better health and sanitary conditions, and the sense of security resulting from the knowledge that the flood threat has been reduced.

Comparison of Costs and Benefits

The ratio of the average annual benefit from measures primarily for flood prevention (A Measures), $8,900, to the average annual value of the cost of the measures, $5,600 is 1.6 to 1. The ratio of the average annual benefit from measures for the conservation of watershed lands that contribute directly to flood prevention (B Measures), $4,550, to the average annual value of the cost of the measures, $2,090, is 2.2 to 1. The ratio of total average annual benefits, $13,450 to the total annual value of costs, $7,690, is 1.7 to 1. See Table 5.

ACCOMPLISHING THE PLAN

The Santa Fe-Sandoval Soil Conservation District, which is sponsoring the project, and the Soil Conservation Service have mutually agreed to share the cost of program installation in accordance with Table 1.

The New Mexico Extension Service will participate in the project through its information program, by encouraging residents of the area to cooperate with the Soil Conservation District in carrying out the plan, including the conservation measures and practices, and the measures primarily for flood prevention.

The Forest Service is installing measures on National Forest lands included in the work plan and will maintain them, as funds are made available for such work.

The sponsoring Soil Conservation District will acquire all lands, easements, and rights-of-way needed for the floodwater retarding structure and contribute cash and other resources toward its construction to meet the cost-sharing schedule provided for in Tables 1 and 2. Figure 4 shows the schedule of anticipated expenditure of Federal watershed protection funds during the installation period.

The District will also encourage and assist cooperators to apply conservation measures on watershed lands as rapidly as possible. The Soil Conservation Service will provide technical services required for work plan development and the design, construction, and inspection of the floodwater retarding structure during construction. This structure will be built by contract and Service technicians will be responsible for preparing specifications and discharging the various duties involved in letting contracts in accordance with Federal procedures. Federal funds and funds set up in trust by the sponsor for expenditure on the project will be disbursed by Service personnel.

The various features of cooperation between cooperating parties are covered in appropriate memoranda of understanding and working agreements. State water laws will be strictly adhered to in the execution of this program.

PROVISIONS FOR MAINTENANCE

The estimated annual maintenance costs after the land treatment and flood prevention measures have been installed are shown in Table 3.

The Santa Fe-Sandoval Soil Conservation District assumes overall responsibility for operation and maintenance of the project except for measures installed on National Forest lands. Land owners and operators will maintain the land treatment measures under terms of their cooperative agreements with the District. The floodwater retarding structure installed primarily for the protection of private lands will be maintained by the District in cooperation with the town of Bernalillo and other organizations interested in the project. Federal agencies involved in this

project will maintain the structures installed primarily for the protection and improvement of Federal lands under their jurisdiction as funds are made available for this purpose.

The floodwater retarding structure installed primarily for the protection of private lands will be inspected periodically, at least annually, by representatives of the Service, the District, and any local organization which has maintenance responsibilities under agreement with the District. All conditions of damage or deterioration in this structure will be noted and satisfactory repairs will be made by the responsible group as soon as practical after the need for repair is discovered. Funds for maintenance will be established by each local group responsible for maintenance of specific structures and these funds will be maintained by annual levies for this purpose.

Project: SANDIA MOUNTAIN TRIBUTARIES (BERNALILLO WATERSHED)

State: NEW MEXICO

TABLE I
INSTALLATION COST

FOR FISCAL YEAR 1954

Date February 1, 1953

Measures	Unit	No. to be Applied	Estimated Cost			
			Federal	Non-Federal Public	Private	Total
A-Measures Primarily for Flood Prevention						
Soil Conservation Service						
Floodwater Retarding Structures	Each	No. 1	$4,000	$500		$4,500
SCS-Subtotal			$4,000 1/	$500 2/		$4,500
Forest Service						
Stabilization and Sediment Control Measures Structures	Each	204	$2,540			$2,540
Stabilization of Critical Runoff and Sediment Producing Areas						
Special Purpose Terraces (Flat Slopes)	Mile	35	16,100			16,100
Special Purpose Terraces (Steep Slopes)	Mile	1	1,980			1,980
FS-Subtotal			$20,620			$20,620
Total A-Measures			$24,620	$500		$25,120
B-Measures - for conservation of watershed lands that contribute directly to flood prevention						
Soil Conservation Service						
SCS-Subtotal						
Forest Service						
Grazing Control						
Fences (Reconstruction)	Mile	5.8	$5,370			$5,370
Range Development and Improvement						
Contour Furrowing (Pitting)	Acre	613	1,410			1,410
Contour Furrowing (Chiseling)	Acre	84	850			850
FS-Subtotal			$7,630			$7,630
Total B-Measures			$7,630			$7,630
Total A and B Measures			$32,250	$500		$32,750
Facilitating Measures						
Program Evaluation SCS						
Work Plan Development SCS			$6,000			$6,000
Work Plan Development FS			2,500			2,500
Summary						
Total Watershed Protection Program SCS			$10,000	$500		$10,500
Total Watershed Protection Program FS			$30,750			$30,750
Grand Total (Watershed Protection Funds)			$40,750	$500		$41,250
Going Program (SCS)						
Going Program (FS)						

1/ Investigation of Site and Design of Structure

2/ Equipment for Site Exploration and Services for Obtaining Easement for Right-of-Way

SANDIA MOUNTAIN TRIBUTARIES
Project: (RENALILLO WATERSHED)
State: NEW MEXICO

INSTALLATION COST

FOR FISCAL YEAR 1955

Date February 1, 1955

Measures	Unit	No. to be Applied	Estimated Cost			
			Federal	Non-Federal Public	Private	Total
A-Measures Primarily for Flood Prevention						
Soil Conservation Service						
Floodwater Retarding Structures	Each	No. 1	$50,240	$6,000	$15,900	$72,140
SCS-Subtotal			$50,240	$6,000	$15,900	$72,140
Forest Service						
Stabilization and Sediment Control Measures Structures	Each	37	$900			$900
Stabilization of Critical Runoff and Sediment Producing Areas						
Revegetation (woody plantings)	Acre	25	1,200			1,200
Special Purpose Terraces (flat slopes)	Mile	14	7,400			7,400
Special Purpose Terraces (steep slopes)	Mile	3	6,800			6,800
Revegetation (Grasses)	Acre	80	1,600			1,600
Gully Control	Acre	360	4,300			4,300
FS-Subtotal			$21,800			$21,800
Total A-Measures			$72,040	$6,000	$15,900	$93,940
B-Measures - for conservation of watershed lands that contribute directly to flood prevention						
Soil Conservation Service						
Range Improvement	Acre	850			$850	$850
Erosion Control Structures	Each	14			420	420
Range Pitting and Chiseling	Acre	265			2,650	2,650
Stock Ponds	Each	1			600	600
Range Seeding	Acre	175			875	875
Fencing	Mile	2			600	600
Land Leveling	Acre	50			2,665	2,665
SCS-Subtotal					$8,660 1/	$8,660 1/
Forest Service						
Grazing Control						
Fences (Reconstruction)	Mile	.2	$200			$200
Range Development and Improvement						
Contour Furrowing (Pitting)	Acre	300	1,500			1,500
Contour Furrowing (Chiseling)	Acre	200	2,400			2,400
Seeding Grasses	Acre	1,200	6,000			6,000
FS-Subtotal			$10,100			$10,100
Total B-Measures			$10,100		$8,660	$18,760
Total A and B Measures			$82,140	$6,000	$24,560	$112,700
Facilitating Measures						
Program Evaluation SCS & FS			$3,450 2/			$3,450
Work Plan Development SCS			2,000			2,000
Work Plan Development FS			500			500
Summary						
Total Watershed Protection Program SCS			$54,440	$6,000	$24,560	$85,000
Total Watershed Protection Program FS			$33,650			$33,650
Grand Total (Watershed Protection Funds)			$88,090	$6,000	$24,560	$118,650
Going Program (SCS)			$685			$685
Going Program (FS)						
Going Program (Extension Service)			$990	$990		$1,980

1/ Estimated that $2,495 of this amount will be provided through ACP Cost-Sharing assistance

2/ $2,200 SCS - $1,850 FS

Project: SANDIA MOUNTAIN TRIBUTARIES (ESTANCIA WATERSHED)

State: NEW MEXICO

TABLE I
INSTALLATION COST

FOR FISCAL YEAR 1956

Date February 1, 1955

Measures	Unit	No. to be Applied	Estimated Cost			
			Federal	Non-Federal Public	Private	Total
A-Measures Primarily for Flood Prevention						
Soil Conservation Service						
SCS-Subtotal						
Forest Service						
Stabilization and Sediment Control Measures Structures	Each	35	$160			$160
Stabilization of Critical Runoff and Sediment Producing Areas						
Revegetation (Woody Plantings)	Acre	25	1,200			1,200
Special Purpose Terraces (Steep Slopes)	Mile					
Gully Control	Acre	200	2,000			2,000
FS-Subtotal			$3,660			$3,660
Total A-Measures			$3,660			$3,660
B-Measures - for conservation of watershed lands that contribute directly to flood prevention						
Soil Conservation Service						
Range Improvement	Acre	850			$850	$850
Erosion Control Structures	Each	14			420	420
Range Pitting and Chiseling	Acre	265			2,650	2,650
Stock Ponds	Each	1			600	600
Range Seeding	Acre	175			875	875
Fencing	Mile	2			600	600
Land Leveling	Acre	50			2,665	2,665
SCS-Subtotal					$8,660 1/	$8,660
Forest Service						
Range Development and Improvement						
Contour Furrowing (Pitting)	Acre	300	$1,680			$1,680
Contour Furrowing (Chiseling)	Acre	40	500			500
FS-Subtotal			$2,180			$2,180
Total B-Measures			$2,180		$8,660	$10,840
Total A and B Measures			$5,840		$8,660	$14,500
Facilitating Measures						
Program Evaluation SCS & FS			$150 2/			$150
Work Plan Development SCS						
Work Plan Development FS						
Summary						
Total Watershed Protection Program SCS					$8,660	$8,660
Total Watershed Protection Program FS			$6,890			$6,890
Grand Total (Watershed Protection Funds)			$6,890		$8,660	$14,950
Going Program (SCS)			$685			$685
Going Program (FS)						
Going Program (Extension Service)			$990	$990		$1,180

1/ Estimated that $2,495 of this amount will be provided through ACP Cost-Sharing assistance

2/ $150 FS

TABLE 1

Project: SANDIA MOUNTAIN TRIBUTARIES (BERNALILLO WATERSHED)

State: NEW MEXICO

INSTALLATION COST

FOR TOTAL PROGRAM

Date February 1, 1955

Measures	Unit	No. to be Applied	Estimated Cost			
			Federal	Non-Federal Public	Private	Total
A-Measures Primarily for Flood Prevention						
Soil Conservation Service						
Floodwater Retarding Structure	Each	No. 1	$54,840	$6,500	$15,900	$76,640
SCS-Subtotal			$54,840	$6,500	$15,900	$76,640
Forest Service						
Stabilization and Sediment Control Measures Structures	Each	356	$3,500			$3,500
Stabilization of Critical Runoff and Sediment Producing Areas						
Revegetation (Woody Plantings)	Acre	50	2,400			2,400
Special Purpose Terraces (Flat Slopes)	Mile	49	23,500			23,500
Special Purpose Terraces (Steep Slopes)	Mile	4	8,780			8,780
Revegetation (Grasses)	Acre	80	1,600			1,600
Gully Control	Acre	560	6,300			6,300
FS-Subtotal			$46,080			$46,080
Total A-Measures			$100,920	$6,500	$15,900	$122,720
B-Measures - for conservation of watershed lands that contribute directly to flood prevention						
Soil Conservation Service						
Range Improvement	Acre	1,700			$1,700	$1,700
Erosion Control Structures	Each	28			840	840
Range Pitting and Chiseling	Acre	530			5,300	5,300
Stock Ponds	Each	2			1,200	1,200
Range Seeding	Acre	350			1,750	1,750
Fencing	Mile	4			1,280	1,280
Land Leveling	Acre	100			5,350	5,350
SCS-Subtotal					$17,320 1/	$17,320
Forest Service						
Grazing Control						
Fences (Reconstruction)	Mile	6	$5,570			$5,570
Range Development and Improvement						
Contour Furrowing (Pitting)	Acre	1,213	4,590			4,590
Contour Furrowing (Chiseling)	Acre	394	3,750			3,750
Seeding Grasses	Acre	1,200	6,000			6,000
FS-Subtotal			$19,910.			$19,910
Total B-Measures			$19,910		$17,320	$37,230
Total A and B Measures			$120,230	$6,500	$33,220	$159,950
Facilitating Measures						$3,900
Program Evaluation SCS & FS			$3,900 2/			8,000
Work Plan Development SCS			8,000			3,000
Work Plan Development FS			3,000			
Summary						
Total Watershed Protection Program SCS			$64,140	$6,500	$33,220	$104,160
Total Watershed Protection Program FS			$70,690.			$70,690
Grand Total (Watershed Protection Funds)			$135,130	$6,500	$33,220	$174,850
Going Program (SCS)			$1,850			$1,850
Going Program (FS)						
Going Program (Extension Service)			$1,180	$1,180		$2,360

1/ Estimated that $4,990 of this amount will be provided through ACP Cost-Sharing assistance

2/ $2,200 SCS - $1,700 FS

NEW MEXICO

TABLE 2
STATUS OF CONSERVATION JOB IN WATERSHED
SANDIA MOUNTAIN TRIBUTARIES (BERNALILLO WATERSHED)

Measures	Unit	Total Conservation Job: Number	Total Conservation Job: Total Cost	Applied To Date	Estimated Cost to Date: Federal	Estimated Cost to Date: Non-Federal: Public	Estimated Cost to Date: Non-Federal: Private	Remaining to be Applied
Non-Federal Land								
"A" Measures								
Floodwater Retarding Structures	Each	4	$76,640	0				4
Diversion Ditches and Dikes	Mile	.5	5,000	.5			5,000	
Non-Federal Land - Subtotal			$81,640				$5,000	
National Forest								
Stabilizing and Sediment Control Measures								
(a) Structures	Each	356	3,500					356
Stabilization of Critical Runoff and Sediment Producing Areas								
(a) Revegetation (Woody Plantings)	Acre	50	2,400					50
(b) Special Purpose Terraces (Flat Slopes)	Mile	49	23,500					49
(c) Special Purpose Terraces (Steep Slopes)	Mile	4	8,780					4
(d) Revegetation (Grasses)	Acre	80	1,600					80
(e) Gully Control	Acre	560	6,300					560
National Forest - Subtotal			$46,080					
Non-Federal Land								
"B" Measures								
Range Management	Acre	6,700	7,300	5,000			5,600	1,700
Erosion Control Structures	Each	28	840					28
Contour Furrowing (Pitting)	Acre	530	5,300					530
Pond Construction	Each	2	1,200					2
Range Seeding	Acre	350	1,750					350
Fencing	Mile	4	1,200					4
Land Leveling	Acre	200	10,570	100	1,240		4,000	100
Educational Assistance			2,360					
Subtotal			$30,520		$1,240		$9,600	
National Forest								
Grazing Control								
Fence (Reconstruction)	Mile	6	5,570					6
Range Development and Improvement								
Contour Furrowing (Pitting)	Acre	1,213	4,590					1,213
Contour Furrowing (Chiseling)	Acre	324	3,750					324
Seeding Grasses	Acre	1,200	6,000					1,200
National Forest - Subtotal			$19,910					
All Watershed Lands								
Facilitating Measures								
Program Evaluation (SCS & FS)			3,900					
Work Plan (SCS)			8,000					
Work Plan (FS)			3,000					
Subtotal			$14,900					
TOTAL PROGRAM COST			$193,050		$1,240			$14,600

NEW MEXICO

TABLE 2A
COST SHARING CALCULATIONS
SANDIA MOUNTAIN TRIBUTARIES (BERNALILLO WATERSHED)

