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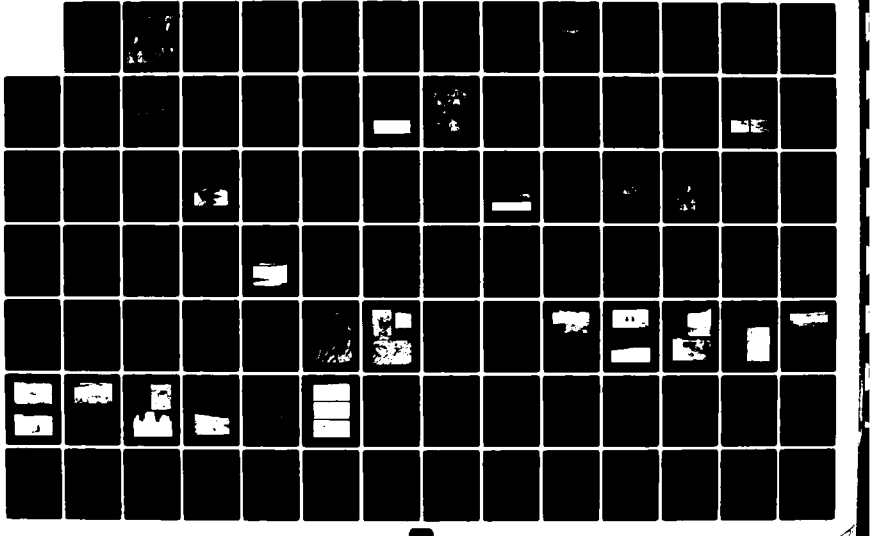

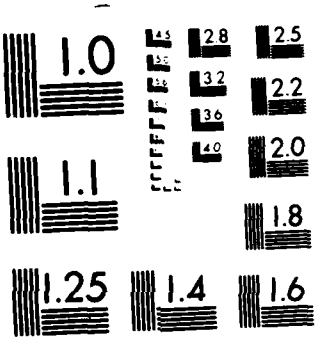

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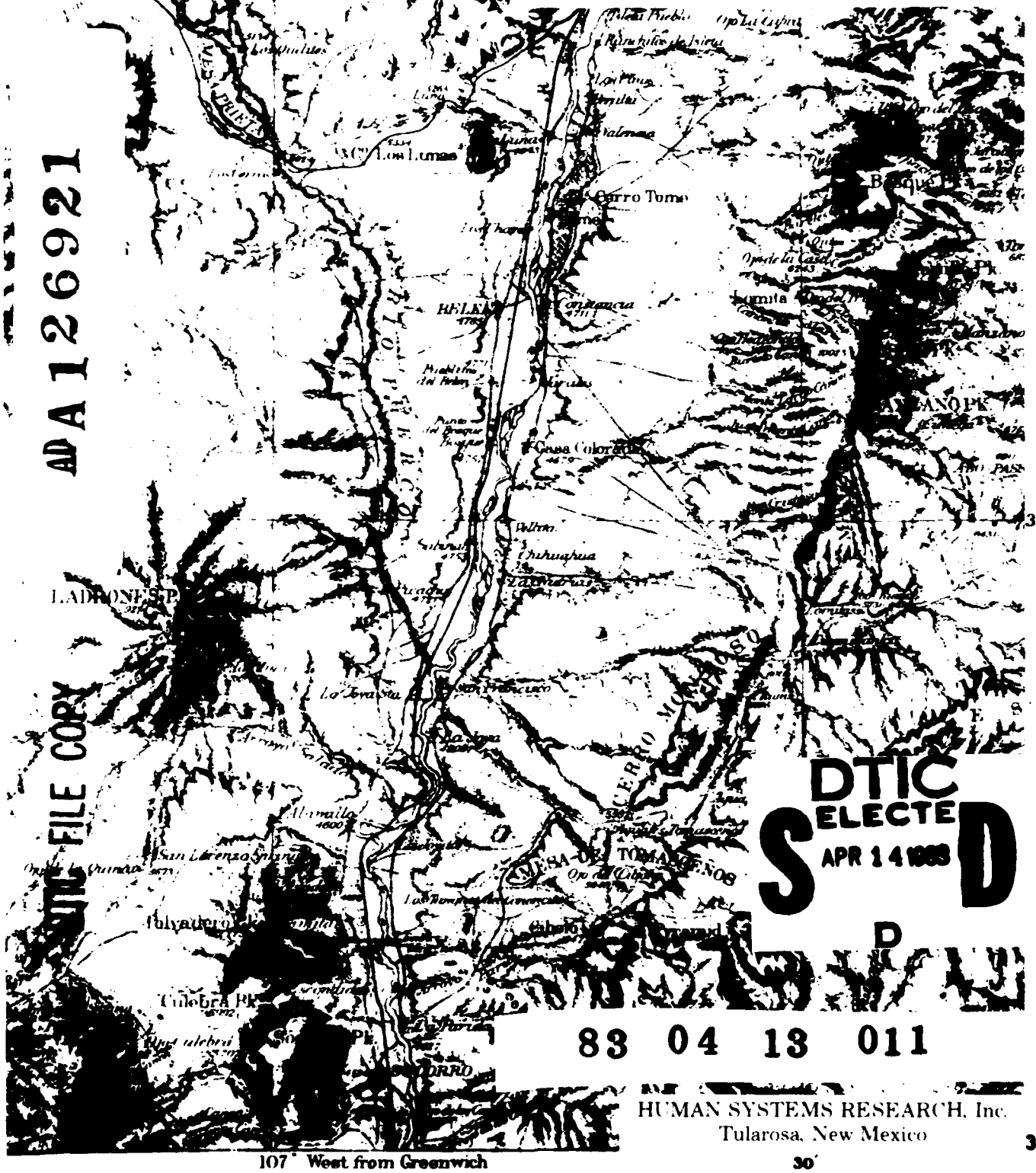
RECONNAISSANCE STUDY OF THE ARCHAEOLOGICAL AND RELATED RESOURCES OF THE LOWER PUERCO AND SALADO DRAINAGES, CENTRAL NEW MEXICO



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HUMAN SYSTEMS RESEARCH, Inc.
Tularosa, New Mexico

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MILES

1st Lieut. Geo. M. WHEELER, Corps of Engineers, U. S. Army.

RECONNAISSANCE STUDY OF THE ARCHAEOLOGICAL AND RELATED RESOURCES OF THE LOWER PUERCO AND SALADO DRAINAGES, CENTRAL NEW MEXICO

ERRATA SHEET

Page No.	*Column No.*	*Paragraph No.*	*Line No.*	*Change*
xii				Photo caption should read "The Rio Salado and Ladron Peak from high ridges looking north - 1480 acres, 10 [illegible] sample, 11 zones".
1				Photo caption should read "Sierra Ladrones from Puerco looking south".
3	2	1	3 & 4	Should read "River Mile 16 to 22".
	2	2	3	Should read "Phase I, General Design Memorandum".
4	1	2	1	Complimentary should read "Complementary".
18				Table 1, last line should read "Predictions of Cultural Resources".
27	1	2	5	Accumulated should read "accumulated".
33	1	2	10	Cochos should read "Conchos".
53				Site RS-5, add "County: Socorro".
54				Site RS-14, add "Elevation: 5420 feet; 1652 meters".
63	2	1	3	Haven't should read "have not".
70	2	2	2	Wasn't should read "was not".
75	2	3	7	Doesn't should read "does not".
81	2	2	1 & 4	Didn't should read "did not".
85	1	1	10	Was should read "were".
	1	1	15	Help should read "helped".
	1	1	17	Expand should read "expanded".
94				Site P-3, Number of Hearths should read "0".
97				Page number missing; Site P-6, Number of Hearths should read "2".
98				Site P-7, Number of Hearths should read "0".
106				Site P-16, Number of Hearths should read "0".
110				Site P-19, Number of Hearths should read "2".
130				Site S-14, add "Fire-cracked Rock" on map.
141				Site S-22, Number of Hearths should read "2".
143				Site S-23, add "Hearth" on map.
154				*Site L-3, add "Fire-cracked Rock" to Provenience 2 on map.*
180	1	2	9	Should read "(see Figure 14 and Gladwin)".
	1	2	10	Which should read "and".
194				Figure 17, Quartz should read "Quartzite" for graph categories.
214	1	1	6	"The" facility should read "that" facility.
235	2	2	8	Eventulaly should read "eventually".

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16. Abstract (Limit: 200 words)

Human Systems Research conducted a reconnaissance archeological survey of ten pecent of the Lower Rio Puerco and Rio Salado Drainages, in central New Mexico. Resulting information has produced probability measures of the distribution and density of cultural materials within the study areas and can serve as a baseline for future studies. A summary evaluation of the recovered information in relationship to current archeological models for the area has been offiered.

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RECONNAISSANCE STUDY OF THE ARCHAEOLOGICAL AND RELATED RESOURCES OF THE LOWER PUERCO AND SALADO DRAINAGES, CENTRAL NEW MEXICO

By

Mark Wimberly and Peter Eidenbach

with contributions by

Michael Marshall, Buck Cully, Julio Betancourt, Cye Gossett, and Bill Gossett

Submitted by

HUMAN SYSTEMS RESEARCH, Inc.
Tularosa, New Mexico

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ABSTRACT

Human Systems Research has conducted a reconnaissance archaeological survey completing a ten percent sample of lands within three selected locations on the lower Rio Puerco and Rio Salado drainages, central New Mexico. A total of 7600 acres were intensively examined for the presence of cultural resources. Background research for this project included summary of all known resources within the sample areas and examination of current anthropological theory which has been advanced to explain and interpret these known resources. Further, this study includes a preliminary overview of previous archaeological projects within the watershed of both drainages. Technical procedures for the actual field sample were based on the assumption that archaeological sites pattern with environmental factors. Landsat imagery obtained from the EROS Data Center was used to stratify the study areas and the field sample uniformly examined land areas within the identified stratifications and along the contacts between each. Resulting information has produced probability measures of the distribution and density of cultural materials within the study areas and can serve as a baseline for future studies. A summary evaluation of the recovered information in relationship to current archaeological models for the area has been offered. Recommendations concerning further research in both the reconnaissance study areas and the full watershed are presented.

As always in any discipline which, like archaeology, progresses by the method of 'successive approximation', the need is for more data and for more intensive, yet broader, study upon them. . . . a start may be made upon data that are incomplete . . . . but it is understood that the results will be in the form of tentative hypotheses and guides to other lines of investigation and are expected to undergo progressive correction, although perhaps not radical change, as research proceeds.

[Taylor 1948:165]

ACKNOWLEDGEMENTS

Because of its regional level, watershed planning procedures, the U.S. Army Corps of Engineers has, since the enactment of the Reservoir Salvage Act of 1960, been in the forefront of conservation archaeology. Even prior to this enactment, the Corps was a primary supporter of large scale programs to evaluate modern impact on archaeological resources. Human Systems Research expresses its fullest appreciation of the holistic conception of the Corps planning process. The direction, assistance and encouragement of Albuquerque District Archaeologist Donna Roxey has been of inestimable value to the completion of this project.

HSR also gratefully acknowledges the assistance and interest imparted to this study by the Bureau of Land Management, Socorro District, and the U.S. Fish and Wildlife Service, Sevilleta National Wildlife Refuge. We express our appreciation to Mr. John L. Huning, Huning Land Trust, and Mr. Ross Ligon, Gray and Ligon Ranch, for permission to enter private lands on the Puerco and Salado rivers.

Although the contributions of many other agencies and individuals are acknowledged in the respective portions of the report in which they were specifically involved, we especially wish to thank the Museum of New Mexico, Laboratory of Anthropology; Mr. Curtis Schaafsma, State Archaeologist, and the staff of his institution; Dr. Myra Ellen Jenkins, New Mexico State Historian; Ms. Frances Levine, Cultural Resource Preservation and Protection Team, BLM, Santa Fe; and Mr. Thomas Merlan, New Mexico State Historic Preservation Officer. Aerial photos of site locations were facilitated through the Operations Division, Army Air Command, Fort Bliss, Texas.

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Julio Betancourt

View of S-7 (LA 20927), S-8 (LA 20928), S-9 (LA 20929) looking west towards Riley, N.M., north side of Rio Salado.
[E. Shearin]

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF ILLUSTRATIONS

PHOTOGRAPHS

PHOTOGRAPHS (Continued)

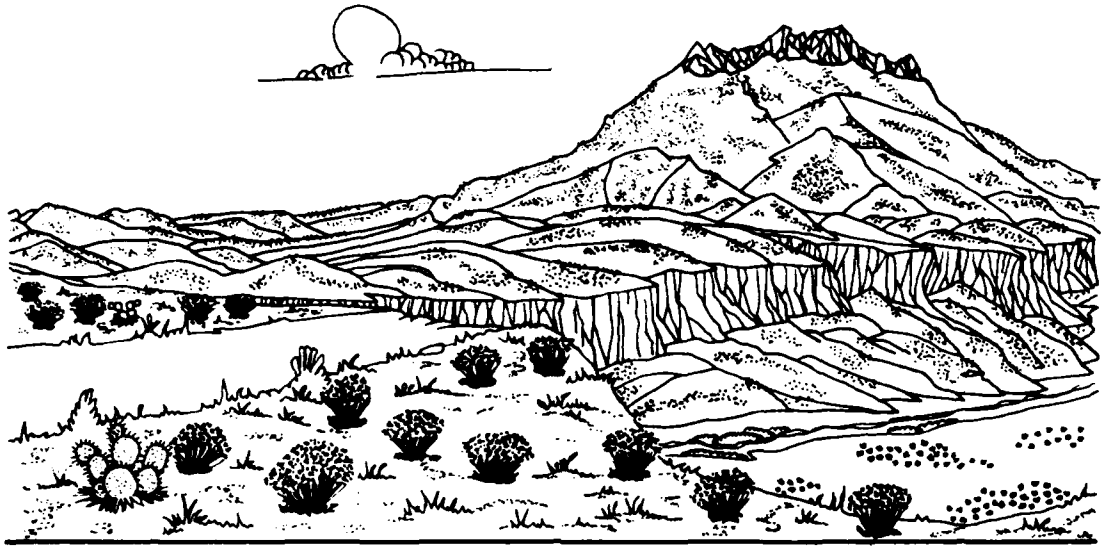
LIST OF ILLUSTRATIONS (Continued)

PHOTOGRAPHS (Continued)

FIGURES

LIST OF TABLES

LIST OF TABLES (Continued)



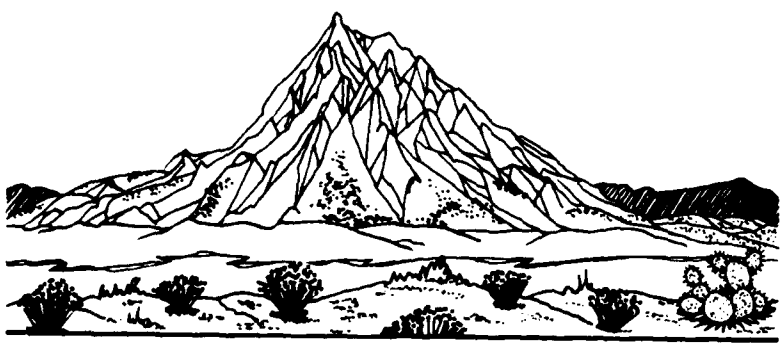
Sierra Ladrones from Puerco looking south.
[E. Shearin]