Measures	Unit	Total Conservation Job: Number	Total Conservation Job: Total Cost	Applied To Date	Estimated Cost to Date: Federal	Estimated Cost to Date: Non-Federal: Public	Estimated Cost to Date: Non-Federal: Private	Remaining to be Applied
Non-Federal Land								
"A" Measures								
Floodwater Retarding Structures	Each	4	$76,640	0				4
Diversion Ditches and Dikes	Mile	.5	5,000	.5			5,000	
Non-Federal Land - Subtotal			$81,640				$5,000	
National Forest								
Stabilizing and Sediment Control Measures								
(a) Structures	Each	356	3,500					356
Stabilization of Critical Runoff and Sediment Producing Areas								
(a) Revegetation (Woody Plantings)	Acre	50	2,400					50
(b) Special Purpose Terraces (Flat Slopes)	Mile	49	23,500					49
(c) Special Purpose Terraces (Steep Slopes)	Mile	4	8,780					4
(d) Revegetation (Grasses)	Acre	80	1,600					80
(e) Gully Control	Acre	560	6,300					560
National Forest - Subtotal			$46,080					
Non-Federal Land								
"B" Measures								
Range Management	Acre	6,700	7,300	5,000			5,600	1,700
Erosion Control Structures	Each	28	840					28
Contour Furrowing (Pitting)	Acre	530	5,300					530
Pond Construction	Each	2	1,200					2
Range Seeding	Acre	350	1,750					350
Fencing	Mile	4	1,200					4
Land Leveling	Acre	200	10,570	100	1,240		4,000	100
Educational Assistance			2,360					
Subtotal			$30,520		$1,240		$9,600	
National Forest								
Grazing Control								
Fence (Reconstruction)	Mile	6	5,570					6
Range Development and Improvement								
Contour Furrowing (Pitting)	Acre	1,213	4,590					1,213
Contour Furrowing (Chiseling)	Acre	324	3,750					324
Seeding Grasses	Acre	1,200	6,000					1,200
National Forest - Subtotal			$19,910					
All Watershed Lands								
Facilitating Measures								
Program Evaluation (SCS & FS)			3,900					
Work Plan (SCS) —			8,000					
Work Plan (FS)			3,000					
Subtotal			$14,900					
TOTAL PROGRAM COST			$193,050		$1,240			$14,600

Total Estimated Cost		$193,050
Total Estimated Federal Expenditures 1/ Prior to Designation of Project	$1,240	
Total Estimated Future Expenditures 2/ on Non-Federal Land (exclusive of W.P. Funds)	6,170	
Total Estimated Future Federal Expenditures - National Forest (W.P. Funds)	68,990	80,300
Program Evaluation - (W.P. Funds)	3,900	
Difference		112,750
50 percent of Difference		56,375
Non-Federal Expenditures Prior to Designation of Project		14,600
Amount of Non-Federal Contribution Require to meet 50-50 Cost-Sharing Objective		41,775
Amount of Non-Federal Contribution Shown in Table 1		35,910
Non-Federal Contribution Percent of Total		44.8

1/ Includes 4,435 Acres National Forest
2/ Federal Expenditures

TABLE 3
ANNUAL COSTS
SANDIA MOUNTAIN TRIBUTARIES
(BERNALILLO WATERSHED)

Measures	Amortization of Installation Costs 3/				Operation and Maintenance			Grand Total
	Federal 1/ (Dollars)	Non-Federal Public 1/ (Dollars)	Private 2/ (Dollars)	Total (Dollars)	Federal (Dollars)	Non-Federal Public (Dollars)	Private (Dollars)	(Dollars)
A-MEASURES								
Non-Federal Land								
Floodwater Retarding Structure	2,190	230	740	3,160	--	200	--	3,360
Federal Land								
Stabilizing & Sediment Control Structures	130	--	--	130	40	--	--	170
Stabilization of Critical Areas	1,600	--	--	1,600	470	--	--	2,070
Sub-Total A-Measures	3,920	230	740	4,890	510	200	--	5,600
B-MEASURES								
Non-Federal Land	260	40	570	870	--	--	420	1,290
Federal Land	700	--	--	700	100	--	--	800
Sub-Total B-Measures	960	40	570	1,570	100	--	420	2,090
TOTAL - All Measures	4,880	270	1,310	6,460	610	200	420	7,690

1/ Amortized in 50 years at 2⅛ percent interest (.03526)

2/ Amortized in 50 years at 4 percent interest (.04655)

3/ Including all costs except program evaluation

TABLE 4

SUMMARY OF AVERAGE ANNUAL MONETARY FLOODWATER AND SEDIMENT DAMAGE AND FLOOD PREVENTION BENEFIT FROM THE PLAN

SANDIA MOUNTAIN TRIBUTARIES
(BERNALILLO WATERSHED)
(Long-Term Projected Prices)

Damages	Average Annual Damage			Average Annual Benefit		
	Under Present Conditions	B Measures Only	With A and B Measures	From B Measures Only	From A Measures Only	Total Flood Prevention Benefit from A and B
	(Dollars)	(Dollars)	(Dollars)	(Dollars)	(Dollars)	(Dollars)
Floodwater Damage						
Crop and Pasture	2,840	2,560	1,490	280	1,070	1,350
Flood Plain Scour	500	450	250	50	200	250
Irrigation Systems	990	900	530	90	370	460
Other Agricultural Damage	700	630	360	70	270	340
Sub-Total	5,030	4,540	2,630	490	1,910	2,400
Urban	4,060	3,720	1,130	340	2,590	2,930
Roads and Bridges	760	700	470	60	230	290
Railroad	230	210	140	20	70	90
Sub-Total	5,050	4,630	1,740	420	2,890	3,310
Total Floodwater	10,080	9,170	4,370	910	4,800	5,710
Sediment Damage						
Irrigation Systems	550	460	150	90	310	400
Flood Plain Deposition	2,000	1,640	650	360	1,080	1,440
Total Sedimentation	2,550	2,100	710	450	1,390	1,840
Indirect Damage	4,320	3,930	1,880	390	2,050	2,440
Total Damage	16,950	15,200	6,960			
Benefit from Reduction of Damage	--	--	--	1,750	8,240	9,990
Benefit from More Intensive Use of Flood Plain Land	--	--	--	--	--	--
Total Flood Prevention Benefit	--	--	--	1,750	8,240	9,900

TABLE 5
DISTRIBUTION OF COSTS AND BENEFITS BY MEASURES AND GROUPS OF MEASURES
SANDIA MOUNTAIN TRIBUTARIES
(BERNALILLO WATERSHED)

Item	Total Cost (Dollars)	Average Annual Cost (Dollars)	Average Annual Benefit: Floodwater & Sediment Benefit (Dollars)	More Intensive Use of Land (Dollars)	Conservation Benefit (Dollars)	Total (Dollars)	Benefit-Cost Ratio
A-MEASURES							
Floodwater Retarding Structure (Piedra Lisa Wash)	84,640	3,360	5,480	--	--	5,480	1.6 to 1
Stabilization and Sediment Control Measures	3,700	170	240	--	80	320	1.9 to 1
Stabilization of Critical Areas	45,380	2,070	2,520	--	580	3,100	1.5 to 1
Total A-Measures	133,720	5,600	8,240	--	660	8,900	1.6 to 1
B-MEASURES							
Non-Federal Land	20,930	1,290	740	--	2,170	2,910	2.3 to 1
Federal Land	19,910	800	1,010	--	630	1,640	2.0 to 1
Total B-Measures	40,840	2,090	1,750	--	2,800	4,550	2.2 to 1
All Measures	174,560	7,690	9,990	--	3,460	13,450	1.7 to 1

TABLE 6
FLOODWATER RETARDING STRUCTURE DATA
SANDIA MOUNTAIN TRIBUTARIES
(BERNALILLO WATERSHED)

Site	Drainage Area Sq. Mi.	Storage Capacity Acre Feet: Sediment Pool	Detention Pool	Total	Storage Capacity Inches of Runoff: Sediment Pool	Detention Pool	Total	Surface Area Acres: Top of Sed. Pool	Top of Det. Pool	Max. Ht. of Dam Feet	Vol. of fill Cu. Yds.	Draw Down Rate cfs	Type of Spillway	Estimated Total Cost
1	4.1	118	183	301	.54	.84	1.38	9	22	37	123,000	50	Veg.	$81,000

TABLE 7
SUMMARY OF PROGRAM DATA
SANDIA MOUNTAIN TRIBUTARIES
(BERNALILLO WATERSHED)

Item	Unit	Quantity
Years to complete program	Year	3
Total installation cost	Dollar	174,850
Federal	Dollar	135,130
Non-Federal	Dollar	39,720
Annual O&M cost	Dollar	1,230
Federal	Dollar	610
Non-Federal	Dollar	620
Annual Benefits	Dollar	13,450
Floodwater retarding structure	Each	1
Area inundated by structures		
Floodplain	Acre	None
Upland	Acre	22
Watershed area above structure	Acre	2,624
Reduction of annual floodwater damage		
A measures	Percent	48
B measures	Percent	9
Reduction of annual sediment damage		
A measures	Percent	55
B measures	Percent	18
Other annual benefits		
A measures	Dollar	660
B measures	Dollar	2,800

TABLE 8
SUMMARY OF PHYSICAL DATA
SANDIA MOUNTAIN TRIBUTARIES
(BERNALILLO WATERSHED)

Item	Unit	Quantity Without Program	Quantity With Program
Watershed area	Sq. Mi.	14.1	14.1
Watershed area	Acre	9,050	9,050
Area of cropland	Acre	1,930	1,930
Area of grassland	Acre	5,000	5,000
Area of woodland	Acre	1,700	1,700
Floodplain area subject to damage by design storm	Acre	1,600	590
Annual rate of erosion	Tons/Yr	1,835	1,193
Sheet			
Gully)	Tons/Yr	7,339	4,770
Streambank)			
Area damaged annually by:			
Sediment)	Acre	200	70
Floodplain scour)	Tons/Ac/Yr	1.76	1.14
Sediment production	Ac/Ft/Yr	2.34	1.52
Sediment accumulation in reservoir 1/	Events/Yr	.33	.04 2/
Frequency of flooding	Inches	12	12
Average annual rainfall	Inches	.4	.4
Average annual runoff			

1/ Proposed

2/ A 25 year frequency flood with program will cause about same damage as present 3 year frequency flood.

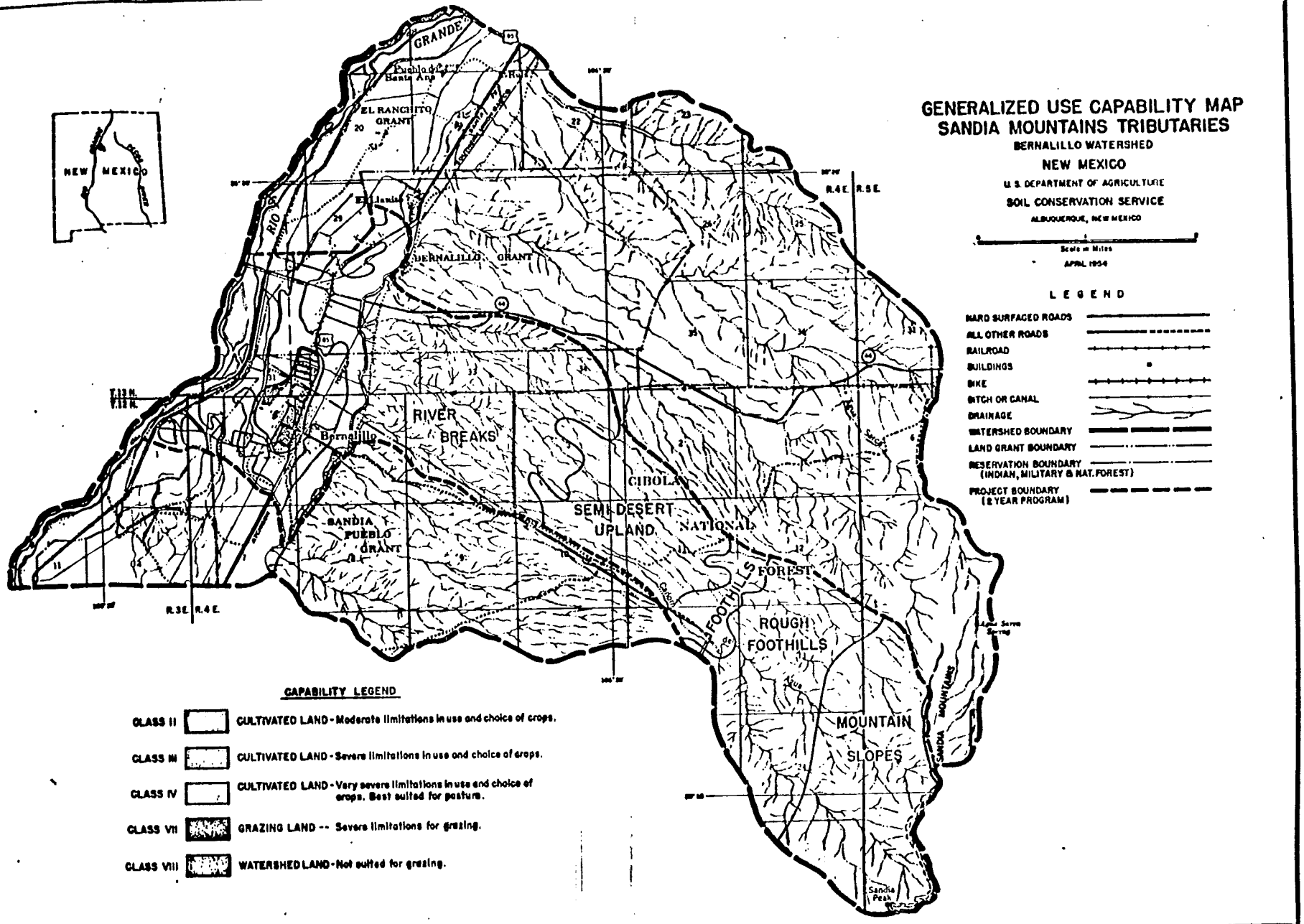

GENERALIZED USE CAPABILITY MAP
SANDIA MOUNTAINS TRIBUTARIES
BERNALILLO WATERSHED
NEW MEXICO
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ALBUQUERQUE, NEW MEXICO
Scale in Miles
APRIL 1954
LEGEND
HARD SURFACED ROADS
ALL OTHER ROADS
RAILROAD
BUILDINGS
DIKE
DITCH OR CANAL
DRAINAGE
WATERSHED BOUNDARY
LAND GRANT BOUNDARY
RESERVATION BOUNDARY (INDIAN, MILITARY & NAT. FOREST)
PROJECT BOUNDARY (5 YEAR PROGRAM)
NEW MEXICO
RIO GRANDE
Pueblo of Santa Ana
EL RANCHITO GRANT
BERNALILLO GRANT
RIVER BREAKS
Bernalillo
SANDIA PUEBLO GRANT
SEMI-DESERT UPLAND
CIBOLA NATIONAL FOREST
FOOTHILLS
ROUGH FOOTHILLS
MOUNTAIN SLOPES
SANDIA MOUNTAINS
Sandia Peak
R.3E.
R.4E.
R.5E.
CAPABILITY LEGEND
CLASS II CULTIVATED LAND - Moderate limitations in use and choice of crops.
CLASS III CULTIVATED LAND - Severe limitations in use and choice of crops.
CLASS IV CULTIVATED LAND - Very severe limitations in use and choice of crops. Best suited for pasture.
CLASS VII GRAZING LAND -- Severe limitations for grazing.
CLASS VIII WATERSHED LAND - Not suited for grazing.
BASED 6-P-13774