CHAPTER I

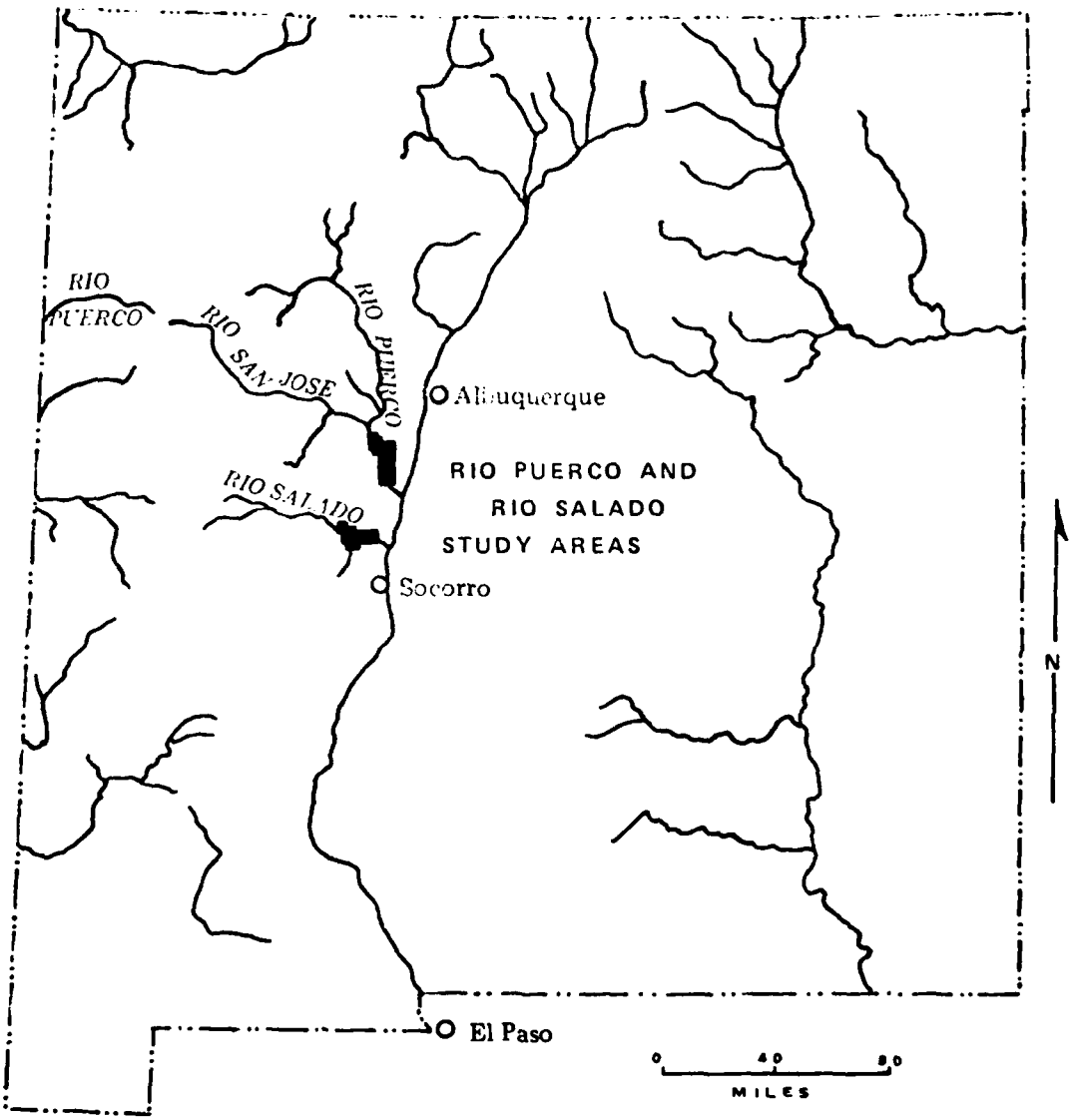
INTRODUCTION

PREVIOUS RESEARCH AND INTERPRETATIONS

RESEARCH DESIGN



The Rio Salado and Ladron Peak from high ridges looking north – 1480 acres, 10% sample, 11 zones
[E. Shearin]



LOCATION OF THE STUDY AREAS

INTRODUCTION

IDENTIFICATION OF THE PROPOSED FEDERAL PROJECT

Massive amounts of silt resulting from uncontrolled seasonal runoff through two major tributaries to the middle Rio Grande annually, threaten both private, river irrigated lands and federal reservoirs at Elephant Butte and Caballo Dams. The Rio Puerco carries the highest recorded amount of silt on earth (approximately 350,000 parts per million, suspended solids). The Rio Salado, although carrying somewhat lesser amounts, is second only to the Puerco in annual silt loads contributed to the middle Rio Grande. The U.S. Army Corps of Engineers, Albuquerque District, is currently in the preliminary stages of a major study of this problem. Three locations, one on the Puerco and two on the Salado, have been designated by the Corps as most reasonable for construction of water control facilities which would both guard against the floods of record and provide storage area for silt dropped due to flow curtailment. In addition to the study of these facilities, the Corps is also examining the possibility of larger scale programs to control drainage area erosion of the main channel in order to curtail the source of silt.

At this early stage in the planning process, in compliance with Department of the Army Regulation ER 1105-2-460 (recognizing all relevant legislation and Executive Orders), the Corps consulted with appropriate federal and state cultural resource managers and initiated a reconnaissance study (including archival research) of the cultural resources which might potentially be impacted by construction of the proposed facilities. Human Systems Research, under contract to the Corps, has completed the preliminary study and the results of this research are presented in this report.

PROJECT LOCATION

The proposed Corps projects are located on the Rio Puerco (lower Hidden Mountain) at approximately River Mile 7 to Mile 13, on the Salado (La Jencia) at approximately River Mile 5 to Mile 10, and Loma Blanca at Mile 15 to Mile 20. The Rio Puerco joins the Rio Grande from the northeast at approximately 45 river miles, south of Albuquerque. The Rio Salado joins the Rio Grande from the west, approximately 10 river miles south of the confluence of the Rio Puerco. Consequently, a general study area including both drainages from above the proposed dam locations to the confluence with the Rio Grande was established. Thus, a single large study unit crossing both drainages was considered in the preliminary phases of this reasearch. This method insured that comparable criteria were used at all three locations and that the relationship of the three locations to the general setting and to each other was considered from the onset of the project.

OBJECTIVES OF THE STUDY

This reconnaissance-overview has been prepared for inclusion in the second stage, first phase of the Corps planning system. It is in no way considered to be an exhaustive or complete treatment of the cultural resources which might potentially be impacted if any of the described projects are undertaken. Rather, this report is a planning document. Information compiled here is a review of cultural resources in the area by: 1) summarizing general archaeological theory which has been developed to explain cultural remains found in the area; 2) conducting an environmentally structured, systematic sample of the land area potentially directly involved; and 3) conducting a general literature

and archival search of the drainage region to review the scope of cultural resource problems if an action more extensive than single dam locations is undertaken.

GENERAL RESEARCH ORIENTATION

In addition, and complimentary to the managerial goals of this study, several important archaeological questions can be approached by this study. The question of significance, a basic precept of management, is at least partially defined by research value (see section on Significance).

An examination of the published archaeological studies which include all, or portions of, the Puerco-Salado study area, suggests the following observations:

1. Human populations have been present in the general region of the study area for more than 10,000 years;

2. The general area is a *type* location for sites of the early to middle Archaic periods, 4,000 to 6,000 years ago;

3. Regional studies summarizing all previous research have presented the area under study as a *contact* zone between at least two major, archaeologically defined population units, the Mogollon to the south and the Anasazi to the north;

4. Limited preliminary evidence suggests that throughout the *Pueblo* era, the Puerco-Salado populations were involved in a regional system of relationships which included the exchange of goods and information;

5. Three separate Spanish occupations are recorded — before and after the Pueblo Revolt of 1680, and after the Apache-Navajo problems of the 1830s;

6. The abandonment of the area by post-Spanish contact, *Pueblo* populations may relate to both environmental stress and human conflict (with the Athapascans);

7. The Anglo-American occupation in the study area began after 1850.

GENERAL ENVIRONMENTAL SETTING

The Puerco-Salado study area falls within the Mexican Highlands section of the Basin-Range Province. The drainage pattern of the general region follows the Rio Grande graben, a physiographic trough approximately 35 miles wide. On the east the trough is bordered by the Sandia-Manzano-Los Pinos Mountains, and on the west by the Lucero uplift, Ladrones and Magdalena Mountains. The Rio Grande River is entrenched approximately 100 feet into the Santa Fe group sedimentary deposits composing the 4,000-to-5,000-foot-thick, upper portions of the Rio Grande graben. East of the Rio Grande River soils are gently sloping to undulating, composing a topography which is characterized by shallow depressions and wide terraces. The western margin of the Rio Grande Valley is marked by the Llano de Albuquerque, a long, narrow mesa. The surface of the mesa is about 400 to 450 feet above the Rio Grande floodplain. The surface of the Llano developed in late Pliocene to early Pleistocene time.

Along the western edge of the Llano de Albuquerque, the Rio Puerco, a major tributary of the Rio Grande, has cut a broad, flat valley which, during recent times, has been dissected by erosion to approximately 40 feet below modern ground level. The land surface rises approximately 1,000 feet within five miles west of the lower Puerco. Toward the southern end of the drainage, near its confluence with the Rio Grande, the southwestern margins are defined by the footslopes of Ladron Peak.

The Salado drainage originates largely in the Datil Mountains to the west of the Rio Grande and flows generally eastward along the southern footslopes of Ladron Peak. The drainage is much shorter and steeper than that of the Puerco, with rolling hills and outcropping structural ridges within the river valley. This factor limits the amount of land available

for agricultural pursuits to the narrow, main drainage benches and tributary valleys in the portions of the drainage west of Ladron Peak. As the drainage emerges from the narrow *Box* area south of Ladron, flood waters spread to cover a much broader course and flow over the ancient sedimentary deposits of the ancestral Rio Grande. Where the Salado meets the Rio Grande at a broad meander in the modern Rio Grande, a large confluence valley has been formed. This location has been a valuable agricultural area for hundreds of years.

CLIMATE OF THE STUDY AREA
(Adapted from Pease 1975)

The lower Rio Puerco flows north to south through eastern Valencia and northern Socorro Counties to its confluence with the Rio Grande at La Joya. The land rises a few hundred feet on both sides of the river to wide mesas, and then to the foothills and low, isolated mountains of Lucero Mesa and the Sierra Ladrones to the west. Eastward, the mesa Llano de Albuquerque separates the Puerco and the Rio Grande. The average yearly precipitation at Los Lunas on the Rio Grande, 7.1 inches, is representative of the valley and adjacent mesas. Lower temperatures and greater precipitation occur in the foothills of the mountains. The temperature occasionally reaches 100° F. or higher, or falls to zero or below, but not in all years.

The growing season is about 5½ months long. In winter, moisture is brought in from the Pacific Ocean, but most of the moisture in these eastward-moving storms falls over the higher western mountains. Summer moisture is brought in from the Gulf of Mexico. The average annual snowfall is less than 5 inches.

Clear, sunny weather, with low relative humidity and a wide range of daily temperature, is characteristic of the arid, continental type of climate. The skies are sunny more than three-quarters of the daylight hours.

The direction of surface winds is controlled mainly by local topography. Prevailing winter winds are northerly, summer winds are southerly. When soils are dry, occasional strong winds cause periods of blowing dust.

Evaporation averages about 95 inches annually, with more than 75 inches during the growing season, May through October.

Climate in the Salado study area is typical of the foothills discussed above. At Magdalena, twelve miles southwest of the study area, mean annual precipitation is 10.9 inches, and the frost-free season averages about four months.

Photo 1: Rio Salado at confluence with La Jencia Creek.

Three fresco elements from Pottery Mound murals (after Hibben 1967)

PREVIOUS RESEARCH AND INTERPRETATIONS

OVERVIEW OF THE CULTURE HISTORY and PROBLEMS OF ARCHAEOLOGICAL INTERPRETATIONS

From the little that is presently known of the archaeological record within the study areas, discussion of the late Pleistocene and early Holocene human occupations must be relegated to the level of barely supported speculation. No sites from these early periods were located during this reconnaissance survey. Institutional and private collections from the general vicinity of the Puerco study area contain artifacts of the approximately eleven-to-seven-thousand-year-ago eras. Dawson and Judge (1969) have examined site locations of the Folsom and later periods north and east of the Puerco study area (several Clovis-age tools were also reported). This evidence suggests that both campsites and possible kill sites or processing stations of the paleo-Indian periods may be expected to occur on Pleistocene aged soils in the Puerco drainage. This may also be true of the lower reaches of the Salado. The exact nature of the livelihood of these early populations in the region, as it relates to river valley locations, is still unclear, and must await more detailed investigation of both paleoenvironmental and cultural evidence before either explication or explanation is possible.

Human occupations dating to the mid-to-late Holocene period are somewhat better understood. Termed Archaic, or Picosa, the "elementary Southwestern culture" (Irwin-Williams 1967), cultural materials and sites of the period 4,000-5,000 B.C. to A.D. 1 have been found throughout the region. This era has been characterized as a period of systematic adaptation to localized conditions. This localization and intensive exploitation of a broad range of resources, including most all species of edible or usable biota in particular areas, apparently marked the beginnings of a more sedentary way of life which eventually resulted in social groupings identifiable in the later *Pueblo* era. It should be noted that many sites of this period which have been reported along the Puerco drainage are buried (often from one to three meters) and are only exposed in the *cut banks* of major drainage arroyos. This factor (a major period of agradation) has certainly affected the discovery of earlier site locations.

Evidence of corn agriculture throughout the region dates to the latter 2,000 years of the Archaic period. At a great many locations in the Southwest, well preserved remains of agricultural crops including corn, beans, squash and later, cotton, indicate that through time an increasing amount of human subsistence activities were directed toward more domestic pursuits. In the Puerco-Salado region, apparent dedication to agriculture as a major subsistence activity is mirrored in the formation of at least semipermanently occupied pithouse villages by A.D. 300-500.

At least concomitant with, if not prior to, the formation of these pithouse settlements, the regular production of ceramic vessels began. In the analysis of ceramics, Southwestern archaeologists have produced the most detailed models of human cultural systems for the prehistoric periods. Based on minor differences in temper, paste, surface finish, paint, and design styles coupled with often tenuous dates based on associations with ceramics dated from distant areas, archaeologists have expounded on such topics as population migrations, trade routes and affiliations, sociocultural groupings, and even linguistics. Undoubtedly contained somewhere in the confusion of modern ceramic typology, is a reflection of the complexity of technological and social factors which explain variability in native Southwestern pottery manufacture and use. However, at this date, it

is important to realize that ceramic typology is an artifact of modern analysis and in fact may bear very little relationship to ancient sociocultural groupings or events.

The fact that the Puerco-Salado study area falls *on the line* between two major archaeological population groups, the Anasazi to the north and the Mogollon to the south, is a case in point. A major characterizing difference between the two *culture* areas is that the general ceramic base type credited to the Anasazi is gray ware (*cum* white ware), while for the Mogollon area it is brown ware. Varying percentages of these two wares present on archaeological sites has most often served as the method for designating the *cultural* affiliation of sites and regions. Be aware of this fact in the following discussion.

The early ceramic period developments in the Puerco-Salado area are considered to be representative of the two culture areas, the Puerco being Anasazi and the Salado, Mogollon (Jennings, Reed, et al. 1955; Ford, Schroeder and Peckham 1972). Through the formative era, the Anasazi are envisioned to have subsumed the Salado drainage until the post A.D. 1350 period when the Piro linguistic group, a Mogollon affiliate, occupied the confluence and lower Salado, holding this area until the time of Spanish contact (Ford, Schroeder and Peckham 1972).

Known archaeological sites in the middle and upper Puerco indicate an indigenous development of pueblo culture which, in the periods shortly following A.D. 950 and extending through A.D. 1150, received ceramic vessels from as far south as the Mimbres area, as far west as the Little Colorado, as far north as the Chaco, San Juan and Mesa Verde areas, and as far east as the Galisteo Basin. The sites of this period which are presently known in the Puerco drainage are not really all that large nor is their number such that they attracted very much attention in the early days of archaeological exploration. It seems unusual that they contain such a regionwide collection of ceramics of the time period. Ceramics of the A.D. 1150-1250 period are represented in the study area, but few previously recorded sites have percentage data on materials of this time period.

The most remarkable archaeological remains on the Puerco date to the Pueblo IV era (post A.D. 1300). Pottery Mound is the type site for this period on the Puerco. This large and important site has produced thousands of artifacts, together with ceramics of the Rio Grande Glaze period and from as far removed from the local area as Casa Grandes, Mexico (Hibben 1966). The mural art preserved in fourteen kivas excavated on this site has given an unprecedented view of certain aspects of 14th century Puebloan society.

All indications to date are that the lower Puerco drainage was largely without resident population at the time of Spanish contact. In fact, it is apparent that there was very little to attract settlement of this area during Spanish colonial times, as the lowest settlement on the Puerco is believed to have been that of Los Cerros, just north of the study area near Hidden Mountain. Even that location was not settled until well after the Colonial period. On the Salado, the settlement of Santa Rita dates to the late 19th century and a great many Homestead era houses are to be found in the upland areas.

In addition to the suspected poor condition of the lands on the lower Puerco during Spanish colonial times and the lack of surface water, it is suspected that the incursions of both Navajo and Apache bands along the Puerco and Salado were major factors in preventing settlement. Some early documentation suggests that both drainages were major routes of travel for the raiding of Spanish settlements on the Rio Grande (see Historical section).

ENVIRONMENTAL FACTORS AFFECTING PAST HUMAN POPULATIONS

The topographic and geographic position of the Puerco-Salado study area is both directive and central in this region of the Southwest. The Salado, at the northeastern end of the Plains of San Augustin, provides access to and from the Rio Grande and the Mogollon country of southern New Mexico and Arizona. The Rio Puerco, running more

or less north-south, parallel to the Rio Grande, is in effect a corridor from the Rio Grande to the Jemez Mountains and San Juan Basin of northwestern New Mexico. The San Jose, a major tributary of the Puerco, flows from the west, providing a corridor to the Red Mesa area and also access to the El Moro Pass and the Zuni area. It should also be noted that a low pass area separates the Salado and Puerco drainages at the southern end of Lucero Mesa, providing access from either drainage and a flat, tableland route running north-south to the west of the Puerco.

The importance of these natural corridors as potential routes of travel should not be underestimated. Accumulating archaeological evidence from throughout the Southwestern region, as well as from areas far removed from the Southwest, indicates that large amounts of goods and materials were moved extensively throughout the continent in prehistoric times. It is very likely that just such natural corridors as are represented by the Puerco and Salado were the scene of such movements.

Another major characteristic of the Puerco-Salado drainages which should receive careful consideration in the analysis of past human adaptations is their agricultural potential. The valley floor of the Puerco within the study area (that area containing almost exclusively river-deposited sands and silts), is on the order of a mile in width. Today the limitations of these soils lie almost totally in their susceptibility to erosion and their lack of surface water. Developed soil surfaces have in most cases been largely if not entirely removed, but the underlying soils are almost all fine silts and sands of high agricultural potential if the above factors could be controlled. The historical record (see Historical section) indicates that the present arroyo-cutting sequence is a turn-of-the-century event. This is not to say that there have not been other sequences of such cutting in the past, but on occasions, when the Puerco flowed at or near the ground surface, the agricultural potential of the valley would have been exceptionally good. This is true also of the Salado valley and the confluence areas of both the Puerco and Salado with the Rio Grande. Journals at the time of Spanish contact report field areas containing extensive crops of corn, beans, squash and notably, cotton. Repeatedly, these journals report *gifts* of literally thousands of cotton *mantas* from the pueblo villages at the time of contact (Hammond and Rey 1966:190, 223, 226). Brody (1979, personal communication) has pointed out that represented in the murals at Pottery Mound were examples of almost every type of garment and weaving technique known for the Southwestern region. It is essential that the possibility of large scale farming of these high-agricultural-potential, valley areas be investigated further, and that such a possibility be considered in light of the implications to regional prehistoric economy.

The geology of the study area presents several factors of interest in terms of prehistoric natural resources. In the Puerco area, gravels of Pliocene age (Santa Fe Formation) are the major constituent of the tablelands in which the drainage valley has been cut. Represented in the gravels are examples of every major rock formation within the drainage of the ancient Rio Grande. Present are quartzites, cherts, chalcedonies, jaspers, petrified wood, sandstones, siltstones, basalts, obsidians, and a great variety of metamorphosed stone. These materials appear to be somewhat differentially sorted, with concentrations of certain materials occurring at locations suggesting ancient gravel bars or perhaps separate alluvial events. The possibility of prehistoric *pick-up type quarrying* of select areas in these gravels should be investigated. The amount of these materials which are readily available at or near the surface, suggests the possibility of export.

A great variety of minerals are available in the mountains to the south of the Puerco and Salado drainages. They include lead, copper, iron, zinc, gold and silver. These should be considered, both in light of the need for some of the materials in the manufacture of glaze paints and the possibility of export. The occurrence of Jet near the Pueblo of Acoma northwest of the study area, one of three locations in the state (another is near Chaco Canyon!) (Beck and Haase 1969:269,271), brings up a myriad of sociocultural implications.

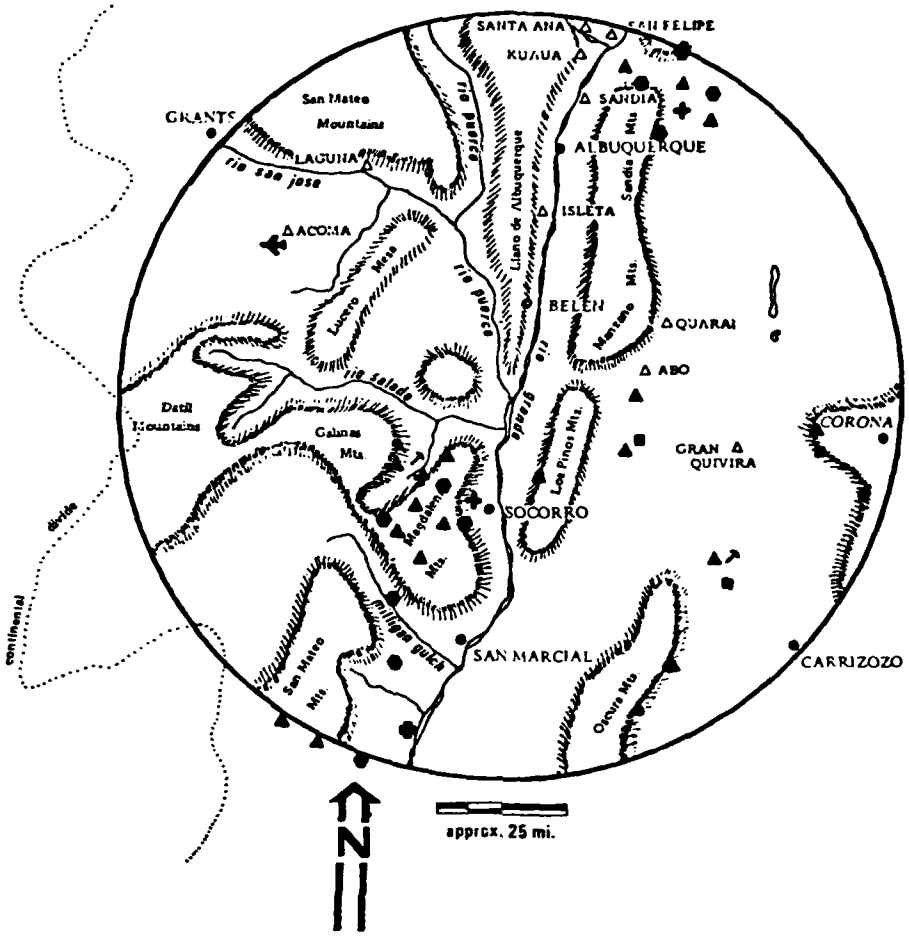


Figure 1
MINERAL RESOURCES

[after Beck & Haase 1969]

GENERAL DISCUSSION OF PREVIOUS RESEARCH

The Rio Puerco and Rio Salado provide drainage for lands which fall west of New Mexico's principal meridian and east of the Continental Divide. The surrounding region has served as a major case study area during the development of American archaeology. Remarkably, however, no general archaeological survey has been conducted within the lower reaches of either drainage. Perhaps partially accounting for the lack of formal archaeological survey in this area is the fact that four major Spanish land grants fall within the lower portions of these two rivers. Consequently, civil township subdivision is lacking in many areas even today, making accurate site location a difficult proposition until the advent of aerial photography.

WITHIN THE PRESENT STUDY AREA

Previous archaeological research within the Army Corps' Puerco-Salado study area has been quite limited. This research falls into three categories:

1. early reconnaissance along the margins of the main drainages (Mera, Yeo, early 1940s);

2. narrow right-of-way transect survey and salvage immediately prior to construction (Wendorf, late 1950s);

3. recent clearance survey and BLM management overview survey of public lands (Klager, Laumbach, late 1970s).

In addition to these limited surveys, major excavations have been conducted at Pottery Mound, on the extreme north boundary of the present study area. These excavations are inadequately reported at present, although some materials exist as Master's theses on file at the University of New Mexico. The few published articles on Pottery Mound generally focus on topical discussion of public architecture and numerous kiva murals (Hibben, Brody, mid 1960s). The University of New Mexico is currently engaged in development of a long-term program of interpretation, publication and additional research at Pottery Mound (Cordell, personal communication).

Summing all sources, including field notes of the Army Corps of Engineers' Archaeologist, Office of Contract Archeology at the University of New Mexico, Cultural Resource Management Division at NMSU, the Bureau of Land Management at Socorro and Albuquerque, and the Laboratory of Anthropology at Santa Fe, only sixteen archaeological sites have been previously recorded within the designated study area. Only five of these have been assigned Laboratory of Anthropology site numbers, three on the Puerco and two on the Salado. (It should be noted that 14 additional sites with LA numbers fall within approximately one mile of the northern and eastern boundaries of the Puerco study area.) With so little actual recorded information, it is surprising that such sweeping cultural generalizations have been applied to the area. The present survey, recording 57 sites, multiplies current knowledge of the prehistory of the area by more than ten fold.

Photo 2

Photo 3

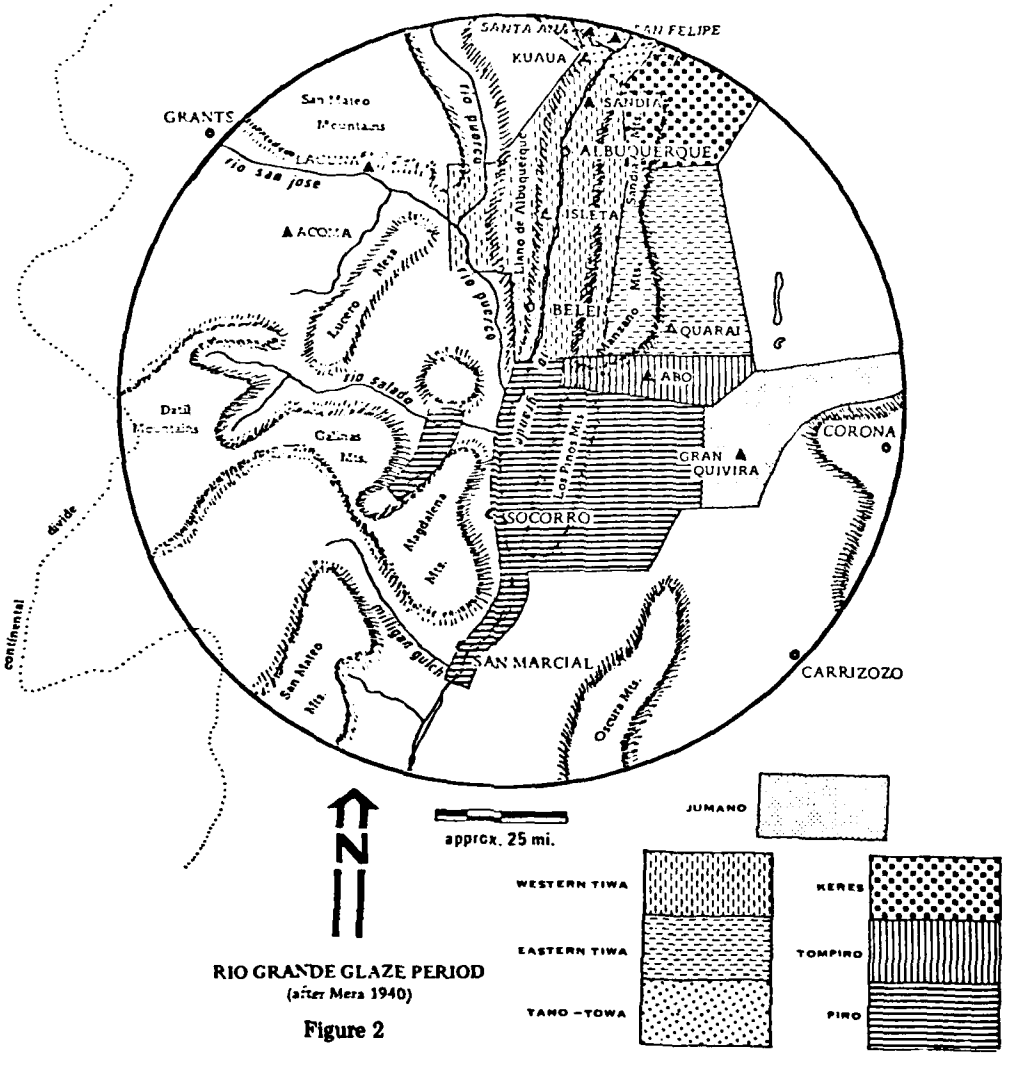
LA 416, Pottery Mound, first identified by Mera (1940) was partially excavated by the University of New Mexico (Hibben 1955) in the mid fifties and nonstructural stratigraphy has recently been examined by Cordell (personal communication). The remarkable murals recovered during Hibben's excavations are the strongest suggestion of interregional relationships to the south yet recovered in the middle Rio Grande.

AN ANALYSIS OF PREVIOUS EXPLANATORY MODELS

The reconstruction of cultural and linguistic distributions of Southwestern puebloan populations has been of continual interest to archaeologists. The accuracy of such reconstructions rests on the availability of an adequate data base, and on the controversial assumption that ceramic traditions reflect linguistic continuities.