Figure 1

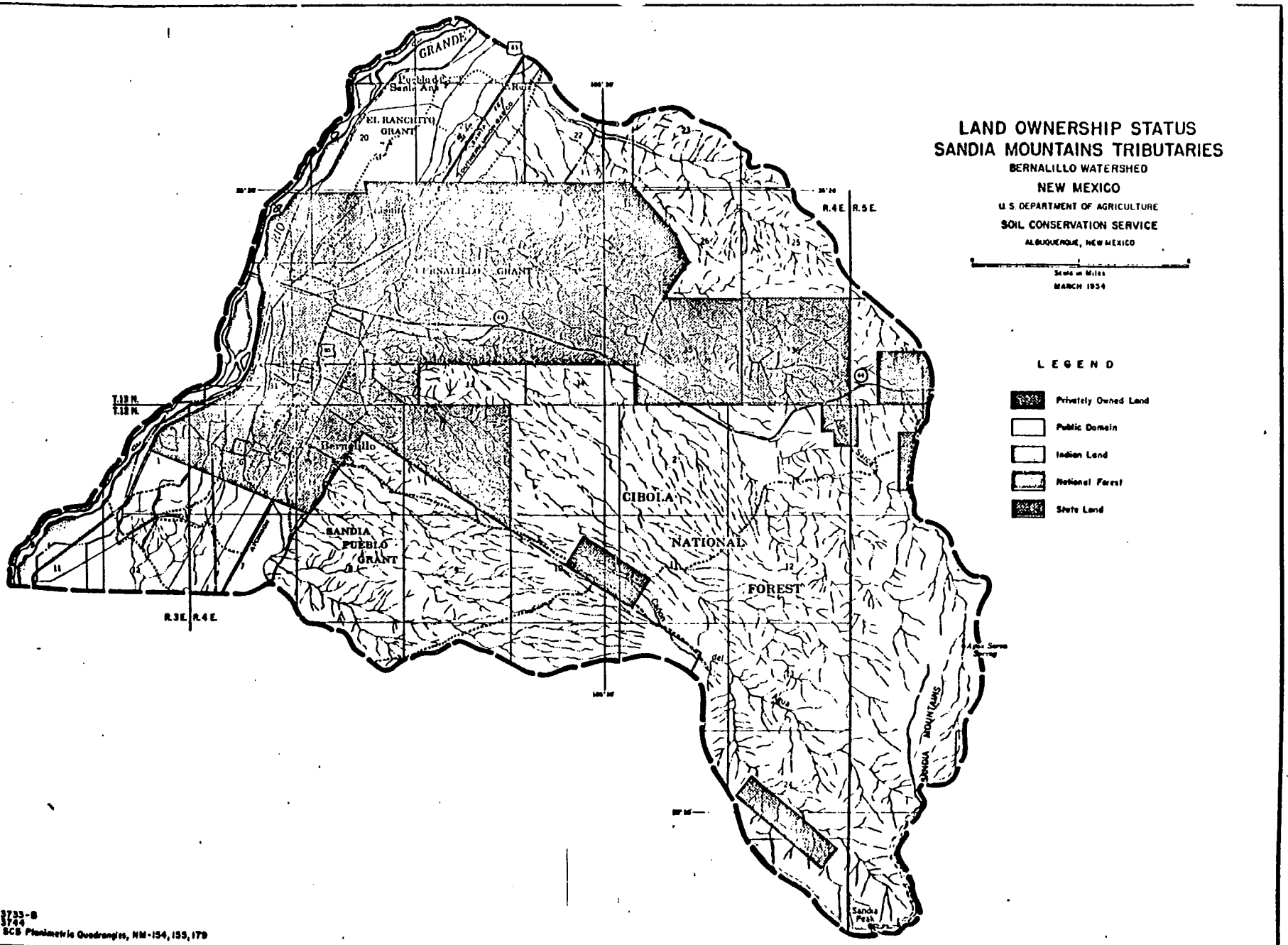

LAND OWNERSHIP STATUS
SANDIA MOUNTAINS TRIBUTARIES
BERNALILLO WATERSHED
NEW MEXICO
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ALBUQUERQUE, NEW MEXICO
Scale in Miles
MARCH 1954
LEGEND
Privately Owned Land
Public Domain
Indian Land
National Forest
State Land
GRANDE
Pueblo de Santa Ana
EL RANCHITO GRANT
Bernalillo
SANDIA PUEBLO GRANT
CIBOLA
NATIONAL
FOREST
SANDIA MOUNTAINS
R.3E.
R.4E.
R.5E.
T.13 N.
T.12 N.
B-3-13733-B
B-3-13744
BASE: SCS Planimetric Quadrangles, NM-154, 155, 179
ABQ-SCS-ALBUQUERQUE, N. MEX. 8-512 MARCH 1954

Figure 2

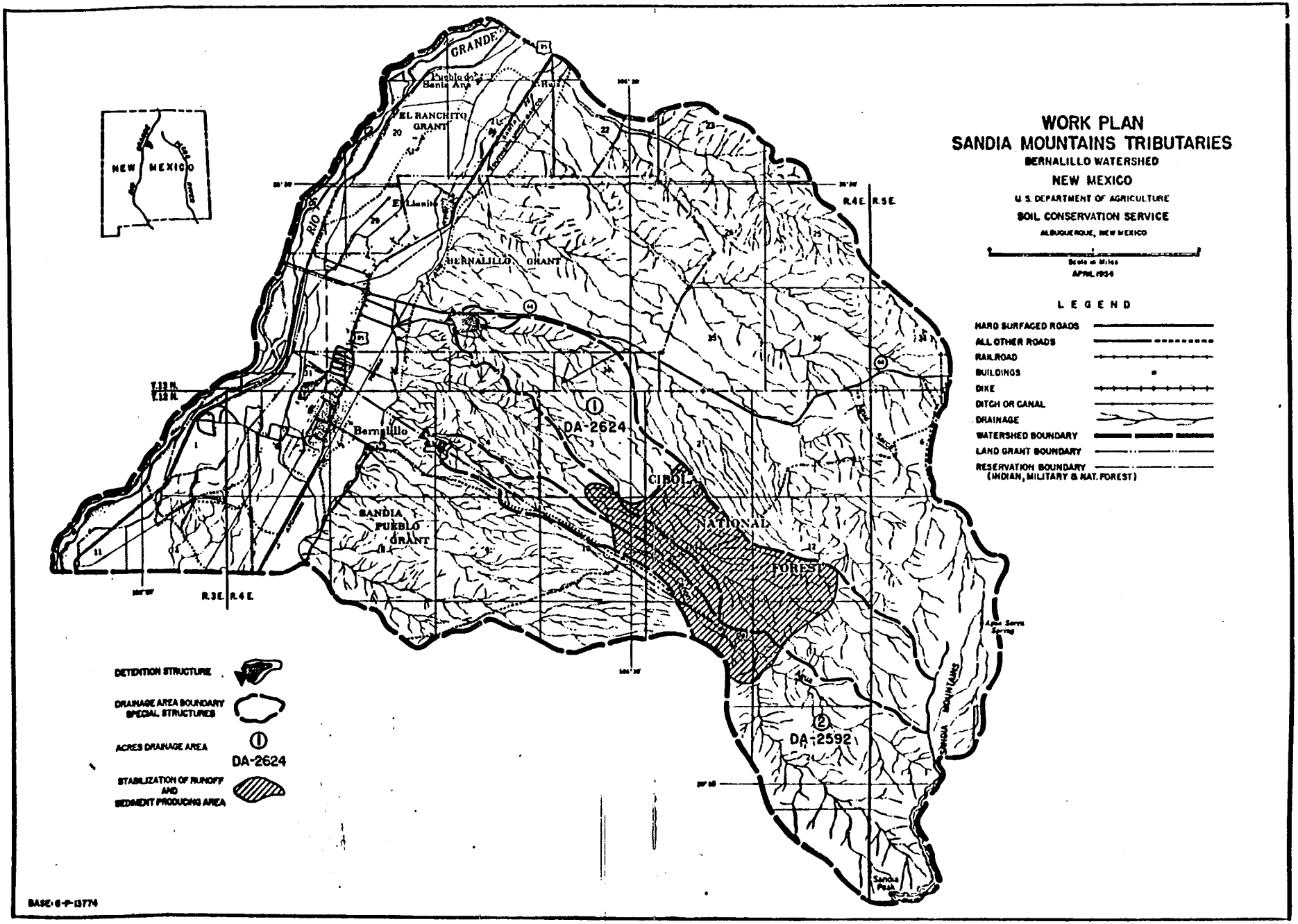
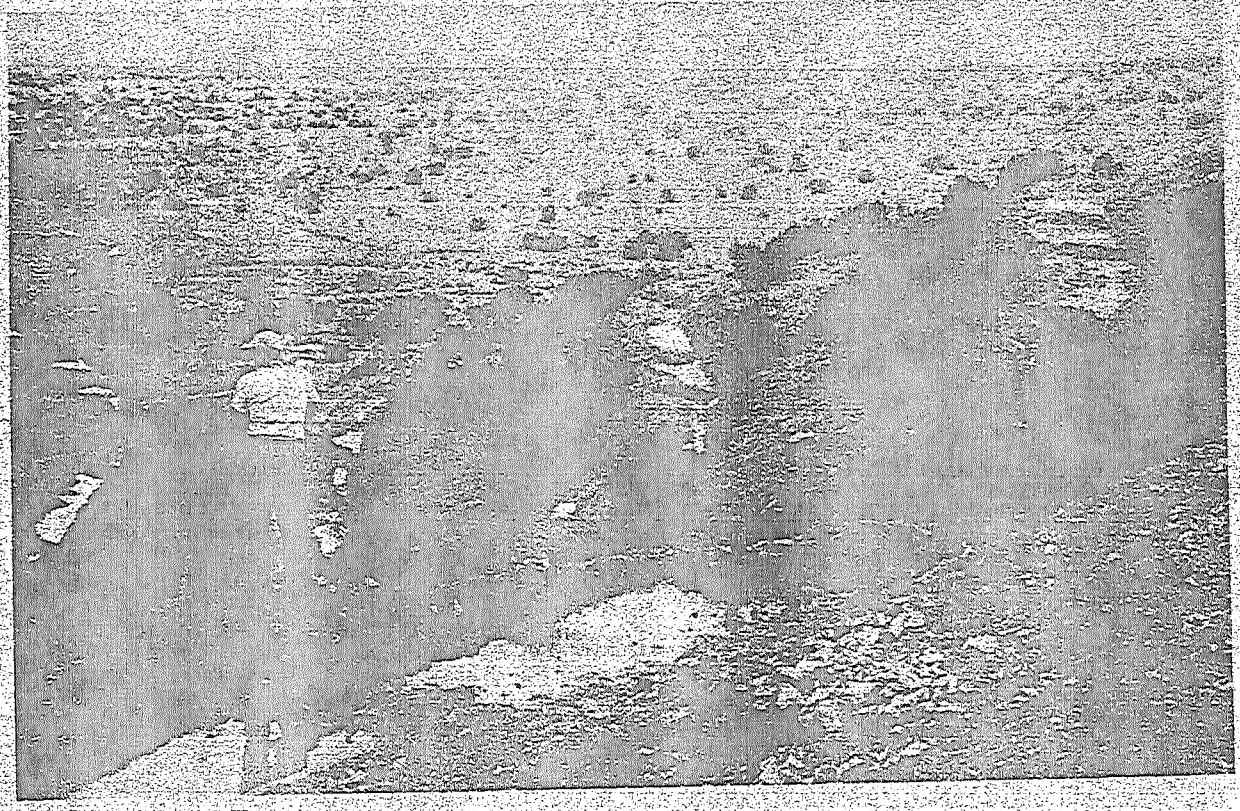

WORK PLAN
SANDIA MOUNTAINS TRIBUTARIES
BERNALILLO WATERSHED
NEW MEXICO
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ALBUQUERQUE, NEW MEXICO
APRIL 1954
LEGEND
HARD SURFACED ROADS
ALL OTHER ROADS
RAILROAD
BUILDINGS
DIKE
DITCH OR CANAL
DRAINAGE
WATERSHED BOUNDARY
LAND GRANT BOUNDARY
RESERVATION BOUNDARY (INDIAN, MILITARY & NAT. FOREST)
NEW MEXICO
RIO GRANDE
EL RANCHITO GRANT
BERNALILLO GRANT
SANDIA PUEBLO GRANT
CIBOLA NATIONAL FOREST
Bernalillo
DA-2624
DA-2592
SANDIA MOUNTAINS
R.3E.
R.4E.
R.5E.
T.13 N.
T.12 N.
DETENTION STRUCTURE
DRAINAGE AREA BOUNDARY SPECIAL STRUCTURES
ACRES DRAINAGE AREA
STABILIZATION OF RUNOFF AND SEDIMENT PRODUCING AREA
BASE: 6-P-13774

Figure 3

Tour Guide to

BERNALILLO WATERSHED PROTECTION PROJECT

Cibola National Forest



Water filled trenches on the slopes of the Bernalillo Watershed Protection Project above Bernalillo, New Mexico, from summer storms in 1955, when work was under construction. The trenches caught surface run-off, preventing floods in the community below.

BERNALILLO WATERSHED PROTECTION PROJECT

INTRODUCTION

The Bernalillo Watershed Protection Project in the Piedra Liza Arroyo was started in 1953 under the sponsorship of the Board of Supervisors of the Santa Fe-Sandoval Soil Conservation District, working with the Forest Service and the Soil Conservation Service of the U. S. Department of Agriculture.

Bernalillo, like many other communities in New Mexico, has been subjected to flood damage from summer storms falling on nearby slopes. Evidence on the ground indicated that much of the flood water came from the foothills of the Sandia Mountains and gentle sloping mesa lands to the east of Bernalillo.

The purpose of the project was to improve watershed conditions so that the soil would be held on the hillsides and most of the rainfall put into the ground to bring back the grass cover. Before the project was started, there was very little grass or shrubs on the watershed. The area had been grazed by livestock for hundreds of years and grazed too heavily because of its closeness to the little villages along the Rio Grande.

The cooperative program between agencies of the U. S. Department of Agriculture and local people called for constructing a 250 acre foot detention dam in Piedra Liza arroyo and installing land treatment measures on the national forest portion of the watershed. The Soil Conservation Service planned and contracted for the construction of the dam. The Forest Service treated National Forest lands involved in the project.

From July 27 to August 1, 1955, over 4 inches of rain fell on the area. One storm produced 1.25 inches in twenty minutes. Arroyos on each side of the treated area produced floods but none came from the treated watershed. During the period this was the only non-flood producing arroyo between Albuquerque and Algodones (to the north) and some of them flooded two or more times. Another intense storm fell on the area on July 19, 1956, and deposited 1.38 inches of rain in the first twenty minutes. An additional .50 inches fell during the next hour.

The land treatment measures by the U. S. Forest Service were designed to stop the rain where it fell and let it sink into the ground instead of running over the surface into the arroyo. Thirteen hundred acres of National Forest land were treated. The detention dam is the only structure located in the arroyo channel.

Land treatment measures were designed to handle the small storms from the National Forest portion of the watershed. The detention dam was constructed to handle the occasional large storm and the water originating on the untreated portions of the watershed.

-0-0-0-0-

WATCH YOUR FOOTING. THE LAND IS ROUGH IN SPOTS.

-0-0-0-0-

STOP NO. 1 Sandia Pueblo Underpass

Flood water closes the highway here several times each year. When a summer storm falls on the denuded mesa lands east of the Santa Fe Railway tracks the runoff comes through the underpass and collects in the highway. It fills this area covering the highway for about 1/2 mile. Traffic cannot go through and must detour.

The water stands on the highway and land to the west until it sinks. The high bank, 7 or 8 feet higher than the land, is dirt and sand scraped off the highway and pushed to the sides. Notice that the fence posts here are higher than the fence to the north.

STOP NO. 2 Flooded Highway and Church Grounds at Bernalillo

Flood damage from the watershed before the project was started, destroyed the 100-year old convent and did heavy damage to homes, farms, and orchards in the path of the flood. While the exact amount of damage was not accurately determined, it cost $130,000 to build a new convent. The people of Bernalillo pledged themselves to sponsor this small watershed program for work done on their farms and private lands. However, the work we will see today on the National Forest is paid for from U. S. Forest Service appropriations.

Flooded highways were a common sight where the Piedra Liza flowed to the Church grounds. Note stalled cars.

Flood waters standing in Church courtyard.

STOP NO. 3 Jemez Flood Control Dam

This is a silt and flood control dam designed to withhold flow of silt and sediment into the Rio Grande above Albuquerque. It costs money to build a dam to hold silt that comes off the land, and that portion of the Jemez Reservoir designed to hold silt has cost $8.40 for each acre of land above the dam. This is not a permanent cure, since work on the watershed itself is not being done.

The Jemez Dam is 780 feet long and 135 feet high. The Reservoir capacity is estimated at 120,000 acre feet, of which 90,000 acre feet is for silt and sediment, and 30,000 acre feet for flood control. The Reservoir covers 2,885 acres and the project cost approximately $7,000,000.00.

Return to the "Y" at Bernalillo and proceed east on Highway 44 toward Placitas.

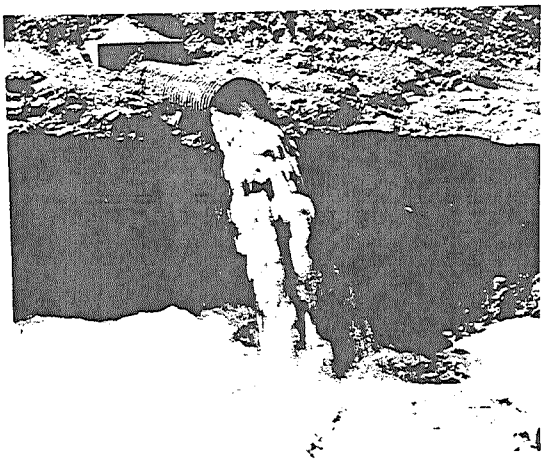
STOP NO. 4 Detention Dam at Piedra Liza Arroyo

You are now approaching the Bernalillo Small Watershed Project and the Detention Dam built across the mouth of the Piedra Liza. This earth dam built by the Soil Conservation Service, is 1030 feet long and 35 feet high. The reservoir holds 250 acre feet of water (that is equal to one foot of water over 250 acres of land).

This is NOT a water storage reservoir. All flood water is owned by water users in the Rio Grande Valley so the dam has an open gate. Flood waters rushing into the reservoir are impounded until the water can run out through the 24" open gate in the dam. The water can be drained out in 36 to 72 hours, depending on the size of the flood. Usually summer floods run large volumes of water for an hour or two. If the water can be caught in a reservoir and allowed to drain off as a small stream, no damage to valuable property will result. The water can be channeled into drain and irrigation ditches where it can be used.