While all such reconstructions have admittedly been speculative, there is a surprising degree of consistency between the earliest (Mera 1940) and the most recent attempts (Ford, Schroeder, and Peckham 1972). Conflicts which do exist are most commonly due to the linguistic interpretation of ceramic distributions, and not to any major changes in the distributions themselves.

If we set the pursuit of linguistic affiliation and history aside, these ceramic distributions become hypotheses about the archaeological record, potentially verifiable by comparison with field survey data.



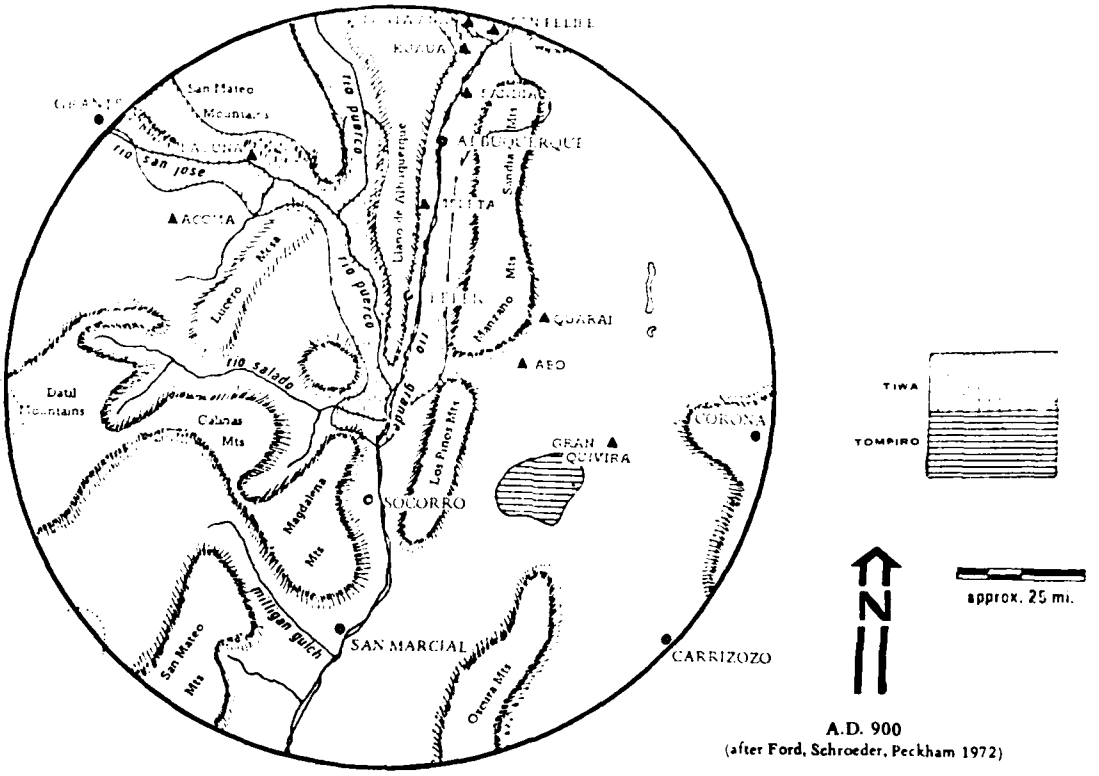
RIO GRANDE GLAZE PERIOD
(after Mera 1940)

Figure 2

When viewed in this fashion, reconstruction like that of Ford, Schroeder and Peckham (1972), suggest potential distributions within the archaeological record, testable by formal data recovered during field survey.

In the Puerco-Salado study area, specific interpretations based upon Ford, Schroeder and Peckham's reconstruction result in the following hypothetical assertions about the archaeological record.

1. A basic ceramic tradition, identified by its decorated wares, developed locally in the Puerco and lower Salado at least by A.D. 900, possibly earlier;
    a. During its early stages, this ceramic tradition was associated with major drainages of the Puerco, San Jose and lower Salado and middle Rio Grande;
    b. During later stages, this tradition became associated with minor tributaries and upland areas associated with these larger drainages;
2. By about A.D. 1050 to 1250, two additional ceramic traditions were also represented in the immediate vicinity of the Puerco-Salado. A Chacoan tradition appeared immediately northwest of the study area, and a Mogollon ceramic tradition bordered the area to the south;
3. After A.D. 1350, earlier ceramic traditions were no longer represented in most of the study area, and appear to have been replaced by the Mogollon tradition represented immediately south.

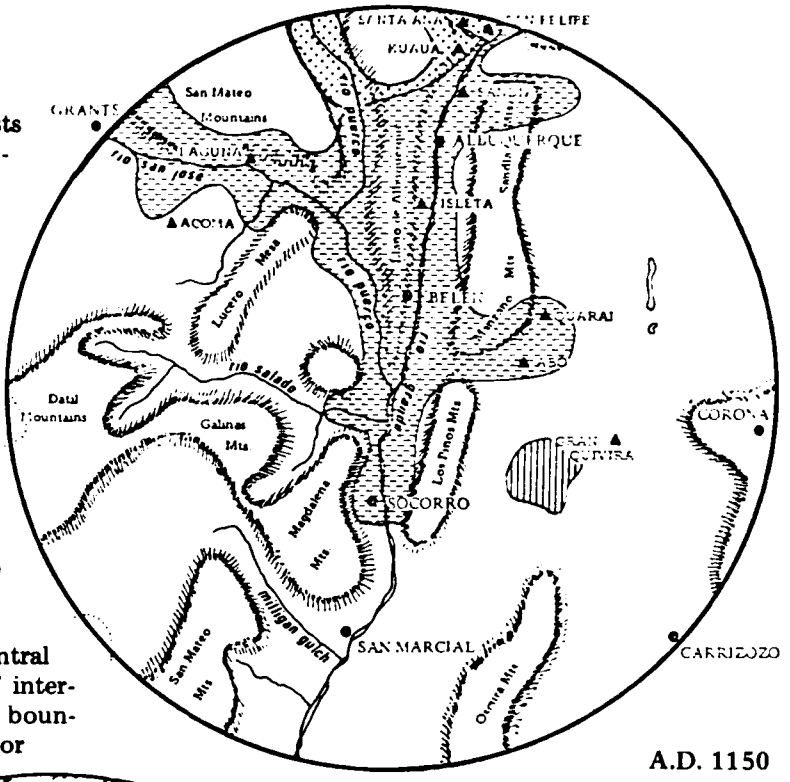


A.D. 900
(after Ford, Schroeder, Peckham 1972)

Figure 3

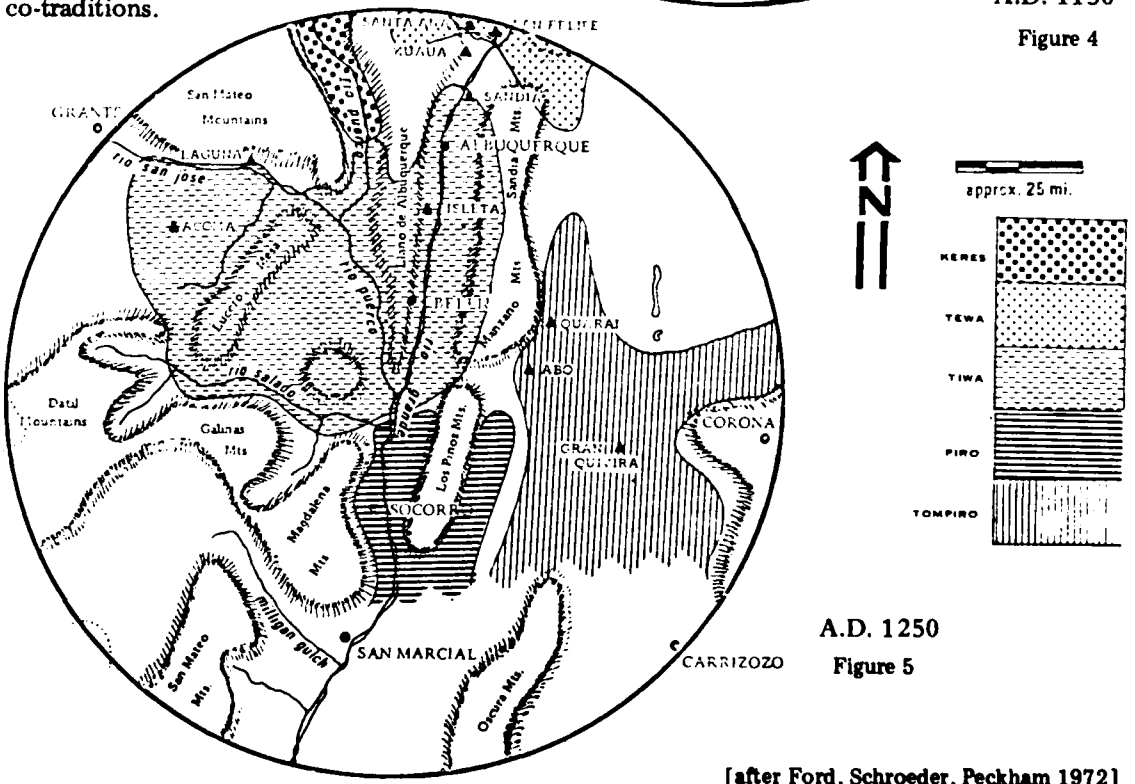
Southwestern archaeologists generally accept the distinction between Anasazi and Mogollon traditions. Broad cultural distinctions in subsistence, social structure, political organization as well as in artifactual assemblages are ascribed to them. The two are basically defined on an alleged distinction between white ware and brown ware pottery traditions, although a great many exceptions are admitted to exist.

Consensus suggests that central New Mexico was a zone of intermittent contact and shifting boundaries between these two major co-traditions.



A.D. 1150

Figure 4

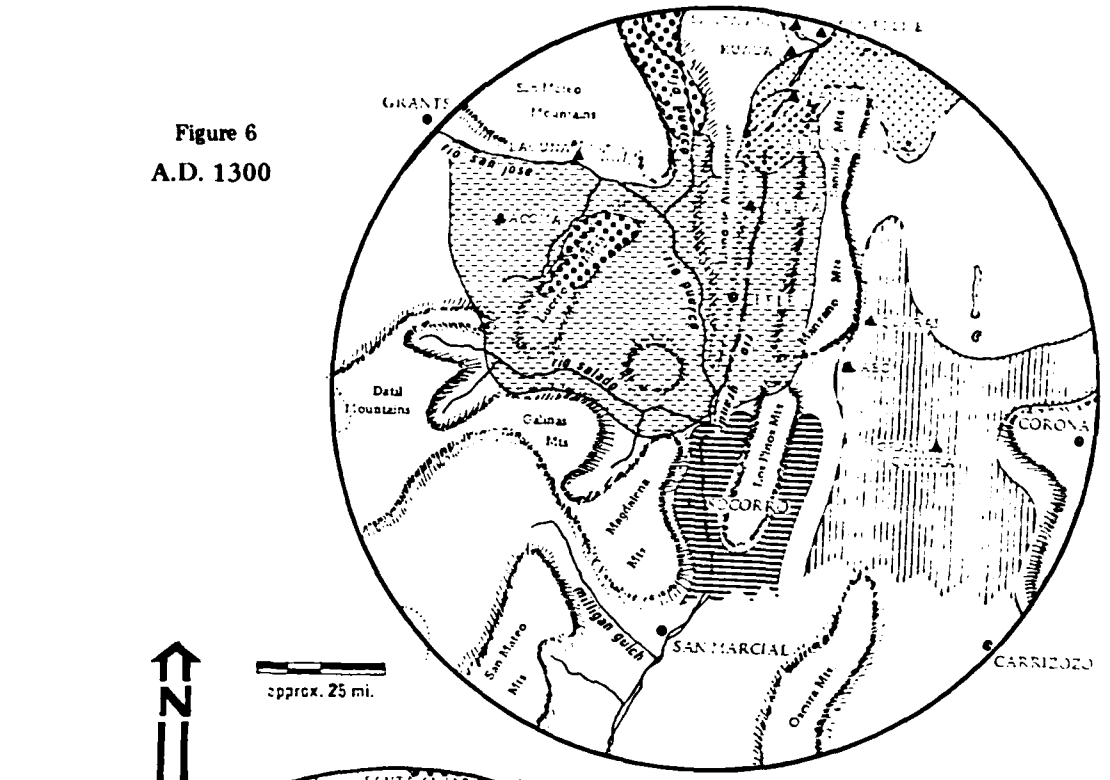


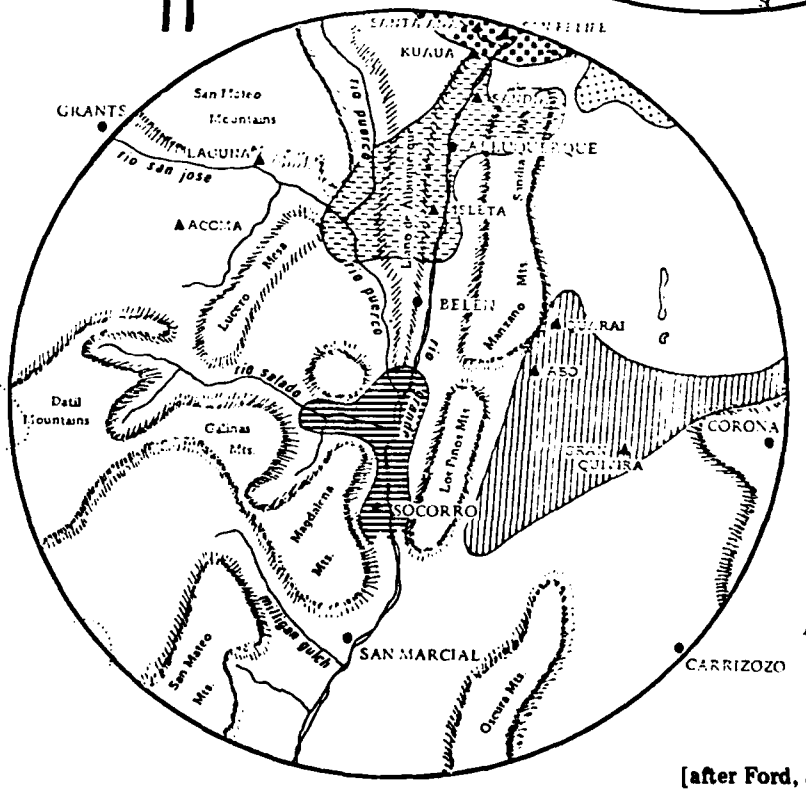
A.D. 1250

Figure 5

[after Ford, Schroeder, Peckham 1972]

Figure 6
A.D. 1300





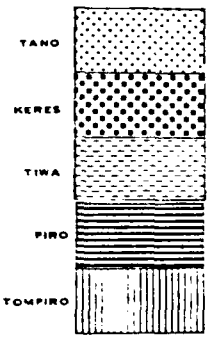


Figure 7
A.D. 1400

[after Ford, Schroeder, Peckham 1972]

A variety of explanatory models have been suggested for major shifts in ceramic distributions (and by implication, in cultural distributions):

1. trade route dynamics;
2. population migration;
3. environmental change;
4. diffusion of stylistic or technological *information*;
5. natural cultural succession.