Unfortunately, no provision has been made by the ditch owners to take these flood waters into existing ditches. While the Piedra Liza Arroyo is one of the flood drainages into Bernalillo, there are others above and below the town which bring water into the valley area and can still cause flooding in Bernalillo.

Floodwaters impounded behind dam after July, 1956 storm



Water flowing out of gate outlet at full capacity

STOP NO. 5 — Entrance Gate to Cibola National Forest Bernalillo Watershed Protection Project

You will see several gullies along the road. They were once roads that were allowed to wash out because no provisions were made to prevent water running down the wheel tracks. As we drive through the Project, you will see that in most places erosion control structures are functioning. This was accomplished by a number of methods:

1. Terraces: Level terraces were constructed with a road grader. They are about a foot deep and the soil removed forms a dike on the lower side of the structure. Cross bars in the terraces prevent flow and will prevent general overtopping and washing when a big storm occurs. The terraces will impound the runoff from the area between the structures.

2. Pitting: Most of the flatter portion of the watershed has been pitted by using an ordinary farm disk. The implement cuts out a shallow basin two feet long and about eight inches wide. These depressions are intended to catch the rainfall so it will soak into the soil where it is available for plant growth.

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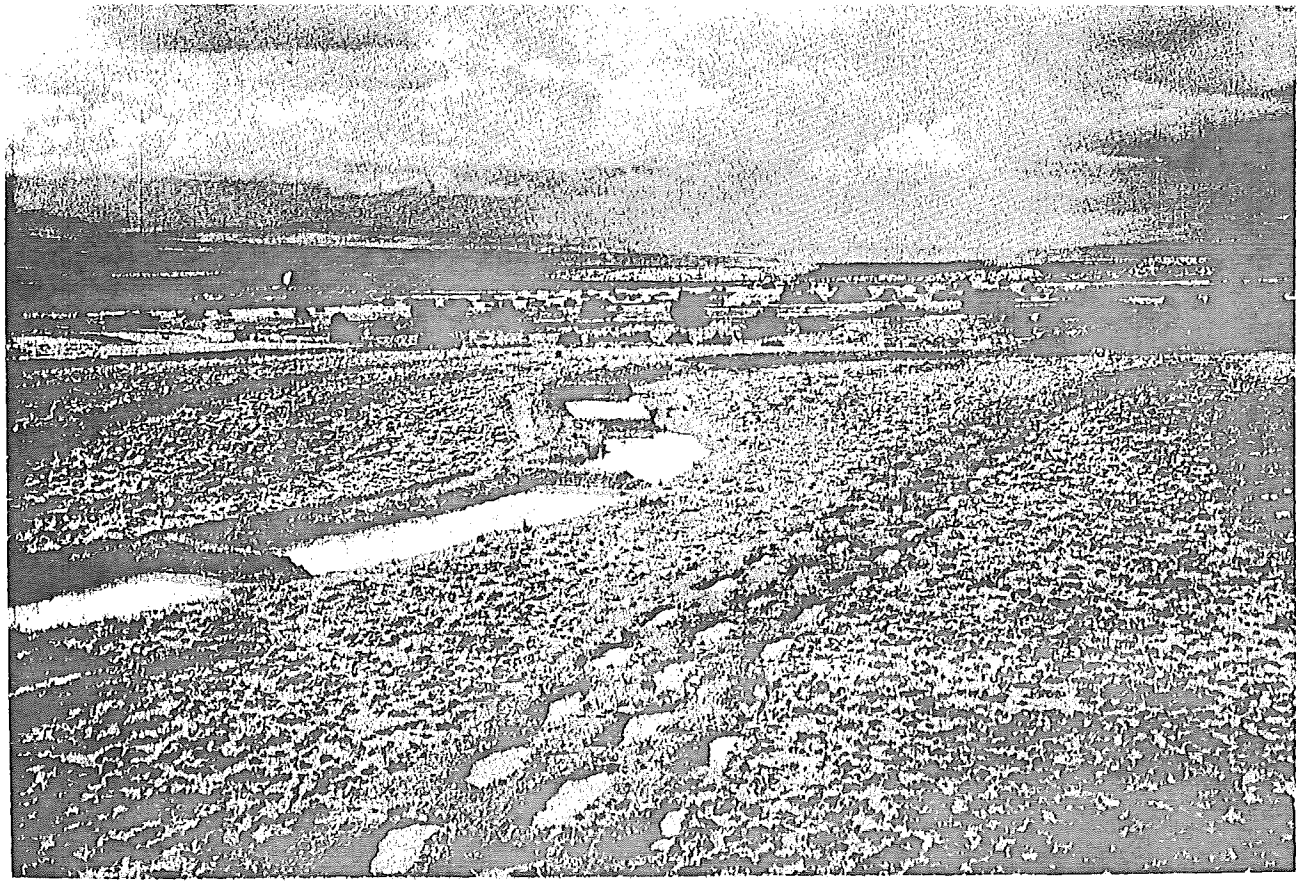

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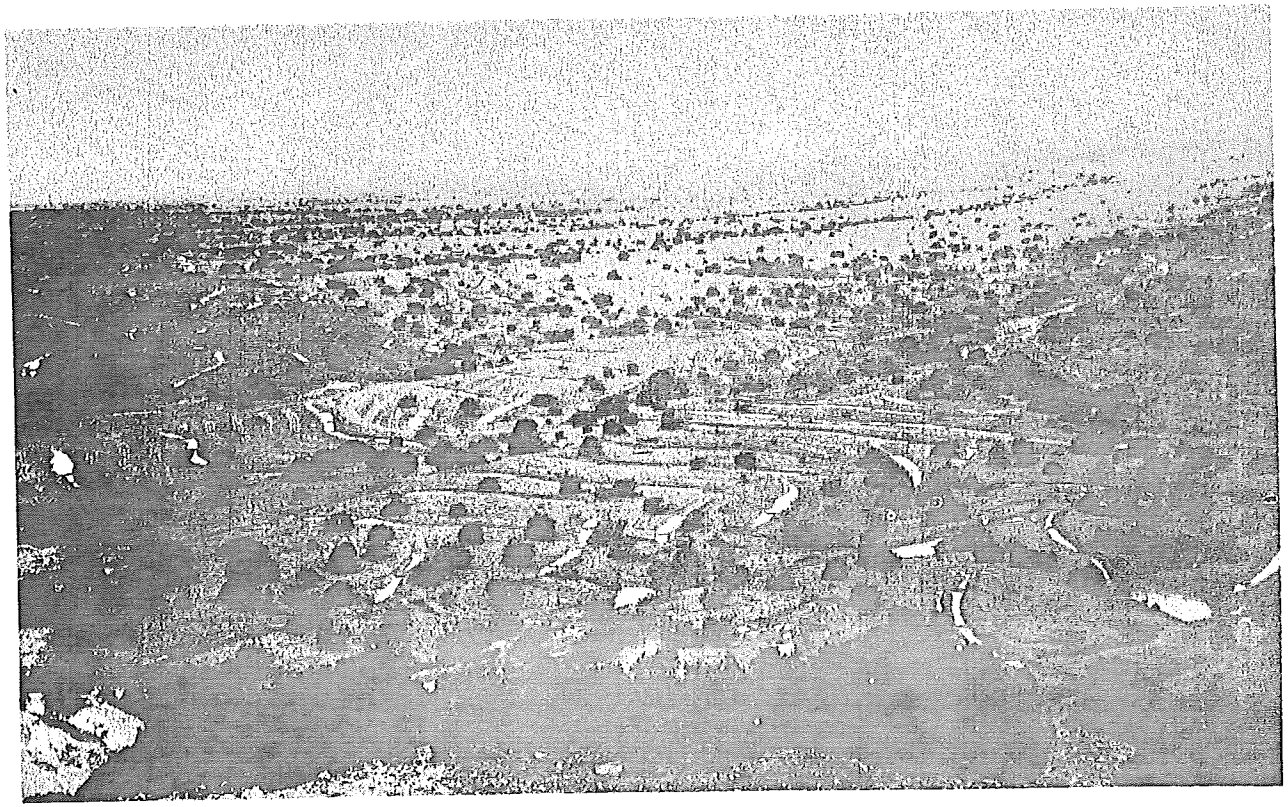

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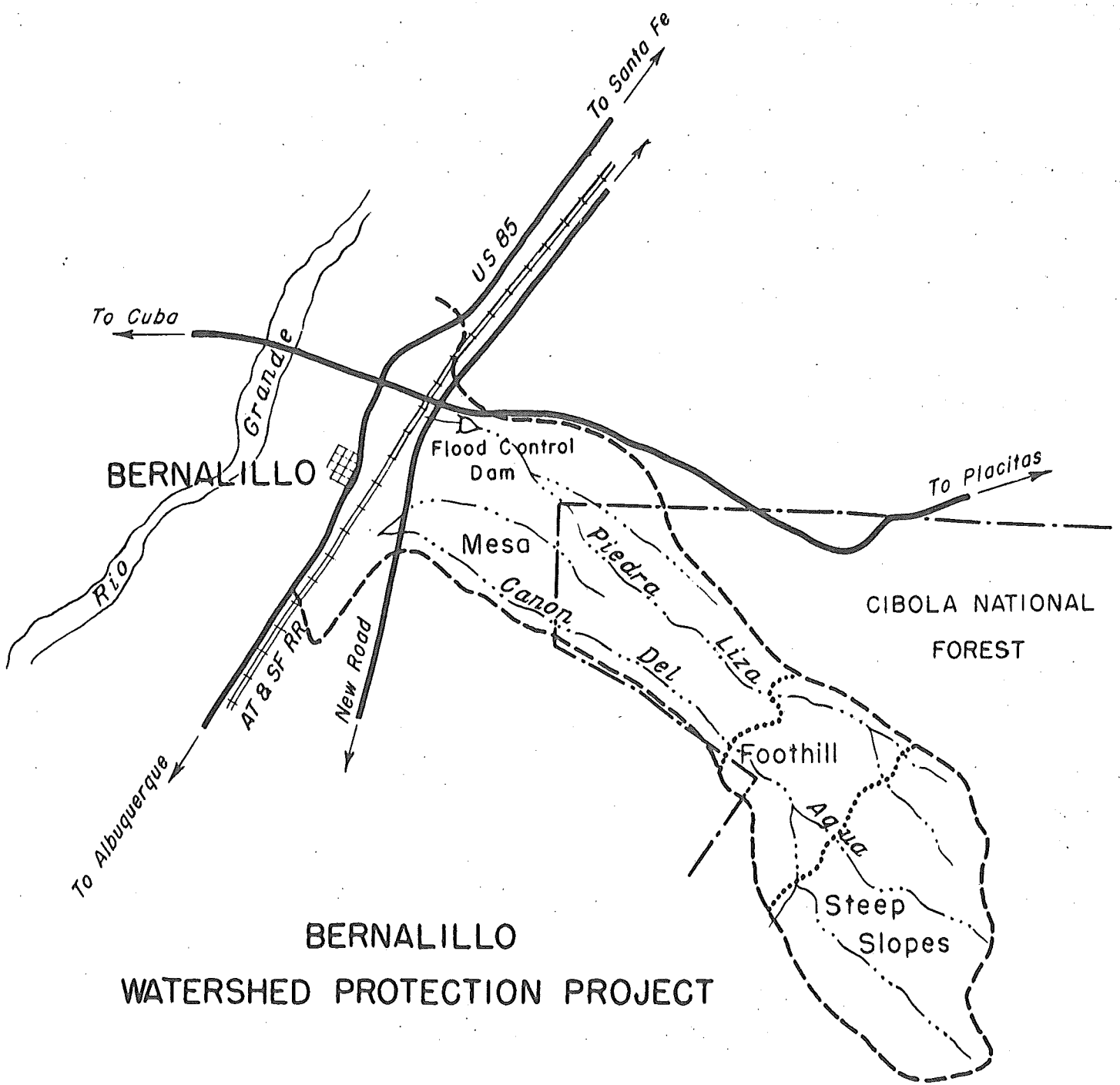

To Santa Fe
US 85
To Cubo
Rio Grande
BERNALILLO
Flood Control Dam
To Placitas
Mesa
Piedra Liza
Canon Del
CIBOLA NATIONAL FOREST
AT & SF RR
New Road
To Albuquerque
Foothill
Agua
Steep Slopes
BERNALILLO
WATERSHED PROTECTION PROJECT

Earl F. Aldon

Tour Guide to

BERNALILLO WATERSHED PROTECTION PROJECT

Cibola National Forest

Water filled trenches on the slopes of the Bernalillo Watershed Protection Project above Bernalillo, New Mexico, from summer storms in 1955, when work was under construction. The trenches caught surface run-off, preventing floods in the community below.

BERNALILLO WATERSHED PROTECTION PROJECT

INTRODUCTION

The Bernalillo Watershed Protection Project in the Piedra Liza Arroyo was started in 1953 under the sponsorship of the Board of Supervisors of the Santa Fe-Sandoval Soil Conservation District, working with the Forest Service and the Soil Conservation Service of the U. S. Department of Agriculture.

Bernalillo, like many other communities in New Mexico, has been subjected to flood damage from summer storms falling on nearby slopes. Evidence on the ground indicated that much of the flood water came from the foothills of the Sandia Mountains and gentle sloping mesa lands to the east of Bernalillo.

The purpose of the project was to improve watershed conditions so that the soil would be held on the hillsides and most of the rainfall put into the ground to bring back the grass cover. Before the project was started, there was very little grass or shrubs on the watershed. The area had been grazed by livestock for hundreds of years and grazed too heavily because of its closeness to the little villages along the Rio Grande.

The cooperative program between agencies of the U. S. Department of Agriculture and local people called for constructing a 250 acre foot detention dam in Piedra Liza arroyo and installing land treatment measures on the national forest portion of the watershed. The Soil Conservation Service planned and contracted for the construction of the dam. The Forest Service treated National Forest lands involved in the project.

From July 27 to August 1, 1955, over 4 inches of rain fell on the area. One storm produced 1.25 inches in twenty minutes. Arroyos on each side of the treated area produced floods but none came from the treated watershed. During the period this was the only non-flood producing arroyo between Albuquerque and Algodones (to the north) and some of them flooded two or more times. Another intense storm fell on the area on July 19, 1956, and deposited 1.38 inches of rain in the first 20 minutes. An additional .50 inches fell during the next hour.

The land treatment measures by the U. S. Forest Service were designed to stop the rain where it fell and let it sink into the ground instead of running over the surface into the arroyo. 1300 acres of National Forest land were treated. The detention dam is the only structure located in the arroyo channel.

Land treatment measures were designed to handle the small storms from the national forest portion of the watershed. The detention dam was constructed to handle the occasional large storm and the water originating on the untreated portions of the watershed.

-0-0-0-0-0-

WATCH YOUR FOOTING. THE LAND IS ROUGH IN SPOTS.

-0-0-0-0-0-

STOP NO. 1 — Sandia Pueblo Underpass

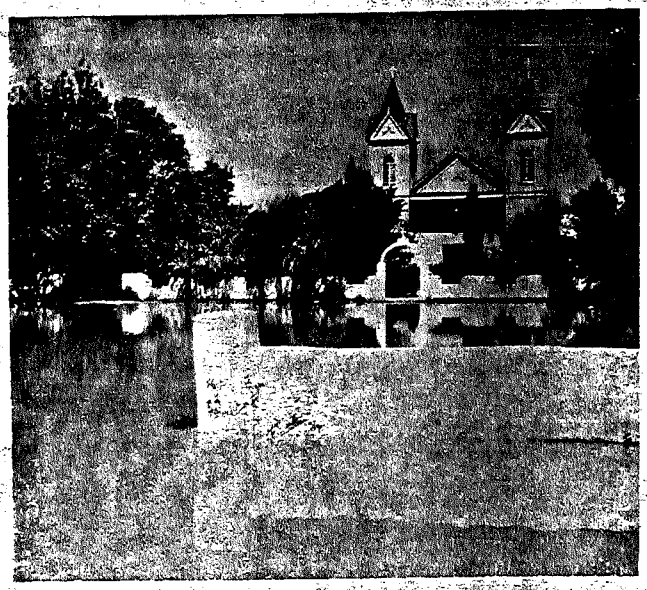
Flood water closes the highway here several times each year. When a summer storm falls on the denuded mesa lands east of the Santa Fe Railway tracks the runoff comes through the underpass and collects in the highway. It fills this area covering the highway for about 1/2 mile. Traffic cannot go through and must detour.

The water stands on the highway and land to the west until it sinks. The high bank, 7 or 8 feet higher than the land, is dirt and sand scraped off the highway and pushed to the sides. Notice that the fence posts here are higher than the fence to the north.

STOP NO. 2 — Flooded Highway and Church Grounds at Bernalillo

Flood damage from the watershed before the project was started, destroyed the 100-year old convent and did heavy damage to homes, farms, and orchards in the path of the flood. While the exact amount of damage was not accurately determined, it cost $130,000 to build a new convent. The people of Bernalillo pledged themselves to sponsor this small watershed program for work done on their farms and private lands. However, the work we will see today on the National Forest is paid for from U. S. Forest Service appropriations.

Flooded highways were a common sight where the Piedra Liza flowed to the Church grounds. Note stalled cars.



Flood waters standing in Church courtyard.

STOP NO. 3 Jemez Flood Control Dam

This is a silt and flood control dam designed to withhold flow of silt and sediment into the Rio Grande above Albuquerque. It costs money to build a dam to hold silt that comes off the land, and that portion of the Jemez Reservoir designed to hold silt has cost $8.40 for each acre of land above the dam. This is not a permanent cure, since work on the watershed itself is not being done.

The Jemez Dam is 780 feet long and 135 feet high. The Reservoir capacity is estimated at 120,000 acre feet, of which 90,000 acre feet is for silt and sediment, and 30,000 acre feet for flood control. The Reservoir covers 2,885 acres and the project cost approximately $7,000,000.00.

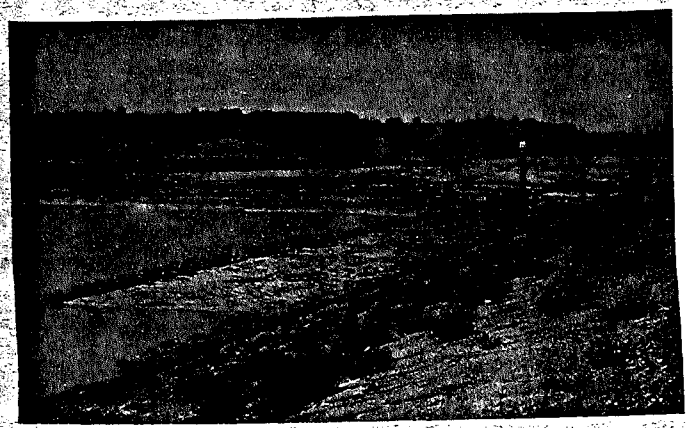
Return to the "Y" at Bernalillo and proceed east on Highway 44 toward Placitas.

STOP NO. 4 Detention Dam at Piedra Liza Arroyo

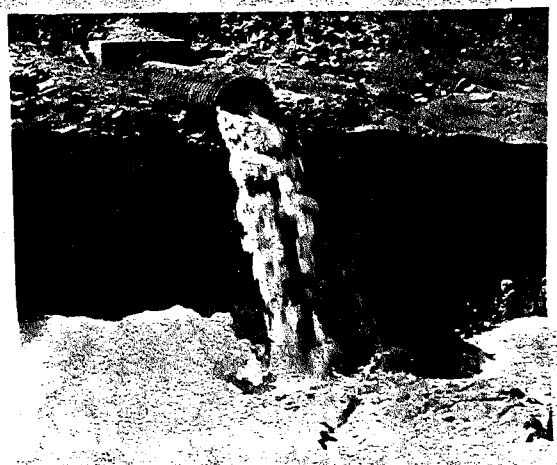
You are now approaching the Bernalillo Small Watershed Project and the Detention Dam built across the mouth of the Piedra Liza. This earth dam built by the Soil Conservation Service, is 1030 feet long and 35 feet high. The reservoir holds 250 acre feet of water (that is equal to one foot of water over 250 acres of land).

This is NOT a water storage reservoir. All flood water is owned by water users in the Rio Grande Valley so the dam has an open gate. Flood waters rushing into the reservoir are impounded until the water can run out through the 24" open gate in the dam. The water can be drained out in 36 to 72 hours, depending on the size of the flood. Usually summer floods run large volumes of water for an hour or two. If the water can be caught in a reservoir and allowed to drain off as a small stream, no damage to valuable property will result. The water can be channeled into drain and irrigation ditches where it can be used.

Unfortunately, no provision has been made by the ditch owners to take these flood waters into existing ditches. While the Piedra Liza Arroyo is one of the flood drainages into Bernalillo, there are others above and below the town which bring water into the valley area and can still cause flooding in Bernalillo.



Floodwaters impounded behind dam after July, 1956 storm



Water flowing out of gate outlet at full capacity

STOP NO. 5 — Entrance Gate to Cibola National Forest Bernalillo Watershed Protection Project

You will see several gullies along the road. They were once roads that were allowed to wash out because no provisions were made to prevent water running down the wheel tracks. As we drive through the Project, you will see that in most places erosion control structures are functioning. This was accomplished by a number of methods:

1. Terraces: Level terraces were constructed with a road grader. They are about a foot deep and the soil removed forms a dike on the lower side of the structure. Cross bars in the terraces prevent flow and will prevent general overtopping and washing when a big storm occurs. The terraces will impound the runoff from the area between the structures.

2. Pitting: Most of the flatter portion of the watershed has been pitted by using an ordinary farm disk. The implement cuts out a shallow basin two feet long and about eight inches wide. These depressions are intended to catch the rainfall so it will soak into the soil where it is available for plant growth.

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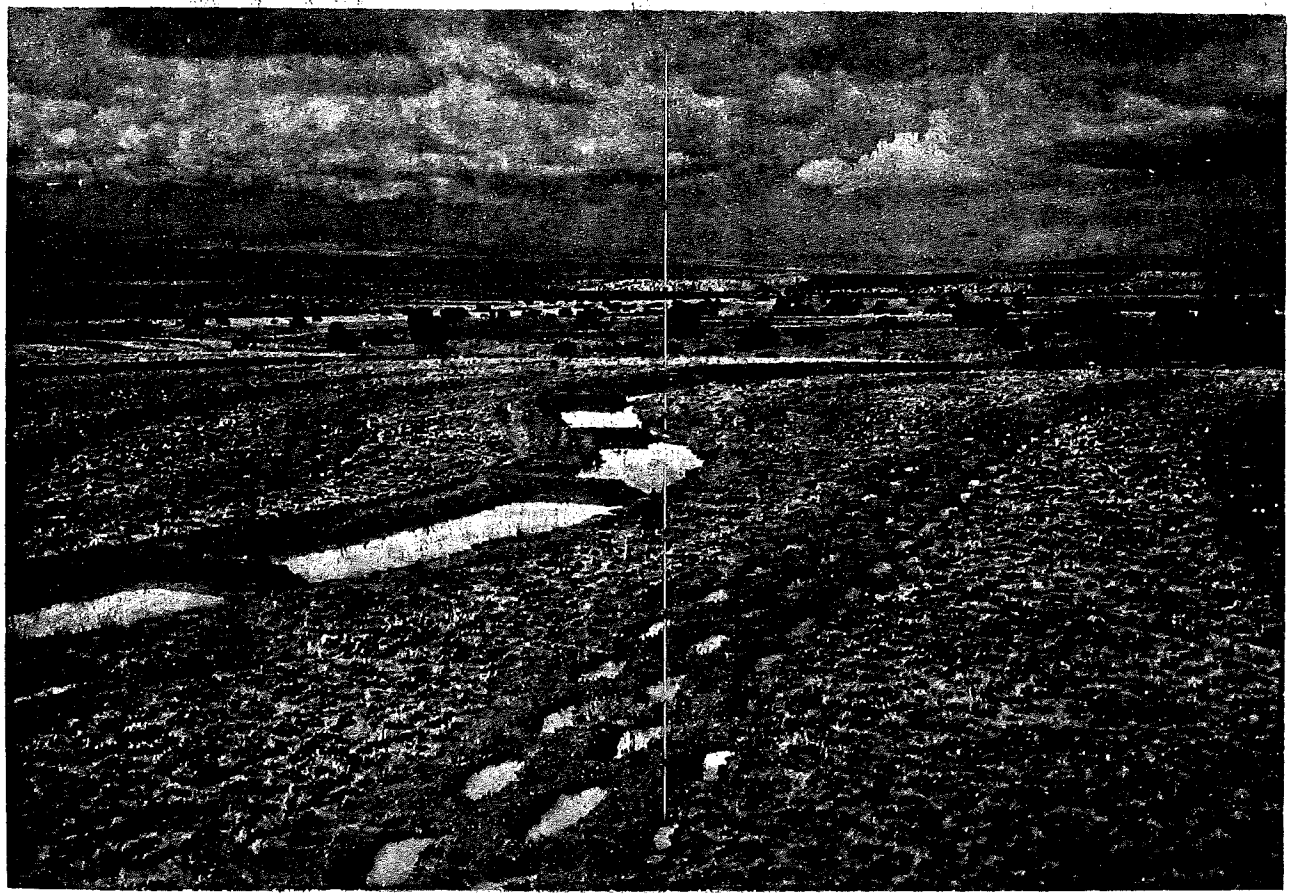

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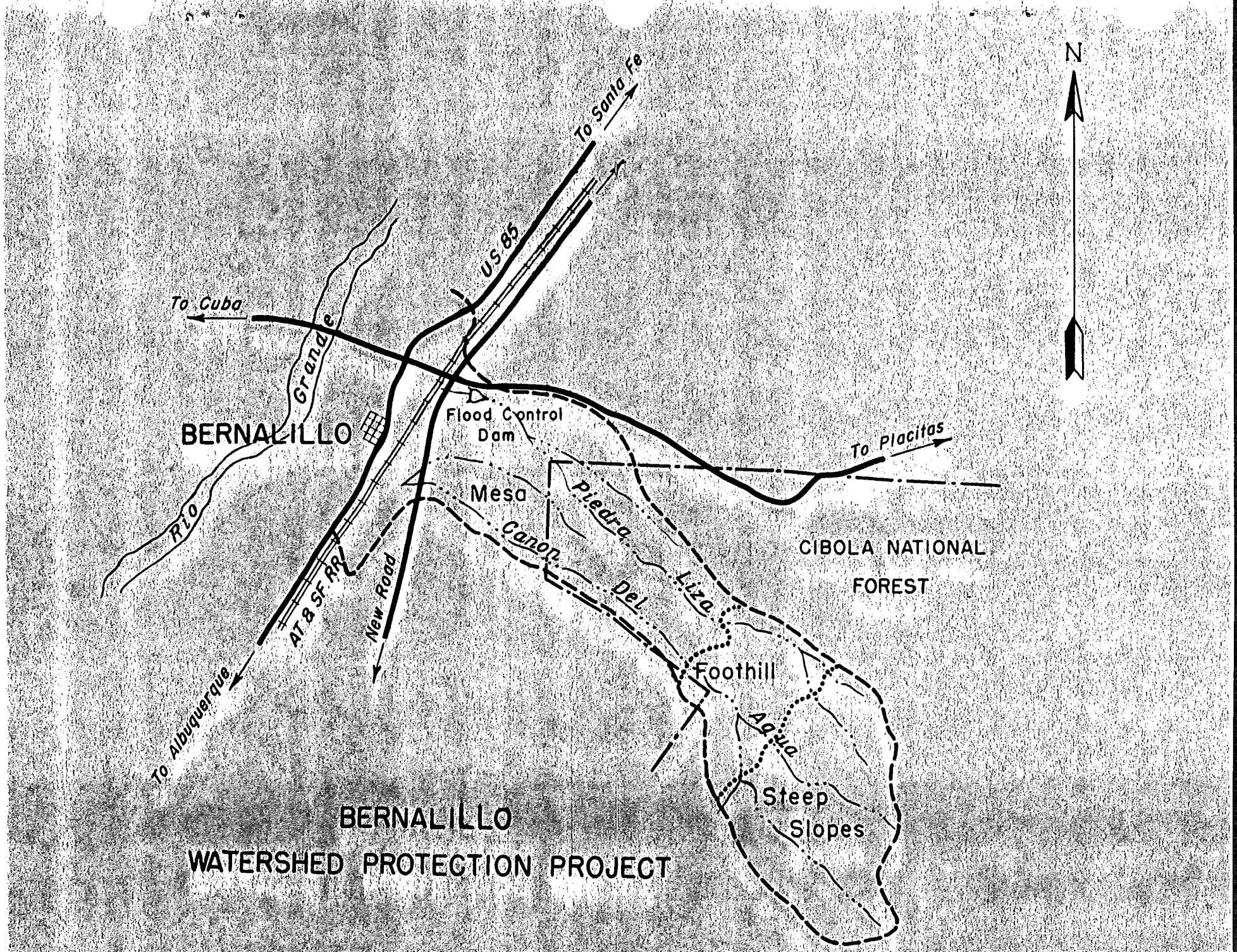
N
To Santa Fe
US 85
To Cuba
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To Placitas
Mesa
Piedra Lisa
Canon Del
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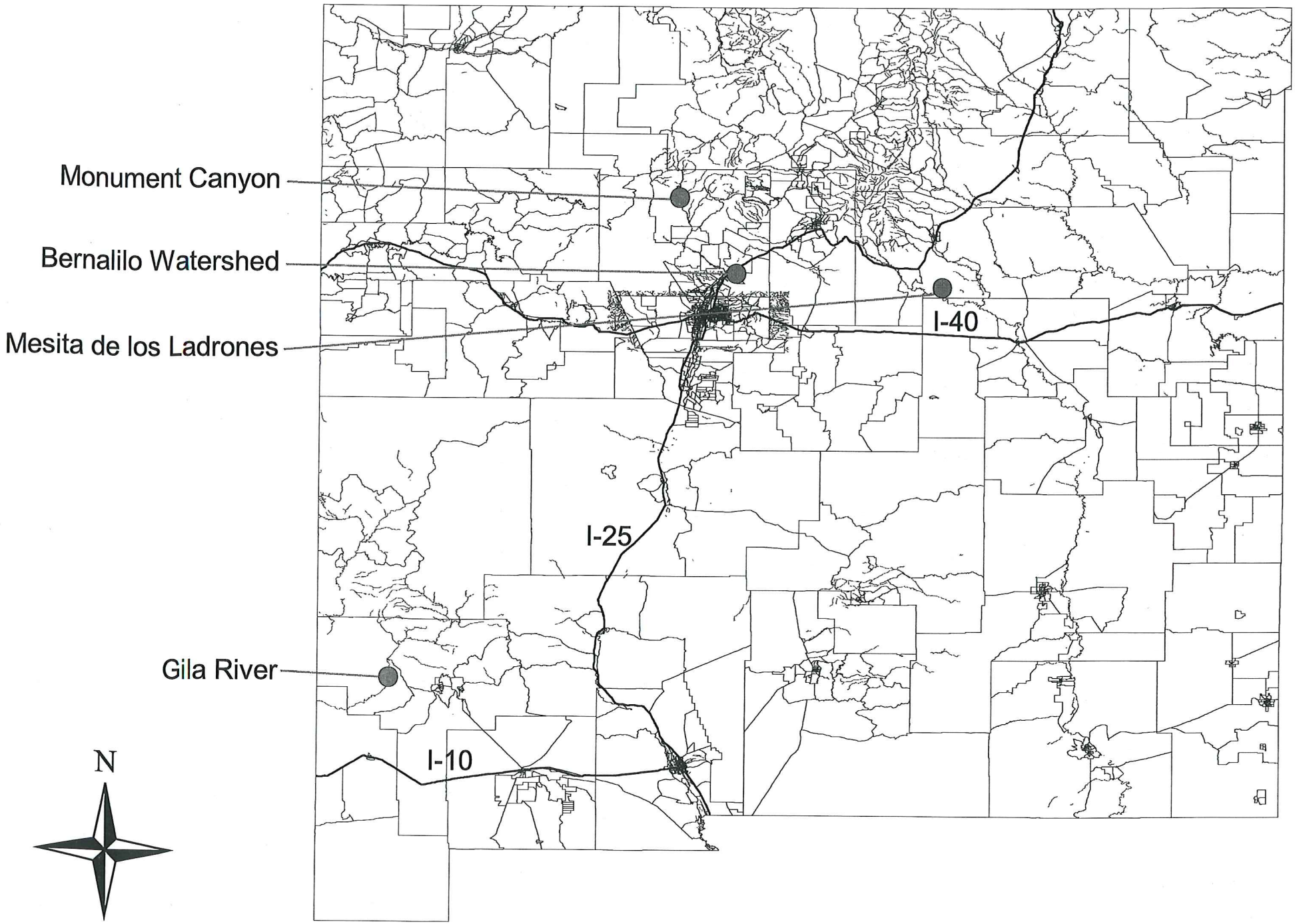
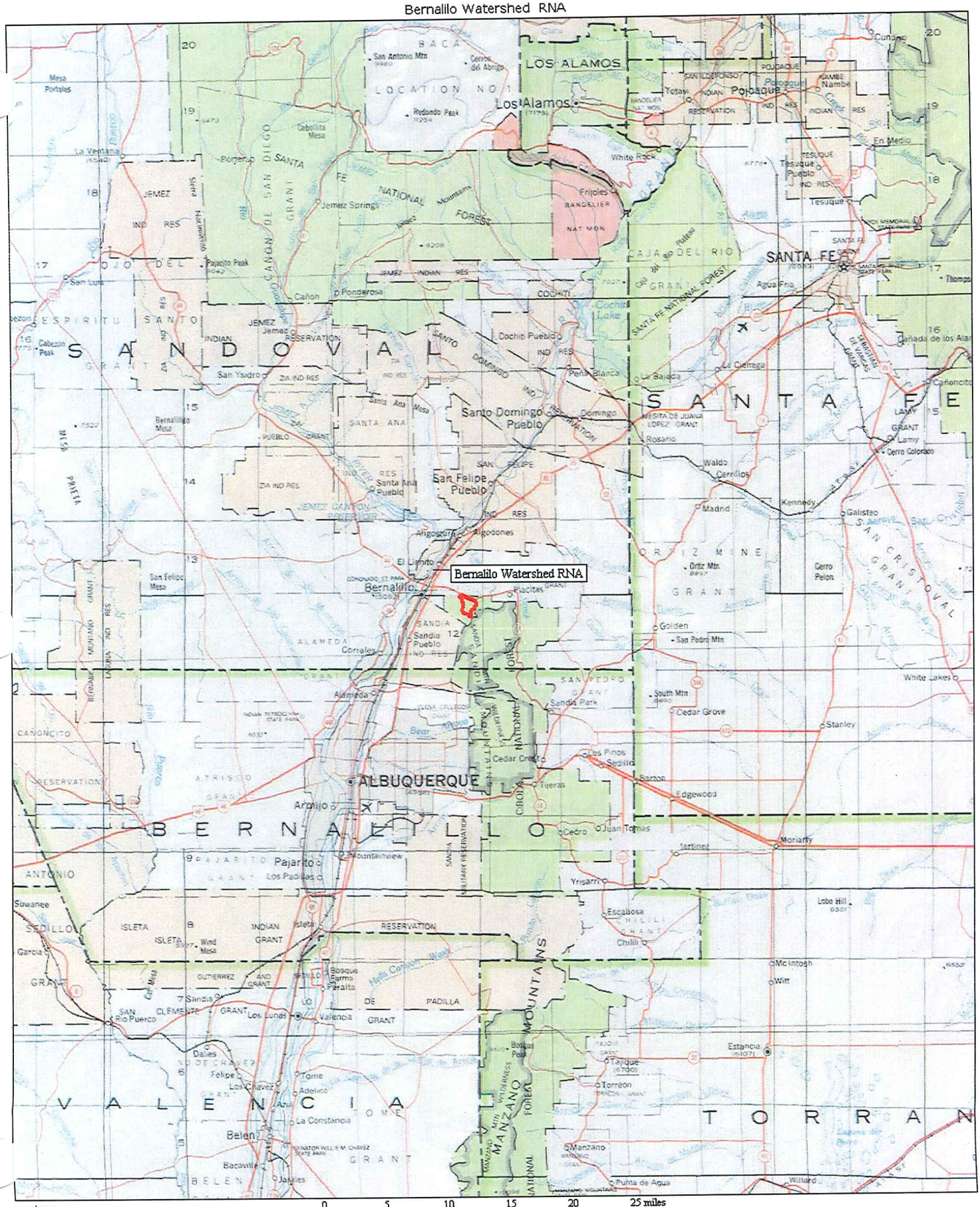
AT & SF RR
New Road
To Albuquerque
Foothill
Agua
Steep Slopes
BERNALILLO
WATERSHED PROTECTION PROJECT