General anthropological theory indicates that no *single* causal factor is likely to furnish an adequate explanation of the archaeological record. Cultural systems are responsive to changes in multiple parameters. These parameters or variables generally act in a mutually interdependent manner, and cultural systems articulate complex feedback relationships among and between them to reduce the overall stress exerted by these parameters at any one time. Thus, we should expect any reconstruction of culture history and process to be multicausal in form, with continually shifting relationships between the human cultural system and other systems, cultural and enviornmental, which impinge upon it.

Existing site records suggest a level of cultural complexity and diversity consistent with general anthropological theory. However, the data base is clearly insufficient for any clear verification of the proposed ceramic sequences, or even for a clear distinction between two major co-traditions, Anasazi and Mogollon.

Discrepancies between the proposed ceramic sequence and site records may be due to:

1. an overall lack of recorded frequencies for ceramic types on known sites,
   or
2. a lack of correspondence between *traditional reconstructions* and the archaeological record itself.

Photo 4: A "defensive" Glaze A, Pueblo IV period site (LA 415) reported by Mera (1940) consists of large plaza square of rooms in saddle, background, and a row of detached rooms along ridge in foreground. Site lies just north of Puerco study area.

THE RESEARCH DESIGN

The Problem:

Predict nature, extent and significance of cultural remains on the lower Rio Puerco and Rio Salado.

Assumptions:

1. The location and distribution of archaeological sites is directly related to environmental factors in a patterned manner;

2. A logically derived, formal, explicit sample of units of the land area will yield sufficient case information to formulate a probability statement concerning all sites.

THE RESEARCH

Assessment of potential impact on cultural resources is part of the normal Phase I planning procedure for all land modifying projects conducted by the Army Corps of Engineers. For the Corps, assessment includes consultation of existing state records, institutions, and individuals considered expert on a subject area, and reconnaissance field survey. Reconnaissance survey in archaeology has traditionally been rather loosely defined by the profession as a more or less informal field visit to the area of potential impact in order to develop a subjective impression of archaeological problems which might exist. In this contract, however, the Corps has specifically requested that a reconnaissance field method and sampling strategy be employed which will yield accurate and replicable predictive statistics.

The Corps has specified that this sample be on the order of ten percent of the land area involved. In recent years a great deal of literature has been dedicated to discussion of the *reliability* of various sample sizes. To state the obvious, the larger the sample size, the more accurate the prediction of the whole. On the basis of limited numbers of studies however, it appears that there are *breaks* in the accuracy of percentage sample size, depending on the purpose for prediction. For example, samples which are on the order of 30% appear to be better predictors of the number of site types than samples of over 50%, which tend to be biased toward the more numerous site types. Samples of 10% or under are, in general, not good predictors of the percentage relationship of site types but generally are reasonably reliable predictors of total number of sites of all types. Size of the sample universe (or study region), however, probably has much greater effect on reliability of any prediction. Thus, a 100% sample (or inventory) of small areas (like BLM units 115 and 116 which are a section or square mile in extent) may be very poor predictors. Conversely, a 10% sample distributed over a broad degree of environmental variability can yield a reasonably accurate and representative result. The accuracy of any sample can also be improved by the application of any knowledge which might condition the location of sites. Thus, if two different soils occur in an area to be sampled (i.e., a 1,000 year old and a 100 year old soil), additional accuracy and discrimination can be achieved by subdividing or stratifying the sample area and sampling each zone separately and equally (i.e., 10% each). Not only will the total prediction based on the sample be more accurate, but the zone distinction itself may result in substantive new data about the distribution of sites within these separate soil areas.

For this reconnaissance of the lower Puerco and Salado study areas, every effort was made to examine past physical and ecological studies conducted in the area.

However, because of the large scale of the present project, none of the previously conducted environmental studies could be uniformly applied. HSR was faced with the need to develop its own basis for stratification. Again, the size and history of the study area imposed limitations in that: 1) there is no set of maps with a consistent scale for the entire area; and 2) existing aerial photography covers only portions of the area. ACE Archaeologist Donna Roxey anticipated these difficulties in deriving a systematic sampling system for the area and obtained Landsat imagery through the EROS Data Center.

First level stratification of the study area was done by HSR consultant Eileen Camilli. Through *"visual photointerpretation of a false-color composite paper print at a scale of 1:250,000"*, Camilli (1979) distinguished surface color and texture differences which were then assigned zone designations. Apparent boundaries were drafted on an acetate overlay. Boundaries were then transferred from the overlay to a project base map compiled from various scale USGS maps and adjusted to a scale of 1:48,000.

It should be noted that no attempt was made to interpret apparent boundaries and zones observed on the Landsat image. Landsat images are not original photographs. They are produced by electromagnetic readings (both within and beyond the visible spectrum) recorded by satellite and transmitted to earth. The image is then reassembled in a manner similar to a television image or stored in the form of digitized information. The composite image used by Camilli was computer enhanced through the U.S. Geological Survey EROS Digital Image Enhancement System (EDIES) and *"provides optimum display of terrain information"* (Camilli 1979). The defined stratifications probably reflect more than one aspect of the setting (i.e., topography, soil, exposure, vegetation, moisture). Consequently, the stratifications do not relate directly to biotic communities. HSR ecological consultant, Buck Cully, conducted systematic samples of modern biota at archaeological sample units in the distinguished stratifications to provide a descriptive basis for ground truth comparison.

Eight surface cover types were originally defined in the Puerco study area, seven in the La Jencia portion of the Salado, and five in the Loma Blanca portion of the Salado. These zones were given the alphabetic designations shown in Table 1 and maps appended. Prior to field reconnaissance, however, each zone was inspected on the 1:48,000 base map for differences in relief in order to develop preliminary interpretations.

Table 1
STRATIFICATION ZONES WITHIN THE PUERCO-SALADO STUDY AREA
Identifications Based on Field Investigations

B	Talus slopes and ridges along the western margins of the Llano
C	lower colluvial and eolian slopes
D	floodplain and active channel
E	alluvial flats
H	flats of the ancient Llano
H′	high mesa top flats
I	broken eroded hills
J	talus slopes and ridges
K	tributary drainage channels
M	canyons and lower mountain ridges
N	mountain slope
O	talus slopes
P	canyons and talus slopes

Note: Boundaries or contacts (*interzones*) between the above zones are enumerated in the section Predictions of Archaeological Resources.

A first stage sample, representing approximately 1.5% of the land area in the Puerco study unit was designed to field test both the logistic and statistical adequacy of the proposed sample. Sample unit size was set at ¼¼ sections (approximately 400 m^2) in order to maximize the number of sample units. This first stage sample tested the empirical reliability of the sample stratification and brought to light necessary modifications for the larger second stage sample.

Contact zones, those areas where two or more stratification zones were represented in one sample unit, had been initially eliminated from the sample universe in order to maintain descriptive clarity and simplicity. The first stage sample, however, revealed that

sites tended to occur in these contact zone units. A thorough consideration of this factor suggested that site distribution might in fact reflect a preference for an ecotonal position.

In addition, a maximum dispersion of ¼¼ section sample units proved to be inefficient in logistic terms. Accurate location of these size units on the ground consumed more time than the process of survey and description itself.

Thus, two modifications of the original sampling design were undertaken. First, the contact zones were included as independent units in the sample universe, and all of the survey land area became equally eligible for sampling. Second, the sampling method itself was stratified, by increasing the actual sample area associated with a chosen sample unit.

The second stage sample was chosen in the following manner. Forty acre sample units (¼¼ section) were mapped on 1:48,000 base maps upon which the sampling stratification had been transferred. Sample units within each stratum, both zonal and interzonal (or contact), were individually numbered, and chosen at random in proportion to the total representation of that stratum within the study area. Deviations from the exact sample fraction arise from the assignment of at least one sample unit for each stratum, regardless of size.

A smaller number of sample units was chosen, and sample size increased by sampling adjacent units, in order to reduce logistic difficulties.

The sample thus chosen was then mapped onto available aerial photography and USGS Quadrangle sheets.

FIELD METHOD

LAND COVERAGE

Actual land coverage of 40 acre sample units by the six member HSR field crew was accomplished on foot. Crew members were spaced approximately 65 meters apart along one plot boundary, and each 40 acre parcel was surveyed by crew members zig-zagging within the 65 meter swath assigned to each across the 400 meter distance. Sites located during the traverse across each unit were flagged. Isolated occurrences of cultural material were noted by each crew member. After completion of a sample plot, the full crew returned to flagged site locations for their specific tasks in description and analysis. Upon completion, all pin and ribbon flags were removed and the crew proceeded to the next location where the description and analysis procedure was repeated. In general, survey and location of sites represented one-third and description and analysis, two-thirds of total field time.

STANDARD RECORDING PROCEDURES

Recording procedures utilized during this project represent modifications of methods developed by HSR since its inception in 1972. The goal of these methods is two-fold: collection of specific metric attributes which can be recorded for all sites; and, systematic measurement of site or artifact attributes which are mutually exclusive, and consistent curation of descriptive categories as needed.

The utility of this format is described in detail, and demonstrated in Wimberly and Rogers (1977). A particular advantage of this recording system lies in the ability to tailor particular field forms to the specific demands of the project, while maintaining methods of data collection which are consistent with all previous research by HSR.

These standard procedures include all descriptive information required by federal and state guidelines, supplemented by formal analytical information. This includes measurements of surface density of artifactual materials (Cultural Litter Density) and attribute analysis of ceramic, lithic and historic remains. The respective attributes are designed to produce on-site preliminary analysis; no collections, beyond small reference and verification samples need be taken.

Samples of artifactual materials for on-site analysis were gathered in a variety of controlled and semicontrolled ways, as circumstances dictated. CLD, or artifact density

estimates were collected on all sites where densities exceeded one item per m^2. In many cases, the complete surface inventory was less than 100 items of ceramics or lithics, or both, and all items were analyzed. In other cases, ten sample locations in high density areas, chosen as encountered, exhausted artifact variability and provided more than adequate coverage of the complete distribution.

The particular methods used in lithic and ceramic analysis were, when possible, based directly on materials inventoried during the density or CLD sampling. Descriptions of lithic and ceramic sample and analysis methods can be found in the respective analysis reports.

Forms have been designed in a modular and hierarchial fashion, for ease in indexing and reference, with a cover sheet describing the sample area which contains site and analysis forms as necessary.

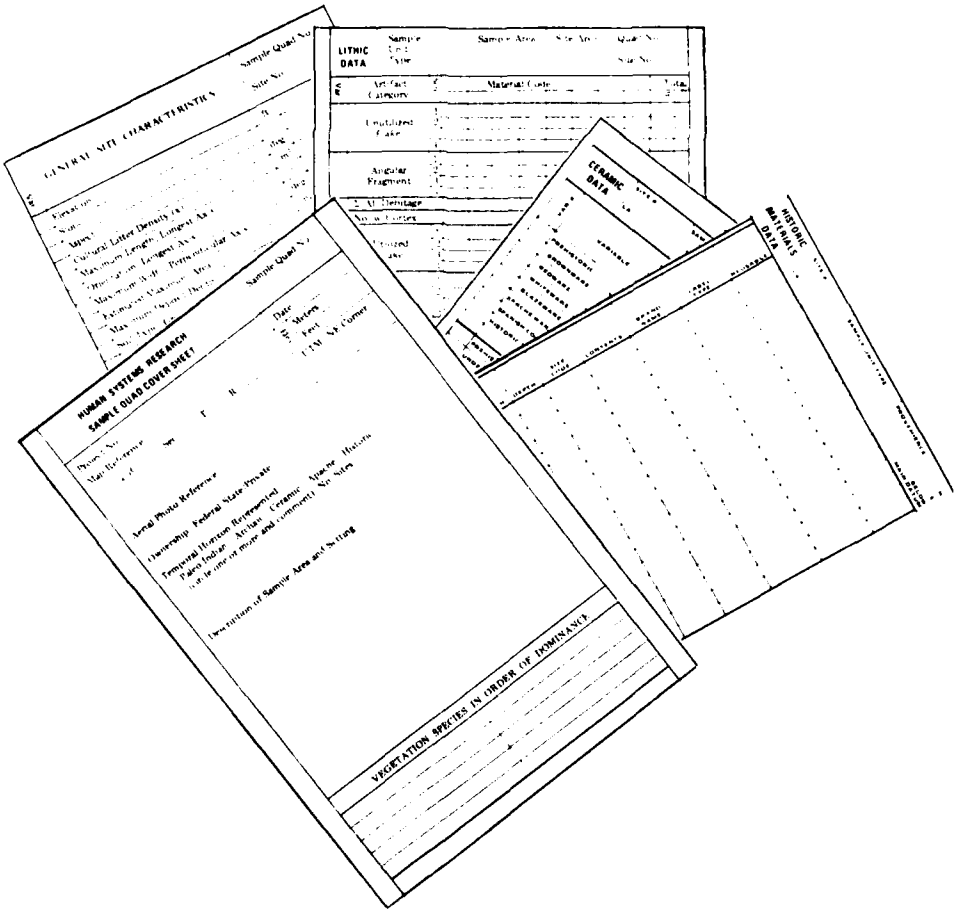
Particular forms used during this project include:

1. Sample quad descript . and cover sheet;
2. Site Description form;
3. Lithic Analysis form;
4. Ceramic Analysis form;
5. Historic Analysis form.

Examples of these forms are included in the Appendix.

Figure 8

HSR FIELD DATA FORMS



SCHEDULE OF FIELDWORK

Actual field survey for each study area, and details of crew personnel are shown below. Historic and ecological consultants operated separately from the archaeological field party. Simultaneous fieldwork by Cully, the consulting ecologist, and the archaeological party allowed in-the-field conference in both the Rio Puerco and La Jencia study areas.

Table 2

FIELD SURVEY INFORMATION

Type of Survey		Investigator(s)	Area	Person Days Fieldwork
Historical Survey		Betancourt	Rio Puerco	5
			Rio Salado	10
Ecological Survey		Cully	Rio Puerco	10
			Rio Salado	9
Sample Design Ground Truth	*Crew*	Wimberly Eidenbach Gossett Shearin	Rio Puerco	12
Archaeological Survey	*Crew*	Wimberly Eidenbach Marshall Gossett Gossett Shearin	Rio Puerco	60
			La Jencia	48
			Loma Blanca	48
		TOTAL PERSON DAYS FIELDWORK		202

Photo 5: HSR field crew *zig-zags* over Puerco drainage flatlands, covering 40 acre sample quadrats in 65 meter-wide traverses.