NEW MEXICO RESEARCH NATURAL AREAS



Bernalilo Watershed RNA

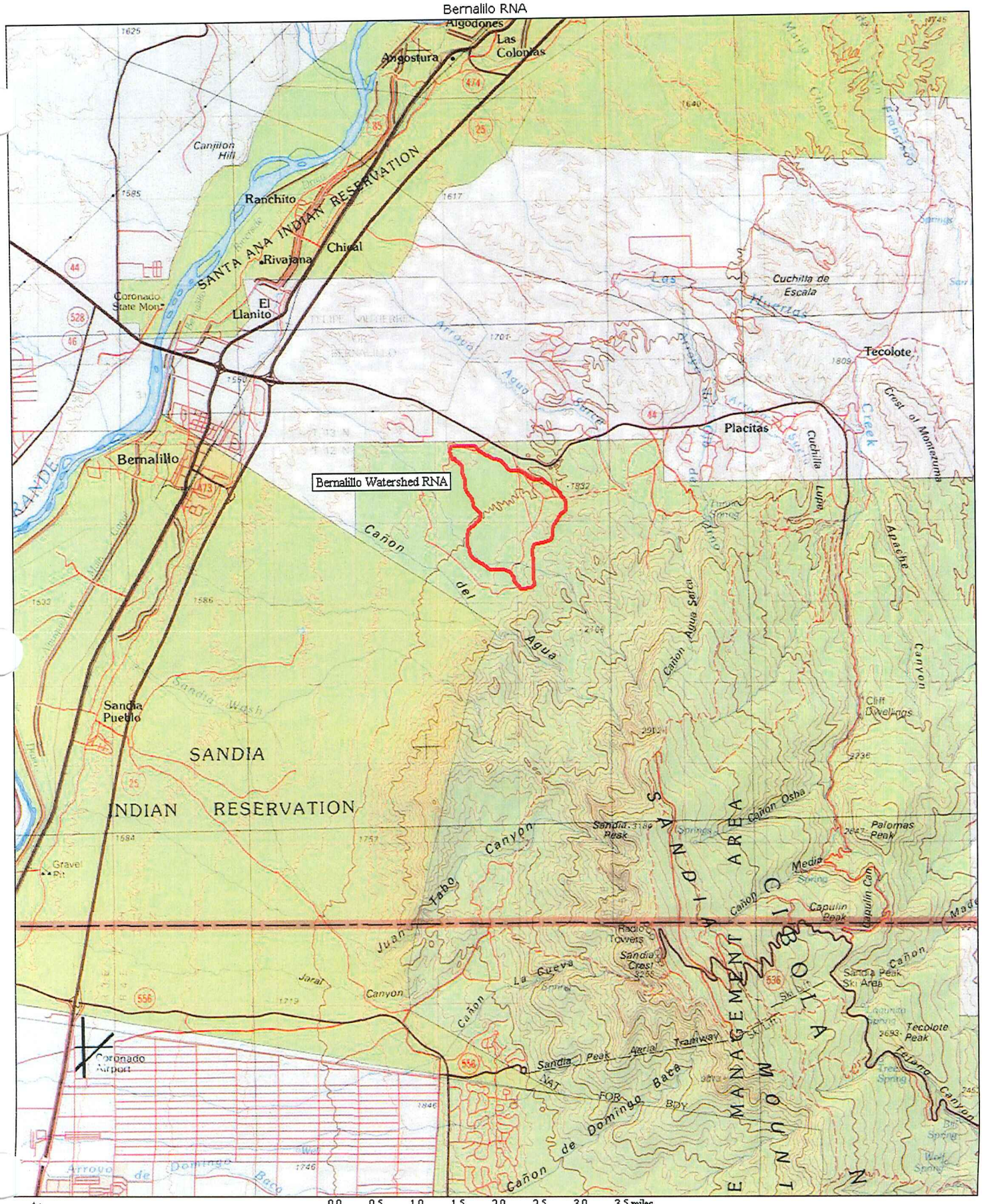


TN 10° MN

0 5 10 15 20 25 miles

0 5 10 15 20 25 30 35 40 km

Bernalillo RNA



TN 10° MN

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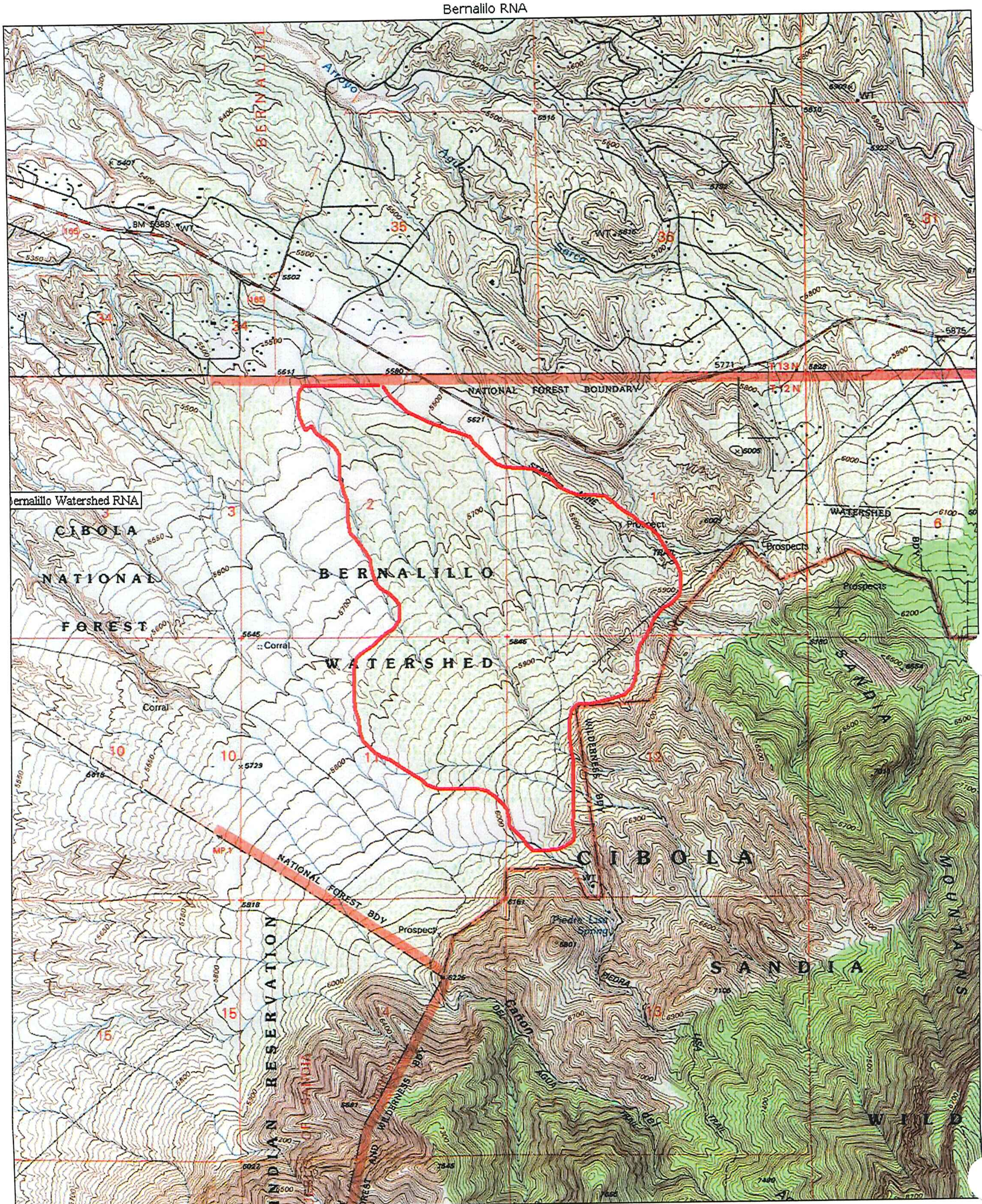
0 1 2 3 4 5 km

Bernalillo RNA



TN/MN 10°

0 .5 1 MILE
0 1000 FEET 0 500 1000 METERS

USDA-FOREST SERVICE

PHOTOGRAPHIC RECORD

(See FSM 1643.52)

PHOTOGRAPHER	DATE SUBMITTED
William W. Dunmire	Nov. 16, 1987
HEADQUARTERS UNIT	**LOCATION**

INITIAL DISTRIBUTION OF PRINTS AND FORM 1600-1:

☐ WO ☐ RO ☐ DIV. ☐ FOREST ☐ DISTRICT ☐ PHOTOGRAPHER Date _____

INSTRUCTIONS: Submit to Washington Office in quadruplicate. Permanent numbers will be assigned and the forms will be distributed as follows: (1) Washington Office, (2) RO or Station, (3) Forest or Center and (4) Photographer.

PHOTOGRAPH NUMBER		SELECTED FOR W.O. PHOTO LIBRARY	DATE OF EXPOSURE	LOCATION (State, Forest, District and County)	CONCISE DESCRIPTION OF VIEW	NEGATIVE (Show size and BW for black and white or C for color)
TEMP. (1)	PERMANENT (To be filled in by the WO) (2)	(3)	(4)	(5)	(6)	(7)
				ALL: New Mexico Cibola NF Sandia Dist Sandoval Co		ALL: 24x36mm color slides
1.			10-29-86		South from Highway 44 toward the southwest corner of Bernalillo Watershed RNA.	
2.			10-20-86		Open grassland, northwest portion of Bernalillo Watershed RNA.	
3.			10-20-86		Dying Cholla cactus on piedmont alluvium of Bernalillo Watershed.	
4.			10-20-86		Upper slopes of Bernalillo Watershed RNA with one-seed juniper occurring throughout the grassland.	
5.			10-20-86		Rabbit brush, apache-plume and brickellia on one of several dry washes in the Bernalillo Watershed RNA.	
6.			10-20-86		Pinyon, one-seed juniper and shrub live oak with black grama grass in upper wash of Bernalillo Watershed.	
7.			10-20-86		Remnants of erosion control terracing constructed in the early 1950s still visible on Bernalillo Watershed.	
8.			10-20-86		Evidence of 30-year-old gully erosion control, Bernalillo Watershed RNA.	

United States Department of Agriculture
Forest Service
Sandia Ranger District
11776 Highway 337
Tijeras, NM 87059
(505) 281-3304

Reply To: 1950

Date: November 8, 1993

Dear Forest User:

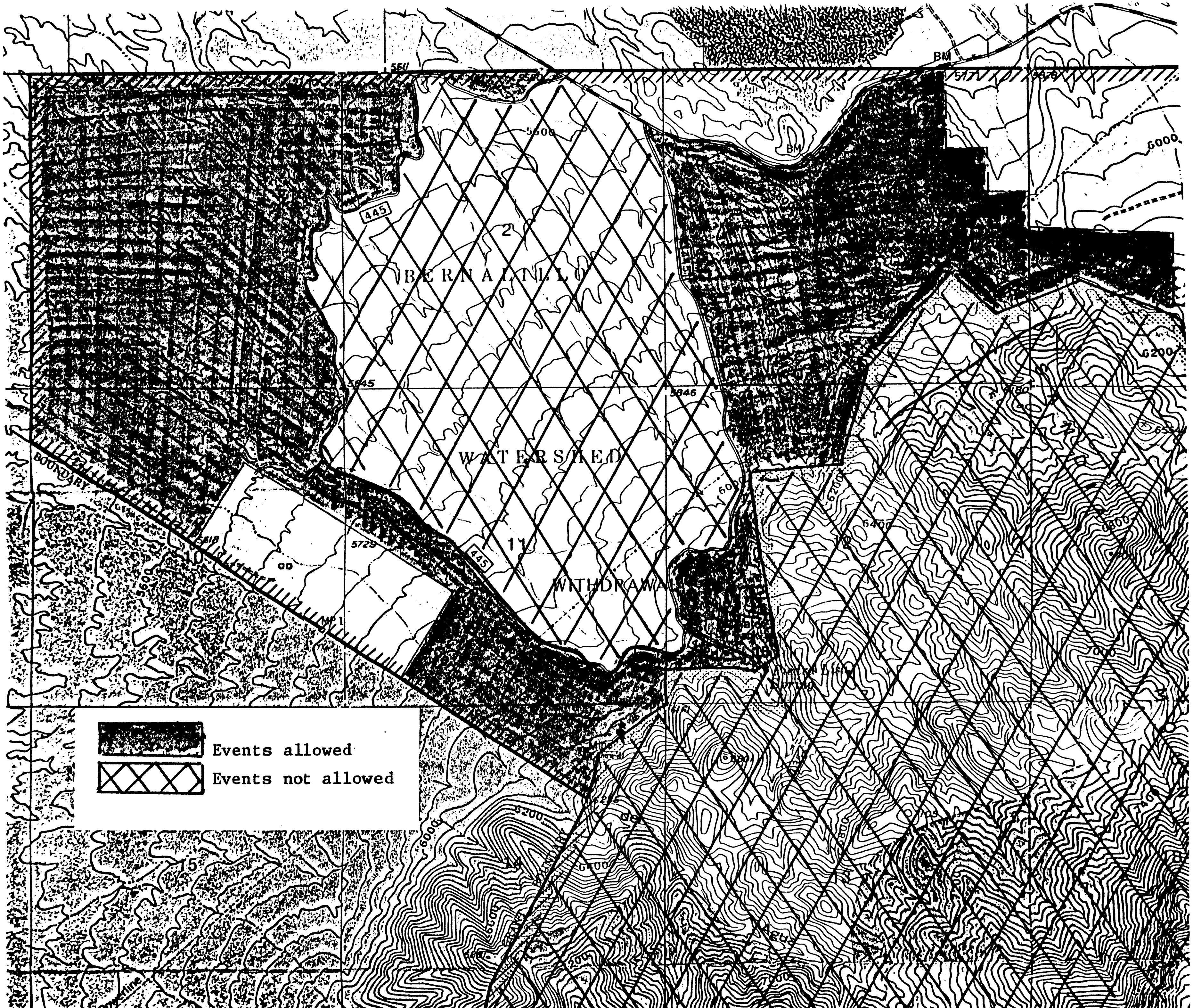
Enclosed is a copy of a decision memo to allow a series of group activities on the Bernalillo Watershed. The decision, which was signed on November 1, allows for activities such as fun runs, mountain bike events, dog obedience exercises, and horse events to occur within the watershed. These activities are restricted to areas outside of the proposed Research Natural Area and outside of the designated Wilderness area. A legal notice was published in the Albuquerque Journal on November 4, 1993. Please pass this information on to individuals in your organization who would be interested.

Sincerely,

FLOYD A. THOMPSON, III
District Ranger

TMCCLUNG:ceb 11/8/93

FILE


BERNALILLO
WATERSHED
WITHDRAWAL
BOUNDARY
445
Events allowed
Events not allowed

DECISION MEMO/ CATEGORICAL EXCLUSION

FUN RUNS, MOUNTAIN BIKE EVENTS, DOG TRAINING EXERCISES, AND HORSE EVENTS ON LOOP ROAD 445 (BERNALILLO WATERSHED)

USDA - Forest Service
Cibola National Forest
Sandia Ranger District
Bernalillo County, New Mexico

Documentation of an environmental analysis, consisting of a project record is available for public review at the Sandia District Ranger's Office in Tijeras, New Mexico. The proposal is to allow permits to be issued on an individual basis for group events on Forest Road 445 located in the Bernalillo Watershed Area. Events will not be allowed in the interior section of the loop road known as the proposed Research Natural Area (RNA). A map is attached that shows the location of the area open to such events.

It is my decision to implement the proposal. I have concluded that this proposal is consistent with the goals and intent of the Cibola National Forest Land and Resource Management Plan (Forest Plan), as amended. The event area is located off New Mexico Highway 165 to Placitas. It is needed to accommodate future dog training exercises, local fun runs and mountain biking events, and is approved for the next five years.

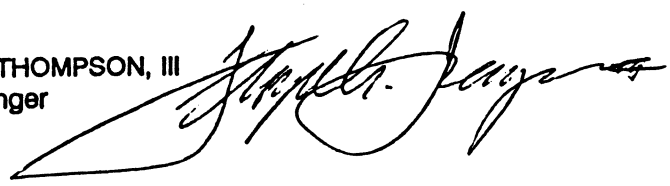
Biological evaluations have been completed and no threatened or endangered species were discovered. A Cultural Resource survey has been conducted and based on State Historic Preservation Officer concurrence, I have granted clearance.

My decision to approve this proposal was made with input from various public interests, Forest users, and nearby residents whose concerns were carefully weighed. I have determined through the scoping process and past experience that this action will not individually or cumulatively have a significant effect on the human environment and is categorically excluded from any further environmental analysis documentation.

This decision is subject to appeal in accordance with 36 CFR Part 217. A Notice of Appeal must be in writing and clearly state that it is a Notice of Appeal being filed pursuant to 36 CFR 217. Appeals must be fully consistent with 36 CFR 217.9, "Content of Notice of Appeal," and must be filed with Jeanine Derby, Cibola National Forest Supervisor, 2113 Osuna NE, Suite A, Albuquerque, NM 87113 within 45 days from the date of publication of the legal notice of decision in the Albuquerque Journal. This project will not be implemented sooner than seven calendar days following publication of the legal Notice of Decision.

For additional information concerning this decision, contact District Ranger, Floyd Thompson, 11776 Highway 337, Tijeras, NM 87059, (505) 281-3304

FLOYD A. THOMPSON, III
District Ranger



Date 11-1-93

Natural Reproduction of Winterfat (*Eurotia lanata*) in New Mexico[1]

ROBERT G. WOODMANSEE[2] AND LOREN D. POTTER

Department of Biology, The University of New Mexico, Albuquerque.

Highlight

In situ **ecological factors influencing the natural reproduction of the important Western browse species winterfat (*Eurotia lanata*) were investigated in central and west-central New Mexico from summer 1967 to spring 1969. Seed of winterfat germinated in late winter and early spring on all slopes and in soils varying widely in origin and texture. Survival was greatest on disturbed soils which supported low vegetation that afforded some shelter but little shading for seedlings. The disturbed soils indicated greater moisture availability. Seedlings were tolerant to competition, and were often found in living clumps of grass. A comparison of vegetation on heavily grazed and protected ranges indicated winterfat was susceptible to heavy grazing, and reproduced when on protected or lightly grazed range dominated by low-growing grasses.**

Winterfat (*Eurotia lanata* (Pursh) Moq.), a low-growing, palatable, and nutritious shrub, is used as browse by livestock and big game on rangelands in western North America. Exploitation of New Mexico rangelands by the white man has led to the decrease, and in some cases the extermination, of valuable browse species, thereby limiting the carrying capacity of the range. Currently, in attempts to improve big game habitat, state and federal agencies are investigating the re-establishment of browse on depleted rangelands. This study was initiated to determine some of the *in situ* ecological factors influencing the natural reproduction of winterfat in the pinyon-juniper and ponderosa pine vegetational types in central and west-central New Mexico. The principle factors considered were life cycle, climate, site, soil, plant association, and animal association. The results of this study are intended to supplement

[1] This research was supported through a Cooperative Agreement with the Rocky Mountain Forest and Range Experiment Station, U.S. Forest Service, Fort Collins, Colorado, and was part of a master's degree thesis at The University of New Mexico. The authors wish to thank Dr. H. Wayne Springfield of the Rocky Mountain Station for his suggestions and advice during the study, and Mr. Andres Lauriano, Governor of the Sandia Pueblo, for permission to work on the Sandia Indian Reservation. Received January 29, 1970; accepted for publication March 30, 1970.

[2] Present address: Department of Range Science, College of Forestry and Natural Resources, Colorado State University, Fort Collins, Colorado.

Table 1. Analysis of sites in areas of reproduction of winterfat (*Eurotia lanata*).

	Sandia Mtns., Sandoval Co.				Zuni Mts., McKinley Co. Fort Wingate	Gallinas Mtns., Socorro Co. Magdalena
	Watershed-A	Watershed-B	Fish hatchery-A	Fish hatchery-B		
Elevation (m)	1,705	1,800	1,875	2,070	2,150	2,090
Topography	Drainage bank on alluvial fan	Bottom of slope, head of alluvial fan, adjacent to head of arroyo	Slope on inside of curve of road	Slope	Canyon floor	Drainage bottom
Slope direction & percent	W 5–10	W 10–15	W 15–20	E-NE 100	N 4	SW 0–10
Parent material	Alluvium	Alluvium	Madera Ls.	Madera Ls.	Alluvium	Dune sand
Mineral soil depth (cm) and horizons	>45 A 0–11 B 11–36	>45 A 0–22 B 22–42	25	25	>45 A 0–15 B 15–?	>45 No development
Soil texture	Cherty, sandy loam	Stony, (angular) gravelly, clay loam	Stony, cherty heavy clay loam	Rocky, stony, coarse cherty, cherty, loam	Heavy clay loam	Sandy loam
Soil pH	7.6–7.8	7.6	7.4	7.6	7.6–8.0	7.9
Vegetation, total cover, all strata (%)	45	63	43	45	44	46
Trees, total cover (%)	0	0	4	1	0	0
Shrubs, total cover (%)	2	5	5	22	19	27
Herbs, total cover (%)	45	58	34	15	29	21

general knowledge of the reproduction of this important browse species, and thus lead to improved techniques of re-establishment and management practices.

Winterfat is found from Manitoba and Saskatchewan to the Pacific Coast states, east to western Texas, and north through the Great Plains. It is common in certain areas up to approximately 2,450 m (about 8,000 ft) elevation and rarely to approximately 3,000 m (about 10,000 ft). Dayton (1931) and others agree that, because of overgrazing by livestock, the species is less abundant and covers a narrower range now than previously.

Winterfat is found most abundantly in the foothills, plains, and valleys of the West. It grows in dry soils that range from sands to clays and which are often impregnated with white alkali and other salts. Associated vegetational types range from desert plains and scrub to ponderosa pine, mountain parks, and mixed-grass prairie. The species is usually associated with desert scrub, semidesert bunchgrasses, sagebrush, and pinyon-juniper. It is frequently abundant and widespread, sometimes becoming the dominant (Dayton, 1931).

Winterfat is very nutritious and palatable for all classes of livestock and game herbivores (Van Dersal, 1938; Jameson, 1952; Cook et al., 1959). All parts of the plant above the woody base are eaten by the animals. Riedl et al. (1954, p. 10) state, "in August the nutritive content (of winterfat) may be higher than that of a good grade of alfalfa hay."

Field Work and Methods

This study was made from the summer of 1967 through the spring of 1969. Detailed investigations were conducted during the summer, and supplementary field observations were continued throughout the year.

The predetermined study areas were on, or adjacent to, the Cibola National Forest in the Sandia Mountains in Bernalillo and Sandoval counties, Gallinas Mountains in Socorro County, and the Zuni Mountains in western Valencia and southern McKinley counties. These areas were selected because they provide a wide variety of surface rock formations, soils, and topography (Table 1).

Two terms, as used in this study, require definition: *Microenvironment* is the environment within a 1 m^2 quadrat frame centered over a seedling. *Seedling* is a plant up to about two years old growing in a microenvironment similar to the one in which it germinated. Determination of seedling age by counting terminal bud scale scars is not possible with this species. Age determination in the absence

of cotyledons is indecisive without careful inspection of annual rings, which are indistinct in winterfat. Plants were not cut for ring counts since seedlings were scarce on some sites and were needed for long-term survival studies. Less reliable but non-injurious examination of morphological characteristics was used to determine approximate seedling age.

Soil profiles of the upper 45 cm, or to bedrock if shallower, were characterized by describing pits near the study plots. Soil classifications of texture, coarse fragments, stoniness, and rockiness were based on the U.S. Dep. Agr. Soil Survey Manual (1951). Soils were classified primarily by observation, with verifications of texture made by the hydrometer method of Bouyoucos (1936). Information on Zuni Mountain soils was supplemented by Williams (1967). The pH of soils was determined with a La Motte-Morgan soil testing kit.

Two methods were used for analyzing total cover of vegetational foliage, rock or large stones, and litter. Total foliage cover was measured rather than basal cover because the foliage of the surrounding plants is generally the dominant feature providing shelter and shade for the seedling microenvironment. A 1 m^2 quadrat frame was centered around a seedling, with the sides oriented to the four cardinal compass points. The plot thus delineated the seedling microenvironment defined above, and chart quadrats were then drawn. Representative plots were selected to be used in seedling survival studies, and were permanently marked by painted metal stakes with plastic flagging at two diagonal corners of the plot. These permanent plots were examined periodically from the time of location through early spring 1969, and notes were taken regarding survival and the observable factors affecting survival. Plants were identified whenever possible and placed in one of three strata: 1) *grass-forb layer*—grasses, forbs, and young shrubs and trees not taller than the surrounding grasses and forbs, 2) *shrub layer*—all shrubs and those trees taller than stratum (1) but less than 1.83 m (6 ft), and 3) *tree layer*—trees taller than 1.83 m (6 ft).

FIG. 1. Fenceline contrast of range condition and winterfat reproduction between Bernalillo Watershed and Sandia Indian Reservation.

The second method of analysis utilized four 10-m line intercepts, all originating from the seedling at the center of the quadrat and running to each of the cardinal compass points. Total cover in the three strata mentioned above was measured and recorded as to distance from the seedling.

The same intercept method was used for a vegetational comparison of protected range on the Bernalillo Watershed and adjacent overgrazed range on the Sandia Indian Reservation in Sandoval County; however, plots were located in the following way rather than originating at a seedling. Three sites were selected along the fence which forms the boundary between the two ranges. Sampling plots, within each site, were placed in physiographically equivalent locations on either side of the fence at the three sites. Plots were placed so that vegetation within 1 m of the fence was not sampled to avoid the effect evident in Fig. 1. In addition to the largely quantitative methods described, detailed subjective notes were taken regarding germination and seedling environments.

Results and Discussion

Climatological Data

Precipitation and maximum-minimum temperature data for representative weather stations in central and west-central New Mexico were evaluated. Due to the great variability of summer rainstorms from one site to another and, to a lesser degree, winter snowstorms, these data were evaluated for trends rather than actual quantitative values. Before discussing the specific implications of the climatological factors to the principal species, several generalizations are warranted.

January through May of 1967 was a period of drought with generally higher temperatures than normal at all stations. The drought was broken in June with abnormally early, general rainstorms. Numerous storms occurred throughout the summer, bringing precipitation far in excess of normal amounts. October and November precipitation was below normal. December precipitation was near normal at all stations except those of western New Mexico, which received a near-

record snowstorm. Little or no precipitation fell at any of the stations in January 1968, but from February to April totals were well above normal. June rainfall was very low at all stations. July and August precipitation totals were above normal and September and October totals were below normal. Data were unavailable for the period January to March 1969 but casual observation indicated above average precipitation in the form of snow.

Table 2. Seedling survival (%) of *Eurotia lanata* at the Fish Hatchery-A, Fish Hatchery-B, Watershed-B, and Fort Wingate sites.

Site	Plot	First counting		Second counting		Last counting		
		Date	No. of seedlings	Date	No. of seedlings	Date	No. of seedlings	Survival
Fish Hatchery-A	1	6/14/68	4	8/5/68	1	3/28/69	0	0
	2		8		1		1	13
	3		9		4		2	22
Fish Hatchery-B	1	6/14/68	ca. 300	7/17/68	ca. 200	3/28/69	20	7
	2		50		21		7	14
Watershed-B	1	7/8/68	ca. 50			3/28/69	22	44
	2		20				3	15
	3		27				3	11
Fort Wingate	1	4/12/68	ca. 500	10/23/68	125	3/30/69	75	15
	2		ca. 200		20		10	5
	3		ca. 200		0		0	0
	4		ca. 200		9		5	3

Germination and Survival

Winterfat usually germinates in late winter and early spring (Plummer et al., 1968; Bleak et al., 1965; Strickler, 1956; U.S. Forest Service, 1948; and Hilton, 1941). Springfield (1968a) and Strickler (1956) agree soil moisture at or near field capacity gives maximum germination; nevertheless, Springfield found a fair percentage of the seeds will germinate under high moisture stresses if the temperature is held near 40 F. Pechanec (1964), discussing seedlings of western plants, and Hubbard (1957), discussing seedlings of bitterbrush, stressed adequate soil moisture must be available following germination to assure seedling success. Thus, as a result of the severe winter and spring drought in early 1967, no seedlings were found when this study was begun in June of that year. Germination did occur in late February and early March 1968 during a period of above-normal precipitation. The number of seedlings produced at that time was enormous at all sites. In areas of seed accumulation (ditches, roadsides, etc.) as many as 2,000 to 3,000 seedlings per square meter were produced. Germination conditions were probably near ideal. Seeds even germinated under several inches of snow at the Fish-Hatchery-B site. Seeds were available from the abundant crop produced in 1967 (probably stimulated by above-normal rains that summer) and from carry-over crops of seeds from previous years. Springfield (1968b) found little loss of viability in winterfat seeds up to three years old, but retention of viability varied from year to year depending on environmental conditions during the time the seeds were forming and maturing and on certain undefined physiological characteristics of the seed. Germination of large numbers of seedlings can be a definite ecological advantage. Ferguson and Basile (1967) found production of large numbers of seedlings of bitterbrush greatly increased the probability of successful establishment. This same conclusion is undoubtedly true for winterfat. However, on properly managed ranges the species can advance even under poor germination conditions (Statler, 1967).

Germination occurred on or near the soil (and litter) surface in all microhabitats, even on bare rocks. This observation agrees with the findings of Springfield (1967), Statler (1967), and Riedl et al. (1964) who suggest winterfat should be planted no deeper than 0.25 inches. Initial establishment was successful wherever the seedling radicles were able to penetrate the soil. Seedlings were able to withstand temperatures at least as low as 12 F (Fry, 1969; and Hilton, 1941) and were probably not limited by subfreezing temperatures that occurred in late winter and early spring 1968. Loss of seedlings by frost-heaving was not apparent in 1968, but observations in March 1969 indicated some of the 1968 plants would be lost due to this action. Strickler (1956) and Biswell et al. (1953) have stressed the importance of this factor. Cracks caused by frost-heaving were observed to serve as germination sites.