Table 3

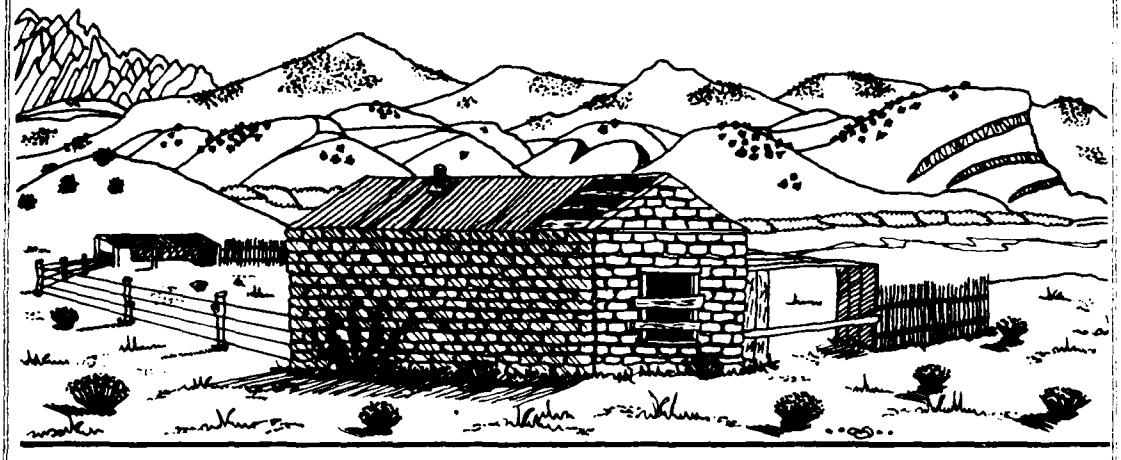
METHODS, TECHNIQUES, AND OBJECTIVES FOR EACH PHASE OF STUDY

Phase of Study	Method/Technique	Objective	Result
I. Compilation of Background material	literature search and review	develop specific research goals & baseline data	Preliminary Report
II. Project Planning			
(a) Development of Sample Design	Landsat stratification random sample	develop effective method for accurate field sample	preliminary sample array
(b) Sample Design Ground Truth	@ 3% sample of initial sample array	verify accuracy & logistic adequacy of sample design	preliminary field data
(c) Revision of Sample Design	apply results of preliminary field data	improve accuracy and logistics of sample	revised sample array
III. Historical Studies	literature & archival research; field evaluation	develop an accurate historical perspective	historical overview & evaluation of study areas
IV. Archaeological Fieldwork			
(a) areal survey	systematic foot coverage of sample plots	locate & record sites within sample plots	inventory of archaeological sites within sample
(b) description	CLD samples, site mapping	characterize the nature & distribution of sites	standard field form for each site
(c) analysis of artifactual remains	lithic analysis ceramic analysis historic analysis	develop temporal, functional & cultural parameters for study areas	preliminary data on intra & inter site variability
V. Ecological Fieldwork	standard ecological metric methods	supplement data from archaeological field studies; test sample stratification	Ecological Report
VI. Overview of Past Research and Review of Previous Archaeological Projects in the Drainage areas	consultation with professionals & existing archives	establish the quality & extent of past studies in the complete drainages	research project inventory and coverage maps
VII. Develop Predictive Model	statistical analysis of field data	develop predictive model & impact assessment	preliminary evaluation of extent and significance of cult. res. in study areas
VIII. Summary and Recommendations for future research	Prose review of the results of this project	direct attention to important scientific & management problems	list of recommendations to aid further research in the area

CHAPTER II

HISTORICAL OVERVIEW OF THE LOWER RIO PUERCO–RIO SALADO DRAINAGES, N.M.

By Julio Betancourt



Silver Creek Camp, looking north.
[E. Shearin]

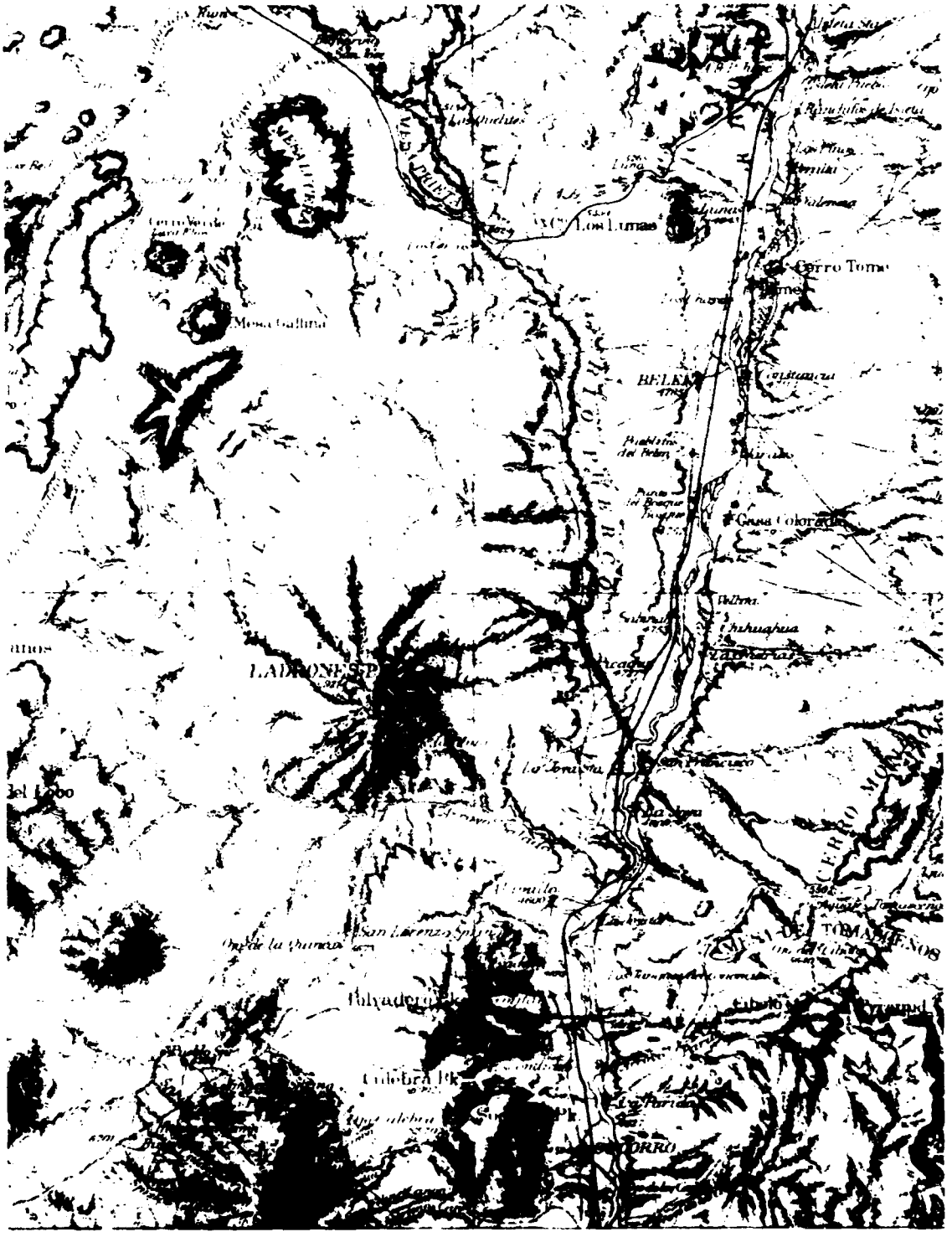


Figure 9: Wheeler, Corps of Engineers, U.S. Army, 1882

HISTORICAL OVERVIEW OF THE LOWER RIO PUERCO–RIO SALADO DRAINAGES, N.M.

By Julio L. Betancourt

INTRODUCTION

Historical research can be applied to various problems inherent to modern watershed management. In the early planning stages of a cultural resources survey, historical research can furnish data concerning the impact of previous land use on the cultural resources of an area.

Historical research also provides a pool of information about man-land relationships in the recent past. The careful study of cultural phenomena and environmental conditions can lead to a clearer understanding of environmental-cultural interactions and serves as suitable testing grounds for current cultural ecological theory. For example, what were the ramifications of late 19th century arroyo-cutting and its detrimental effect on irrigable valley floors, the most desirable sites for settlement and economic pursuit in an otherwise inhospitable desert?

It is unfortunate that man's own impact on watersheds throughout the course of history seldom is considered in the decision process involving modern drainage modification. It has been stated that a drainage might be best considered to have a heritage rather than an origin.[1] In the American Southwest, man's activities have played an important role in that heritage. The nature and causes of arroyo formation in historic times have been a matter of great debate since the turn of the century, a time that saw the Southwest develop into a major field laboratory for the natural sciences.[2] Since then, a principal focus of research has been to determine whether or not the impact of Anglo-European settlement on the landscape was instrumental in bringing about channel entrenchment. *Downplaying* the cultural factor, some investigators have emphasized that arroyo formation has been a part of the natural scene for as long as semi-arid and arid conditions have prevailed in the region, adding that the recent erosional episode was synchronous throughout arid North America. Recent work has concluded that different combinations of initial conditions (in many cases predetermined by man's activities) and environmental changes could have resulted in similar arroyos in different areas. It has become increasingly evident that each watershed must be studied separately to account for variability in both the cultural and physical settings.

In the late 1920s, pioneering studies by Kirk Bryan in the Rio Puerco and Rio Salado watersheds suggested that the ultimate causes of arroyo-cutting could not be evaluated without careful historical study. In Part I of this report, Bryan's methodology and findings serve as the point of departure for discussing the historic environments of the study areas. My focus is on the timing and extent of arroyo formation along the Rio Puerco and Rio Salado. At best, the fragmentary historical record presented here narrows the field of study to pertinent routes of inquiry.

Written in narrative style, Part II furnishes the basic historical overview in the general region encompassing the study areas. Although my aim is to focus primarily on the areas of potential impact, a wide array of distant facts are brought to bear on the task of placing local histories within their regional context. Details of Spanish and Mexican land grants within the study areas are bolstered by general discussion of the grant system and the settlement pattern it created in New Mexico. I had originally intended to present the narrative in topical fashion because some events, such as Sibley's retreat up the Salado, begged

for space of their own. A chronological framework was finally adopted to allow contemporaneous events to speak for the times in which they occurred.

In Part III the methodology enlisted in the field reconnaissance is made explicit. Field notes and plats of Territorial land surveys supplied an inventory of historical features extant during the period from 1880 to 1920. Prior to the field reconnaissance, this archival material had demonstrated that historical sites would be far more numerous in the Rio Salado than the Rio Puerco study area. A second aspect of the methodology was to contact ranchers in the area with the old survey plats in hand. Inquiries were made as to the exact location, nature, and condition of historical features shown on the plats. The section concludes with a detailing of survey results.

The summary bemoans the tasks left incomplete with the admonition that the effort fell short of being comprehensive. A case is made for prefacing future fieldwork with additional and more specific archival research.

I would like to extend my thanks to several individuals who expedited this study. Paige Christiansen, Professor of History, New Mexico Institute of Mining and Technology in Socorro, made available several important references and shared freely his knowledge of the area. State Historian Myra Ellen Jenkins gave priceless aid in locating relevant Spanish documents and census data for the late 19th century villages of Santa Rita (Riley) and Los Cerros. To Fran Levine, archaeologist and historian for the Bureau of Land Management in Santa Fe, I owe a special note of gratitude for introducing me to the historical records on file with that agency. Finally, I would like to acknowledge the hospitality of Ross and Pat Ligon of the Grey and Ligon Ranch. Without their help, the task of locating documented sites would have been an arduous one indeed.

Part I
ENVIRONMENTAL DESCRIPTION AND ANALYSIS THROUGH HISTORICAL RECORDS

Old-timers' recollections and published accounts make frequent mention of clear streams meandering on Southwestern valley floors, carpeted by grass *belly-high to a horse.* The resulting portrait of late 19th century valleys favors a likeness to the *Biblical Land of Milk and Honey.*[3] To many, the drastic changes in the modern landscape imply that Anglo-European settlement had been pervasively disruptive of an existing natural order.

Side-stepping alternate explanations such as climatic change, indictment of man for his excess has fostered the popular belief that resurrection of former conditions is tenable. Considerable optimism over the restoring potential of reduced grazing has been raised.[4] In the 1940s, a known climatologist working under the auspices of the Department of Agriculture expressed this optimism:

> *The accelerated erosion that is damaging the lands in the Southwest appears to have been caused by man, and by proper methods man can check the erosion and reclaim the land for his use . . . making possible the rehabilitation of the Southwest.*[5]

On the other side of the coin, arroyos have often been taken to be indicators of environmental change. Various theories and supporting data have been advanced to explain arroyo formation in the 19th century that attribute a minor role, if any, to cultural factors. One of the earliest proponents of the climatic model was Kirk Bryan. A versatile field geologist, Bryan argued that a shift to drier conditions that diminishes vegetation cover and thus reduces infiltration of water into the soil, produces greater storm runoff. He considered overgrazing merely as the *trigger pull* initiating the impending change. A number of other climatic models have been proposed and are reviewed elsewhere.[6]

The key to Bryan's work was not necessarily the model he proposed, but the way he went about his reasearch:

> *Valid conclusions as to the merits of these theories can not be reached until historic data on the time at which erosion began have been accumualted. Knowledge of the date of the beginning and progress of this spectacular change in the regimen of streams is particularly necessary in arriving at a decision as to the effect on erosive processes of the introduction of cattle and sheep and the overgrazing that in most localities ensued.*[7]

In the late 1920s, Bryan followed up his initial interest in arroyo-cutting with two case studies on the Rio Salado[8] and Rio Puerco[9], respectively. Below, Bryan's findings are reviewed and additional historical data is contributed wherever applicable. The discussion is generally restricted to the proposed damsite areas.

RIO SALADO DAMSITE AREA

Bryan combined the use of field notes from the original Territorial land surveys with interviews of settlers who had known the watershed at the time of entrenchment. At Santa Rita (Riley) on the Rio Salado he interviewed Lorenzo Padilla, the village's first settler in 1880. Padilla informed him that the river channel was then inconsiderable and that the broad flat of the valley seemed a propitious place for farming. This led Bryan to the survey notes of that particular township (T2N, R4W) and he compared them for the years 1882 and 1918.[11] In the earlier survey, Daniel Curry had recorded the width of the stream as varying between 11.88 and 48.84 feet (3.6—14.8 m) on a number of section lines. The 1918 survey, carried out by Paul B. Moore, showed some radical changes —width of the stream was recorded as ranging from 330 to 550 feet (100.6—167.6 m). Informants made reference to an exceptional flood in 1883, which washed out a road and formed a new channel. Since then, the river had continued widening its channel until virtually all the agricultural land had been lost. Presumably, downward cutting by the stream was retarded by bedrock underlying the shallow valley floor (example: the Salado Box).

Bryan also documented headward erosion along the upper tributaries of the Salado as late as 1923. He says little, however, about the effect of the 1883 flood on these tributaries. In the 1893 proceedings of the U.S. Court of Private Land Claims, interesting testimony was given on erosion within the Antonio Chaves Grant, abutting the Salado on the south. Pablo Sanchez, a resident of Polvadera, described changes along Ariveche Creek, a tributary of La Jencia Creek which empties into the Salado just east of the Box:

> *It is a cañada coming down from the plain that is called Zore plain or prairie; the sides of the cañada come down to the bluff, where there are small growths of oak trees, and on that side of that bluff of oak trees is a small hill, and the spring was situated on the side of the hill about 30 feet from the bottom, and at the place where it was situated there was a cave and the amount of water that rushed from it was very small, only enough to soak the ground . . . there was a tank . . .there was a flood in the year 1883 that dug the arroyo out and afterwards the spring gushed forth in the arroyo.*[11]

Today the spring is developed once again, supplying the Grey and Ligon Ranch headquarters. Throughout its entire length, Ariveche Creek flows within a confined channel with incised banks occasionally rising 3-4 m above the streambed. Arroyo-cutting along La Jencia Creek appears to be more drastic, but historic documentation of its initiation is inconclusive. Leslie J. Otto's survey plat for the year 1902 (T1N, R3W) shows an agricultural field just west of the stream in Section 24, but it is uncertain that it was irrigated from the creek's intermittent

flow.[12] Today, this same field is perched some 6-8 m above the stream bottom. Elsewhere in the Rio Salado area, field evidence suggests that former wagon roads shown on the old survey plats are now minor arroyos.

Although not relevant to the question of arroyo formation, general descriptions of historic environments within the proposed Rio Salado damsite are available in the archives. In the 1893 litigation over the Antonio Chaves Grant, the question of boundaries called for detailed overviews of the landscape. One description in particular comes to mind. Almost a decade prior to the litigation, Martin B. Hays bought property within the grant and went through the expense of having it surveyed. At the time there were claims by onlookers that Hays was attempting to survey more land than he had bought. The main controversy stemmed from the setting of the western boundary at La Jara Spring, some 10 km upstream from Santa Rita. The U.S. attorney claimed that the spring referred to in the original grant papers was actually Ariveche Spring, reducing Hays' property by more than half. If carried out, the new boundary at Ariveche Spring would exclude the choicest property in the western sector of the grant. Hays argued that:

> *There is little valuable land lying east of the La Jinza Arroyo until you get to the bottom land on the river front of the Rio Grande. It is rolling hills, or mountains, I would call it, stripped of everything, even the grass is not good, sheep do run over there some but cattle could not live; west of there we have foothills—tapering from the bottom it is poor land, and then we get onto a rolling prairie, extending about 12 miles and that is good grazing land; over this rolling prairie is where La Jinza Arroyo runs, the land west and over to the mountains has considerable timber on it, and I attach some value to that . . .the merit in the grant is grazing and no other purpose, outside of the bottomland of the river a mile or a little over, which is agricultural. . .it was to my mind the value of the property was in the land west from those foothills, the grazing was very good. . .and the timber on Bear Mountain was of considerable value and the coal also.*[13]

RIO PUERCO DAMSITE AREA

Spanish Colonial documents indicate that the Rio Puerco was an intermittent stream as early as mid-17th century. In 1765 settlers at Los Quelites, a small village on the west bank of the Rio Puerco below the confluence with the Rio San Jose', saw the advantages of:

> *. . . contributing to the greater utility of their land by diverting into the Puerco River the waters which are near its source, which is supposed to be easy and . . . giving to said Puerco River permanent running water.*[14]

During that same year, a large gully began encroaching into agricultural fields at Los Quelites. A report filed by a grant officer forced Governor Capuchín to issue a mandate that the gully be dealt with immediately. It is unfortunate that the exact circumstances are not known; the gully may have resulted from negligence in maintaining irrigation ditches. Antonio Sedillo, the original grantee, assured the Governor that something would be done as soon as all the settlers assembled. Sedillo added that,

> *Sir, in regard to the water of the place, it is not malicious, because when the year is dry, it is always short; as for the water for drinking purposes, we do not need either from the hole* [?] *or from the Puerco River; we have a planked well with a great deal of water for drinking and irrigating purposes, and for all needs.*[15]

The role of earlier erosional events in

later 19th century entrenchment of the Rio Puerco is unclear. Apparently, Bryan was totally unaware of the erosional event at Los Quelites. Making extensive use of the notes and plats of government surveyors, he focused on 19th century developments along the Rio Puerco and determined that accelerated erosion of the channel began sometime between 1885 and 1890.[16] His use of surveyors' notes was enhanced by the 1855 establishment of the New Mexico Principal Meridian along the lower reaches of the Puerco. A rocky hill some 10 km below the river's mouth was selected by the newly-created Office of the Surveyor General as the initial point of the survey, a convenient spot within the main traveled portions of the Rio Grande Valley.[17] The Principal Meridian intersected the Puerco channel at various points within T3N, R1W and T4N, R1W, furnishing Bryan with a mid-century reference point for the condition of the channel.

In April and May, 1855 surveyor John W. Garretson commenced surveying north from the initial point. Where the Puerco was crossed along the eastern boundaries of Sections 13 and 18, T1N, R3W, Garretson recorded 20 foot (6.1 m) banks, the width of the arroyo varying between 72.6 and 92.4 feet (22—28.2 m). In the township to the north, a width of 132 feet (40.1 m) was noted, but the height of the river banks was not recorded.

It may be inferred from Garretson's data that the lower Puerco valley had already been dissected by a major arroyo by as early as 1855. Other accounts corroborate this. In 1846 Abert crossed the Puerco at a point roughly west of Albuquerque where the banks of the river are now between 25 and 30 feet (7.6—9.1 m):

> *The valley of the Puerco is wide and flat, overgrown with varieties of artemisias and coarse grass, fit only for sheep and goats. The banks of the river are of stiff loam; they are 10 or 12 feet high, and stand vertically.*[18]

Another early account is that of Simpson who crossed the Puerco just north of Cabezon in 1849. At this place the Puerco was 100 feet (30.5 m) wide with vertical banks 20 to 30 feet (6.1—9.1 m) high, which had to be cut down to get the cannon across.[19] It appears that even as early as 1850, the valley of the Rio Puerco was already dissected by deep and stable channels at certain localities. Bryan claims that the Rio Puerco then flowed in a plain subject to overflow and that its channel was discontinuous, thus rationalizing otherwise conflicting historical evidence.[20] My own impression is that while Bryan's suggestion of discontinuous gullying may be accurate, descriptions of wide and shallow channels along the Rio Puerco are historically few and far between.

Discontinuous gullying has been attributed to both natural and cultural causes in the Southwest. The natural process involves changes in the slope of longitudinal profiles of streams due to differential deposition along them. When a stream is unable to move a load below a certain point on a profile, it will increase or steepen its gradient by depositing some of its load at the point of incompetency.[21] Trenching can occur when critical slope angles are reached. One study of arroyo formation along small drainage basins of Wyoming, South Dakota, Nebraska, and New Mexico documented that gullying is often associated with steepening of gradients.[22] Cultural modifications within drainage basins may have also led to discontinuous gullying, even as early as 1850 in the Rio Puerco. A popular hypothesis is that arroyos were initiated as the result of drainage concentration by man. No attempts have been made to document the possible coincidence between the location of drainage-concentration features such as ditches, wagon roads, etc., and arroyos or discontinuous entrenched segments of the Rio Puerco.

It is interesting that D. R. Cunningham, in his 1881 survey of T4N, R1W, recorded the same width for the channel as did Garretson some 26 years earlier (Table 4). Regrettably, there is no basis for documenting the height of the banks in the township to the south; it was not until 1920 that T3N, R1W was surveyed, when the height of the banks was

Table 4

Measurements of width and depth of Rio Puerco in T3, 4, 5, and 6, R1W compiled from survey notes on file at the U.S. Land Office, Santa Fe, cross-sections under the direction of George M. Post and other surveys by the Middle Rio Grande Conservancy District from Bryan (1923:269).

T3N, R1W

	Garretson 1855		Devendorf 1920		Farmer 1922		Post 1927		Mid. R.G. Cons. 1927	
	W	D	W	D	W	D	W	D	W	D
E. boundary of S. 13 and 18	72.6 92.4	20	–	30 or 40	399.9	25	450.0	42	norm. to chan. immed. south, 400-450; north, 320-350.	

T4N, R1W

	Garretson 1855		Cunningham 1881		Richards 1912		Post 1927	
	W	D	W	D	W	D	W	D
E. boundary of S. 12	132.0	–	132.0	–	425.5	30	–	–
N. boundary of S. 1	–	–	132.0	–	–	–	–	–
Line between S. 1 and 12	–	–	132.0	–	–	–	325.0	30
E. boundary of S. 36	–	–	132.0	–	788.7	25	440.0	34

T5N, R1W

	Cunningham 1881		White 1897		Pradt 1898		Walker 1900	
	W	D	W	D	W	D	W	D
N. boundary of S. 1	99.0	–	330.7	–	–	18	531.3	–
Line between S. 1 and 12	165.0	–	410.5	–	960.9	16	844.8	–
Line between S. 12 and 13	132.0	–	–	–	–	–	–	–
Line between S. 13 and 24	99.0	–	–	–	–	–	–	–
Line between S. 24 and 25	82.5	–	–	–	–	–	–	–
Line between S. 25 and 36	85.8	–	–	–	–	–	–	–
S. boundary of S. 36	132.0	–	–	–	–	–	–	–

T6N, R1W

	Cunningham 1881		White 1897		Pradt 1898		Walker 1900		Post 1927		Survey of Rio Puerco Reservoir 1927	
	W	D	W	D	W	D	W	D	W	D	W	D
N. boundary of S. 6	132.0	–	504.9	20	–	–	–	–	360.0	43	450.0	40
Line between S. 5 and 6	39.6	–	186.1	20	–	16	752.4	–	480.0	40	900.0	–
Line between S. 8 and 9	26.4	–	374.5	–	–	18	143.9	–	440.0	37	725.0	–
Line between S. 9 and 16	66.0	–	429.0	–	–	18	677.2	–	230.0	46	800.0	–
Line between S. 15 and 16	66.0	–	264.0	–	–	16	299.7	–	185.0	30	325.0	–
Line between S. 16 and 22	66.0	–	–	–	–	15	–	–	250.0	35	–	–
Line between S. 22 and 23	99.0	–	–	–	–	15	–	–	160.0	45	–	–
Line between S. 23 and 26	115.5	–	493.7	–	–	15	797.94	–	280.0	42	625.0	–
Line between S. 25 and 26	132.0	–	653.4	–	–	18	665.3	–	370.0	27	550.0	–
Line between S. 25 and 36	99.0	–	863.3	–	–	14	559.2	–			–	–
Line between S. 36	132.0	–	330.7	–	–	18	531.3	–			–	–

(All measurements are in feet)

recorded as being 30 to 40 feet (9—12 m). Cunningham did not record depth of the channel in T4, 5, or 6, R1W. We are left with the impression that only a short segment of the river was deeply entrenched in 1881.

At the Mexican village of Los Cerros in T6N, R1W, Cunningham noted that water was taken from the river for irrigating fields in Sections 5, 6, and 8. A brush and rock dam was used for diversion. In 1927, the base of the remains of this dam was about 22 feet (6.6 m) above the bottom of the channel.[23] Today, the cross-section of an irrigation ditch at the site of Los Cerros is exposed 40 feet (12 m) above the base of the cut bank (Photo 6). There is little doubt that both widening and entrenching of the Rio Puerco has occurred within the last 100 years, although the precise nature of the stream prior to the turn of the century has not been determined. Cunningham recorded a lateral shift, or new channel, in T6N, R1W in 1881, perhaps indicating that the Puerco was a shallow stream in that township.

Under the rubric *General Description*, surveyors often included impressionistic accounts of the terrain surveyed. The accounts often varied from surveyor and were sometimes in conflict with one another. In 1881, Cunningham described the lands within T4N, R1W, as:

> *. . . generally rolling and gravelly or stony with abundant grass, but no permanent water. Two good valleys cross it from west to east and the Rio Puerco crosses it in the northwest corner. The valley of the Puerco along the eastern side of the property contains good farming land but not water can be obtained for irrigation. The timber consists of scattered cedar and pinyon bushes.*[24]

Some 21 years later, W. H. Richards described the township to the south:

All the land included in the boun-

Photo 6: West bank of Rio Puerco at Los Cerros; cross-section of irrigation ditch at top left of the bank.

daries mentioned above could be irrigated from the Rio Puerco. The river is a small sluggish stream, usually somewhat muddy and strongly alkaline. The riverbed is about 1.50 chains (99 ft) wide and about 20 feet deep. It has numerous quicksands and is considered quite dangerous to cross with a wagon. There is a small dismantled cabin in the southwest corner of Section 18 but no settlers.[25]

In the two accounts, there seems to be discrepancy on whether irrigation was possible in the general vicinity of T3N, R1E and T4N, R1W. Cunningham, who in the same year observed that water was taken from the river for irrigation at Los Cerros (two townships to the north), apparently thought that the same was not possible downstream. Richards, in the area long after arroyo-cutting had taken its toil, apparently thought it no problem to raise water onto the fossil floodplain from the stream channel some 20 feet (6.1 m) below.

In summary, several lines of historical evidence have been selected here to represent the types of documentation available for evaluating environmental changes in the areas of the proposed Rio Puerco and Rio Salado damsites. In the Rio Salado watershed, channel entrenchment occurred as early as 1883 and affected not only the mainstem but also tributary channels. Progressive widening of the Rio Salado channel destroyed much of the agricultural land near the village of Santa Rita (Riley). Erosion during the flood of 1883 was greatest along drainage-concentration features. A new channel formed along an old wagon road flanking the Rio Salado and an arroyo was dug out at the developed spring of Ariveche Creek. Spanish Colonial documents not only indicate that the Rio Puerco was an intermittent stream as early as mid-17th century, but also that gullying was then a problem near human settlements. In the 1840s and 1850s, several sources document discontinuous segments of entrenched channels along the Rio Puerco. Whether arroyo formation at these localities was associated with the natural steepening of gradients or with drainage-concentration features has not been determined. According to Bryan, accelerated erosion and the joining of the various channel segments occurred sometime between 1885 and 1890. Historical evidence for the Rio Puerco is conflicting.

The great debate over the nature and causes of widespread arroyo formation in the Southwest at the end of the last century has demonstrated that one model cannot serve to explain the histories of individual watersheds. There is a pressing need for separate studies of each watershed. Watershed management efforts stand to benefit from such an approach. In the Environmental Impact Statement of the proposed damsites on the Puerco and Salado, the Department of Agriculture suggested that more attention should be given to the environmental consequences anticipated when the reservoirs are filled with sediments, predicted to happen in 110 years.[26] The time depth afforded through historical records could furnish important clues as to the implications of watershed related decisions.

Part II
HISTORICAL SUMMARY OF THE MIDDLE RIO GRANDE VALLEY:
Focus on the Rio Salado and Rio Puerco Watersheds

EARLY SPANISH EXPLORATIONS AND MISSION EFFORTS IN THE RIO ABAJO: 1540–1700

By 1536 the forlorn Cabeza de Vaca and the black Moor Estebanico had finally reached Mexico City, carrying tales of gold and silver, *the legendary Seven Cities of Cibola*, related to them by the various Indians they had encountered. Their stories provided the initiative for the northward expansion of the Spanish commonwealth into New Mexico. First contact with the Rio Abajo area of the Rio Grande was in 1540, when the Coronado expedition payed a visit to Tutahaco, a province of eight pueblos centered near present-day Isleta. Coronado ordered Captain Don Francisco de Ovando to explore settlements

further downstream. Four Piro villages were visited around present-day Socorro but are not well described in chronicles of the expedition.[27]

Decades passed before another expedition was organized to explore the Rio Grande. Because Coronado's entourage had reached the Rio Abajo from Hawikuh far to the north, the lower reaches of the Rio Grande were virtually unknown. At Parral near the headwaters of the Rio Conchos and the northernmost outpost of Spanish Colonial efforts, speculation arose that the large river into which the Cochos emptied was the same as Coronado had known in New Mexico. Whereas before the principal route to the north followed Coronado's journey along the New Mexico-Arizona border, future expeditions could follow the Conchos to the confluence and upstream to New Mexico. This new route was first followed by Friar Agustin Rodriquez and Captain Francisco Chamuscado in 1581.