Seedlings were successful both near and far (at least 250 m) from mature plants, illustrating excellent wind dispersal. As the spring dry season advanced large numbers of seedlings perished, especially those on bare soil. June 1968 was very dry, but apparently the soil contained enough residual moisture to support large numbers of seedlings. Root growth of survivors during dry periods may have been stimulated by moisture stress (Weaver, 1958). By the time July rains started, only seedlings protected by mature plants of winterfat, those in or very near grass clumps, or those in litter were alive. Observations of the survival plots (Table 2) indicated low survival percentages after one year, but actual numbers of seedlings still alive were rather high.

Seed germination and seedling success of winterfat (Table 2), as occurred in 1968, were rare phenomena that depended upon nu-

merous, complex interactions of plant growth habits and environments. Pechanec (1964) states, ". . . good seed years are infrequent. And the association of good seed years with subsequent climatic conditions favorable to germination and survival is even less frequent." Observations indicate 1967 was an excellent seed production year for winterfat, possibly due to the very wet summer. Certainly, summer moisture conditions were favorable during 1968. Thus, Pechanec's requirements for the establishment of new plants seem to have been met.

Early germination, for plants that can survive subfreezing temperatures, permits the seedlings to become established before other plants, especially grasses, commence growth and start using large quantities of soil moisture. Weaver (1958) states some plants have the ability to germinate, put out several sets of leaves, and then cease shoot growth and undergo rapid root elongation. Winterfat has that type of growth habit. The roots of successful seedlings all penetrated below the grass root-level. Most of the initial root elongation was completed before the grasses started rapid summer growth. Some grasses do show spring growth and as Schultz et al. (1955) report, sufficient moisture from spring precipitation must be present in the soil to allow for both grass and shrub seedling growth. Hubbard (1957) also stresses the importance of sufficient soil moisture in the development of bitterbrush seedlings. An interesting paradox, probably relating to soil moisture, is the dependence of seedlings of winterfat upon their harshest competitor, grass. Seedlings develop best in full sunlight, but not on bare soil because the late spring-early summer soil surface temperatures are very likely lethal to the young, tender plants. Low-growing grasses offer a more hospitable microclimate and act as a "living mulch" even though they reduce maximum development of winterfat. This hypothesis is supported by the following observations. Occasionally seedlings of winterfat are found in litter, although litter, except for dead Russianthistle (*Salsola kali* L.), is scarce on Southwestern ranges. These seedlings, in the presence of mulch and the absence of competition from grass, appear more vigorous than seedlings in grass clumps. H. W. Springfield (personal communication), in studies involving blue grama (*Bouteloua gracilis* (H.B.K.) Lag.) range, found seed germination, seedling survival, and vigor of winterfat to be greater on mulched plots than on unmulched plots. He also observed that seedlings seldom are found on bare soil. Thus, it is apparent that seedlings are more vigorous in mulch or litter than in grass. But, since litter is not common, seedling survival is most often dependent on grass ("living mulch").

Vigorous, expanding stands of winterfat were observed on all slopes and parent materials where livestock use was light to negligible. However, best stands were found on gentle slopes and relatively well-drained alluvial substrate. Soil reactions were slightly basic (pH 7.4 to 8.0). Texture and rockiness varied greatly. These results support the findings of workers in Utah who concluded the species is probably restricted only by high salinity, high alkalinity, and by poorly drained soils (Workman and West, 1967; Gates, Stoddart, and Cook, 1956; Strickler, 1956; and Fautin, 1946). Without exception, in these studies, the vigorous, expanding stands of these plants were found on soils exhibiting some signs of erosion or disturbance, e.g., drainage bottoms, arroyo heads or banks, steep slopes, roadsides, rodent mounds, or sites of active sheet erosion. However, none of these sites were so severely eroded or disturbed that substantial vegetation, especially grass, was not present. Increased water availability, together with some protection for seedlings, appear to be the key factors involved in the success of the species on these sites. Fautin (1946) stated winterfat has relatively high water requirements and often occurs on ". . . soils where watercourses spread out over flat areas and where the normal amount of precipitation is augmented by runoff from higher places." In areas of well-developed caliche layers, the more severe types of erosion and disturbance, such as arroyo heads or banks, drainage channels, or rodent holes, disrupt the caliche and allow water to more readily penetrate the subsoil, and also allow greater opportunity for seedling root development. The direct effect of erosion or other disturbances in removing competing plants is probably of secondary importance since the species is quite tolerant to competition.

Big game use of winterfat was not evident in this study, but livestock use was observed on many ranges. Statler (1967), Kinsinger and Strickler (1961), Eckert (1954), and Hutchings and Stewart (1953) discussed livestock use of the species and all agree overgrazing is detrimental to the plants. The relationship of the degree of utilization to vigor of the species is striking.

Range Vegetation Comparison

A vegetation comparison study was made on the Bernalillo Watershed and the adjacent Sandia Indian Reservation to determine the influence of range condition on reproduction of winterfat (Fig. 1). The comparison was made after summer rains had begun but before significant summer growth started. The watershed was closed to livestock use in 1956 and was subjected to extensive land treatment, e.g., terracing, ripping, discing, etc., (Aldon, 1966). The reservation land has been continually overgrazed for many years. The right side of Fig. 1 shows vegetation on the protected watershed side of the boundary fence and the left side shows vegetation on the overgrazed reservation side.

Heavily grazed ranges, e.g., Sandia

Indian Reservation, may be void of plants of winterfat. Lightly grazed ranges may support stable stands and protected ranges, e.g., parts of Bernalillo Watershed, often support rapidly expanding stands. The Fort Wingate site has been protected only since 1966, yet the stand is advancing rapidly. Contrary to the above, some protected ranges support such vigorous stands of grass that winterfat is excluded (Fig. 1). A precise explanation of the excluding factors involved is not known, but several possibilities merit discussion. Potter and Krenetsky (1967) indicated some grasses, especially black grama (*Bouteloua eriopoda* Torr.) can make dramatic increases in cover on protected ranges. Important influences of different growth forms of grass, indeed species of one genus (*Bouteloua*), may be evident at the Bernalillo Watershed. Watershed-B and Watershed Site 1 are similar in site characteristics. Total vegetational cover and total herbaceous cover are similar at both sites; but the sampling plots of Watershed Site 1 (right side of Fig. 1), having mature, seed-producing plants of winterfat nearby, contained no reproduction of the species. The dominant grass at Watershed-B is blue grama (50% relative cover) with sand dropseed (*Sporobolus cryptandrus* (Torr.) Gray) (27%) as subdominant. At Watershed Site 1 black grama (58%) is dominant and sand dropseed (30%) is subdominant. The crown foliage of blue grama is low (0–10 cm) and tufted, and produces very little ground shade. Crown foliage of black grama, in contrast, is tall (30–45 cm) and compact and often produces dense ground shade, possibly limiting winterfat. Another explanation is the possibility that black grama is a better competitor for spring moisture than blue grama, and in this way deprives winterfat of available water. This latter premise is difficult to accept, however, because both grasses appear to be dormant until after summer rains begin. Seedlings of winterfat were not found even during the period of dormancy.

Watershed Site 2 is similar to Watershed Site 1 in vegetational characteristics and also in the exclusion of winterfat. Watershed-A and Watershed Site 3 both contain low-growing, open-crowned grass species and also winterfat reproduction.

Summary

Drought in the winter and spring of 1967 in central and west-central New Mexico limited spring germination and probably killed many seedlings of winterfat. As a result, little recent reproduction was found when the study was begun in June 1967. Above-normal precipitation in the summer of 1967 and the winter of 1967–1968 proved to be beneficial for reproduction.

Winterfat germinated in February and March 1968 in large numbers and at all sites containing parent plants. Large numbers, but a low percentage, of the seedlings that germinated in 1968 had survived at all sites after one year. In typical winterfat habitat, seedlings did not survive the high summer temperatures produced on bare soil; and survival was limited to the shelter of older plants, clumps of low-growing grasses, and litter. Litter was not abundant on most ranges, and grasses offered the "mulch" necessary for seedling success.

Reproducing stands of winterfat were found on all well-drained slopes, parent materials, and soils that were slightly basic in reaction. The best stands were found on gentle slopes of alluvial origin. All sites were eroded or disturbed but supported a substantial vegetative cover, especially grass. It is the greater amount of available moisture resulting from erosion and disturbance, together with some protection offered by low-growing grasses, that favors establishment of winterfat in the sites observed.

The overgrazed Sandia Indian Reservation land with foliage cover reduced to 22–33% contained no winterfat. The protected Bernalillo Watershed range with 50–60% foliage cover dominated by grasses with low, tufted, open-growth habit contained numerous stands of reproducing winterfat. However, two protected ranges with 61 and 62% cover, dominated by grasses with tall, compact growth habits producing dense ground shade, suppressed reproduction of winterfat.

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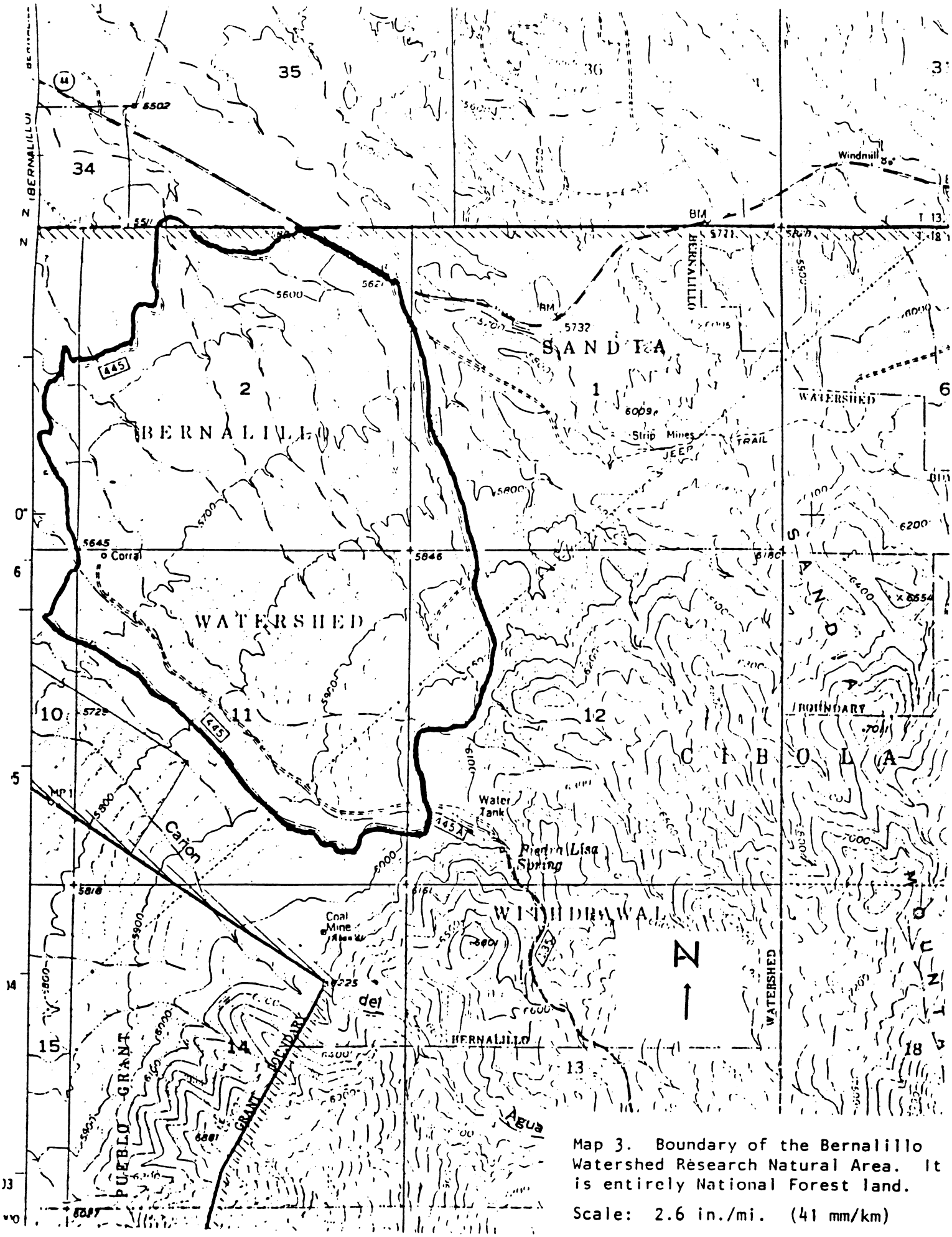
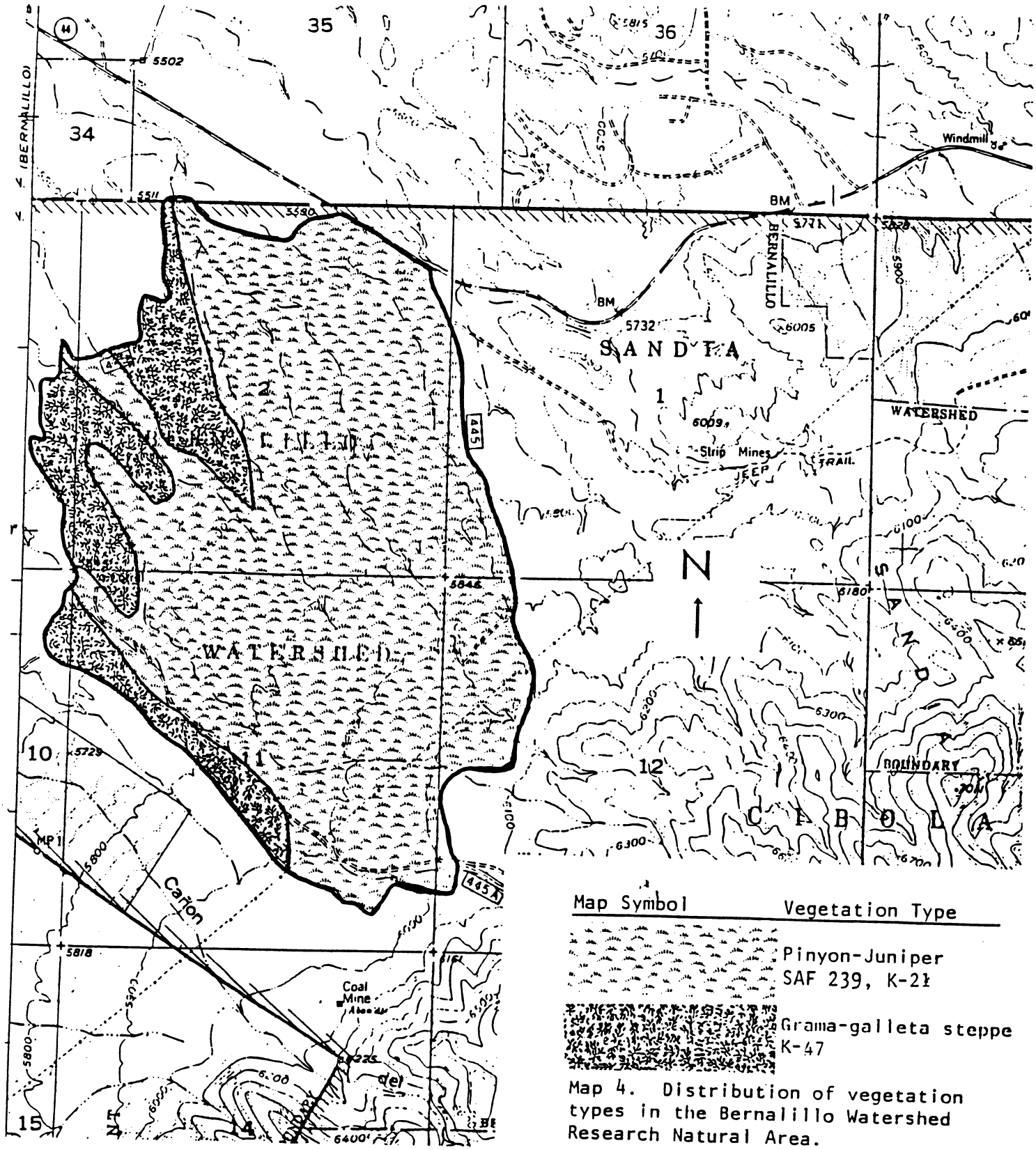


Map 3. Boundary of the Bernalillo Watershed Research Natural Area. It is entirely National Forest land.

Scale: 2.6 in./mi. (41 mm/km)



Map Symbol	Vegetation Type
	Pinyon-Juniper SAF 239, K-21
	Grama-galleta steppe K-47

Map 4. Distribution of vegetation types in the Bernalillo Watershed Research Natural Area.