The Rodriquez-Chamuscado expedition reached an abandoned pueblo near present San Marcial in August, 1581 and named it San Felipe. Continuing north along the west bank of the river, the expedition traveled two leagues to a Piro village, later known as Senecu, where the inhabitants had fled the approach of the Spanish but soon returned some 2,000 strong:

> *The following morning we left the abandoned settlement (San Felipe) and after traveling the two leagues. . .came to a pueblo of many houses three stories high, but found no inhabitants. They had left the night before because they had noticed an approach. In the houses we found many turkeys and much cotton and corn. Although we did not see any people in the pueblo on entering it, we did find in the valley many cornfields like those in Mexico, and also fields of beans, calabashes, and cotton. We did not dare to take any of the goods, for we wanted the people to know we did not dare to harm them. We found the houses very well decorated with monsters, other animals, and human figures . . . the inhabitants have a great deal of crockery, such as pots, large earthen jars, and flat pans, all decorated and of better quality than the pottery of New Spain.*[28]

The Espejo expedition in the following year noted some twenty Piro pueblos in the region between present San Marcial and Sevilleta, the major ones being San Juan Baptista, Sevilleta, Alamillo, Pilabo, Teypama, Qualacu, San Pascual and Senecu. The Espejo expedition led to the Royal Cédula ordering the conquest and colonization of New Mexico. In 1595 Don Juan de Oñate was appointed governor of New Mexico and was commissioned to settle the territory. By 1598 Oñate and his contingency forded the Rio Grande at what was to become the site of El Paso del Norte (Juarez), crossing the east bank, and continuing on into New Mexico. At the Piro settlement of Trenaquel across from Senecu, the ten Franciscans and 129 soldier-colonists and families were received well and they remained for several days. Near the mouth of the Rio Puerco, the party reached Teypama, which Oñate named Socorro because the natives received him kindly and supplied him with corn. No references are made at this time to Athapascan presence in the Rio Abajo, although both the Espejo and Oñate expeditions noted mountain peoples, referred to as Querechos, trading at Acoma to the north.[29] In 1626, Friar Alonzo de Benavides first mentions *Apaches de Xila* while at Senecu and stated that they were encamped some 14 leagues to the west[30] (probably in the San Mateo Range).

Beginning in 1626, Franciscan mission efforts turned to the Rio Abajo and the Piro pueblos. Sevilleta, which had been abandoned in the 1610s or 1620s due to Apache pressure, was resettled and a church built and dedicated to San Luis Obispo. A convent, with friars in residence, was established at Pilabo in the summer of 1626. The mission was dedicated by Benavides to Nuestra Señora del Socorro,

and the location still bears that name today. Teypama, Onate's earlier Socorro, was subsequently abandoned with the population distributed at Senecu and Pilabo. It is possible that San Pascual was also abandoned at the same time as Sevilleta, while across the river on the west bank, Friars Antonio de Arteaga and Garcia de Zuniga founded a mission at Senecu in 1629. In 1638, Alamillo replaced Sevilleta as a mission in the northern Piro district. During the mission and earlier exploration period, no mention is made of the lower Rio Puerco or the Rio Salado.

The next three or four decades were relatively uneventful in the Rio Abajo. The Spaniards had to contend with an Apache-Piro conspiracy during the administration of Governor Fernando de Villanueva (1665-68). A military entourage was ambushed in the Magdalena Mountains prompting the Governor to hang six Piros and imprisioning others or selling them as slaves. The Apache-Piro alliance would be shortlived, however, and in August, 1671 Gila Apaches, led by El Chilmo, and Apaches from the Siete Rios area attacked Senecu.[31] On January 23, 1675 Apaches again surprised Senecu, killing its missionary, Fray Alonzo de Avila, and decimating the population to such an extent that the survivors fled to Socorro and El Paso deserting the pueblo permanently.[32]

The Rio Abajo pueblos would receive a greater blow five years later, this time as a consequence of the Pueblo Revolt of 1680. As early as 1660, administration of New Mexico had been partitioned in two major districts, the Rio Arriba and the Rio Abajo, with the boundary being just south of Santa Fe at La Bajada. Communications with the governmental center in the Rio Arriba were interrupted during the uprising. The remoteness of the Rio Abajo from the center of revolt in northern New Mexico may partly explain why the Piros remained uninvolved. Spanish refugees at Isleta decided to flee further south to El Paso in August. They were joined by Piros from Sevilleta, Alamillo, Socorro, and Senecu. In 1681, Governor Otermin set out from El Paso to recapture New Mexico. He found the four major Piro pueblos abandoned and apparently sacked by Apaches; Otermin set fire to these pueblos. His initial attempt at reconquest failed, though, and it wasn't until Don Diego de Vargas assumed command of the dispirited New Mexico colony in exile that the pueblos were reconquered. In January, 1693 de Vargas visited abandoned Senecu, recommending that it not be resettled because of its location on the Apache frontier and the damage done to agricultural lands by the shifting of the Rio Grande's course.[33] For all practical purposes, the Piro Nation in the Rio Abajo was a thing of the past.

APACHE, NAVAJO, AND SPANIARD: THE 18th CENTURY

After de Vargas' successful attempt at reconquest, more than a decade passed before the Spaniards were back at the helm, only to face another revolt in 1696. By the early part of the 18th century, the focus of the Spanish Crown and its burgeoning colonial bureaucracy was no longer the missions, but the need for defense and revenue. Colonization took on a new intensity. By the end of 1705, enough settlers had been recruited to found a new villa in the Bosque Grande de Dona Luisa, the future Albuquerque, with 35 families claiming lots.[34] Seventeen estancias between Bernalillo and Albuquerque, established by 1680, were reoccupied. Travel along the Camino Real from Chihuahua City and Santa Fe increased.

During the 18th century, the Spanish land grant system expanded into New Mexico. Rural villages were established by these settlement grants and tended to be collections of scattered dwellings on large garden plots. Four square leagues were granted to ten married men who promised to found a town where the land was arid. In fertile locations, the grant was usually one square league, while ranching grants were from 10 to 15 square leagues. Two major types of grants were allowed. Individual holdings were granted for services rendered in government or military services, while empresario grants were given to an individual responsible for colonizing a larger area. Grants generally had to be located at least five leagues from any other cabezera or town center. When a petition to found a

settlement was granted, the alcalde placed the petitioners in receipt of the land, their names were recorded and the boundaries of the land were walked. For his part, the settler had to live and farm his property for four years before ownership was finalized. Desertion was defined when the settler abandoned the land for more than two months. Taxes were not levied on the land but on the products paid in kind.[35]

The scattered nature of homes and agricultural fields within loosely-defined grant boundaries made the Spanish Colonial municipality seem more like a modern county than an urban center.[36] House lots were known as solares and made up the central portion of the grant, surrounded by suertes or agricultural plots. Beyond the farmlands was the ejido or town common, used for grazing stock, fuel procurement, etc. Smaller community pastures, known as dehesas or meadows, flanked the river. While occasional floods made land grants along the Rio Grande rather precarious living, a more serious threat was posed by incursions of Apache and Navajo bands in the area.[37]

While Apaches had frequented the Rio Abajo during the 17th century, it wasn't until the early 1700s that Navajos are noted in the area. In 1708, a party of thirty soldiers and sixty Indians pursued Navajos from Albuquerque to the Sierra de los Ladrones where they found that the Navajos outnumbered them.[38] Few other mentions are made of Navajos in the Rio Abajo until the second half of the century.

In 1739, Nicolás Duran de Chaves, a resident of Atrisco, petitioned then Governor and Captain General of New Mexico, Gaspar Domingo de Mendoza, for a grant on the banks of the Rio Grande, the boundaries which were the river on the east, on the west the Rio Puerco, on the north the land of Captain Bernabel Baca, and on the south the lagoons or esteros called San Pablo. Land was granted June 1, 1739 with the addendum that the northern boundary would be a little round lagoon which was grown up with rushes. (The western part of the land grant is included within the eastern portion of the Rio Puerco damsite.) Duran de Chaves testified in behalf of his petition:

> *. . . because of my being in possession of a stock of neat cattle and sheep, and not having any place on which to keep them, without damage to my neighbors and the Pueblo of Isleta. . .I am burdened with a family of nine male children. . .because the land is uncultivated. . .I registered it and took possession of it with iminent peril of my life; I built a cabin and placed my stock on it to the present with considerable trouble and danger from the heathen.*[39]

In 1739 the Nuestra Señora de la Concepción de Tomes Dominguez was established on the east bank of the Rio Grande. The following year the Belen grant was made to Diego Torres de Salasar, Pedro Vigil, Miguel Salasar, and 32 other residents.[40] Genizarios, Indian slaves ransomed from the Apaches and then emancipated to work out their account, were gathered into settlements strategically located as buffers protecting Rio Abajo towns. One such genizario community, Los Jarales de Belen, was located on the east side of the Rio Grande opposite Belen and south of Tome, apparently to guard against Apache incursions from the west and southwest. Another genizario community was that of Los Lentes, just north of present Los Lunas.[41] How effective these communities were in protecting the larger settlements is debatable. In the 1750s, Governor Capuchin noted that although in Albuquerque the Gila Apache can invade along the Rio Puerco, the Sierra de los Ladrones is at such a great distance that they rarely try to come in from that direction; they always seek shelter in the Sierra de Sandia.[42]

In 1744, a suit against Duran de Chaves by Bernabe Baca over boundaries threatened to nullify the grant. In 1746 a compromise was reached. It appears that Duran de Chaves had built his house on Baca's land but in order to avoid tearing it down, Baca gave Duran de Chaves 250 paces of land north

from the boundary. During the next two decades, settlers from Atrisco and Albuquerque began moving into the Rio Puerco area. Twelve families were granted the Montaño grant (Nuestra Señora de la Lúz Fernando y San Blás) in 1753, with the southern boundary set at Cerro Colorado:

> *We. . .all residents of the town of Albuquerque appear before your excellency, and state that at the place called the Rio Puerco, there is some public land hitherto unsettled, with little permanent water, and as the places we now occupy, we are crowded and needy, for our maintenance from day to day and we are obligued* [sic] *to go out among the nearest Indian Pueblos, to work for them, sometimes weeding their fields, and sometimes bringing firewood from the mountains, for the small compensation of the few ears of corn with which they pay for this and other laborious work.*[43]

As Fray Juan de Escalova explained, "*a Spaniard who gets his fill of tortillas feels as if he has obtained a grant of nobility.*"[44]

In April, 1761 Governor Marín del Valle granted Antonio Sedillo land centered at Los Quelites on the west bank of the Rio Puerco just south of the Rio San José.[45] The name Los Quelites was one of long standing, applied to the Rio San José (Arroyo de los Quelites) as early as 1692 by de Vargas.[46] Four years later, there was trouble at Los Quelites. Sedillo, Alcalde Mayor of Acoma and Laguna had convinced several settlers from the Rio Abajo to settle at Los Quelites. Crop failure and the constant harassment from nomadic bands discouraged some of the settlers and they petitioned to be let out of the arrangement. Ironically, the original grant petition had argued that Los Quelites could serve as a buffer against the Apache and Navajo, protecting communities along the Rio Grande. Other settlers desired to stay at Los Quelites. The two parties seemed to be divided between those who owned livestock and settlers who depended almost entirely on farming. Sedillo argued that the only crops that could not be cultivated at Los Quelites were wheat and beans, but that corn, cotton, and chiles could be grown without difficulty. Apparently, those settlers who desired to leave were relative latecomers and not the original group that settled Los Quelites. All was for naught, however, as the Apaches raided the settlement toward the end of 1765 and it was abandoned. Four years later Sedillo again applied for a grant at Los Quelites and it was granted by Governor Mendinueta.

By the 1770s, a Navajo-Apache alliance succeeded in harassing settlers along the middle Rio Grande and on the Puerco frontier to the west. A major military expedition from the south, led by Hugo O'Conor in 1776, managed to subdue the Apache threat in southern New Mexico but had little impact to the north. The expedition did reach the immediate surroundings of the study area, when Governor Mendinueta from Santa Fe sent a detachment under Lieutenant Diego de Borica into the Sierras de Magdalena and Ladrones.[47] Due largely to the administration of Governor Don Juan Bautista de Anza, between 1777 and 1787, the Gila-Apache alliance was broken. Friction that had developed over land in the Cebolleta area temporarily ceased. Apache raids, however, forced abandonment of the Montaño grant in 1785.[48] Several Apache goups congregated around Sabinal in the Rio Abajo towards the latter part of the 18th century. As late as 1799, Pedro de Nava mentioned troops attacking an Apache ranchería near Socorro.[49]

In January 1800, Governor Chacon planned to resettle the old site of Socorro but the ruined town was on the west side opposite the Camino Real. Instead, Sevilleta was resettled successfully along with Las Nutrias. Zebulon Pike described Sevilleta in 1807 as:

> *. . .situated on the east side and is a regular square, appearing like a large mud wall on the outside, the doors, windows, etc., facing the square, and is the neatest and*

most regular village I have seen; it is governed by a sergeant at whose quarters I put up.[50]

Apache raiding in the Rio Abajo continued and in 1803, Governor Chacon ordered another campaign in the Sierra Magdalena. In 1809, Navajos began raiding down the Rio Puerco and crossing the Rio Grande to attack Mescalero Apaches. In 1817, settlers from Los Padillas, confronted with several conflicts with the Pueblo of Isleta, petitioned for land at Los Quelites but were refused by Governor Allende who suggested instead that they move to Socorro.[51] Socorro had been revived two years earlier by residents of Belen. In June, 1819 Sevilleta residents were granted lands bounded on the north by the Belen grant, being the line drawn between the house of Felipe Romero and the paint of Sabinal Hill, on the east by the Cerro Montoso, on the south Arroyo de Alamillo, on the east the Rio Grande, and on the west the summit of the Sierra de los Ladrones.[52] The Rio Grande Valley around Valverde was granted to Don Pedro Arcus de Armendaris in December, 1819.[53]

CONTINUED SETTLEMENT AND NAVAJO RAIDS IN THE RIO ABAJO UNTIL THE TREATY OF GUADALUPE-HIDALGO 1821–1848

In 1821, Mexico received her independence, but life in the Rio Abajo continued as before. New land grants were established and predation on these by Navajo and Apache intensified, with the former's presence being felt more strongly than before. Almost single-handedly, Navajos prevented Mexico from establishing permanent settlements in the Valverde region. Armendaris, after substantial losses in 1822, abandoned the grant two years later. Navajos also attacked Socorro in 1822 and 1823 and Las Huertas and La Joya in 1823, the latter which resulted in the deaths of 17 Mexicans.[54] Until 1854, when a U.S. fort was established in the area, there were no settlements between Socorro and Doña Ana.

An important development in the 1820s was the development of the Santa Fe trail. During Spanish Colonial days, Spain exercised a policy of exclusion, whereby all goods imported into and exported from the Spanish colonies had to flow through Spain and be transported on Spanish ships. With the beginning of Mexico's rule, trade was opened with the United States and goods began to flow along the Santa Fe trail from St. Louis, Missouri. The Chihuahua trade and thus the old Camino Real were abandoned at first but American traders, aware of large quantities of silver being mined in Mexico, revived the old route along the Rio Grande. The Chihuahua trail hosted these mule pack trains destined for Chihuahua City at several stopping places on the east bank of the river in the Rio Abajo; these included Casa Colorado, Sevilleta, and Hacienda de Luis Lopez.

On March 3, 1824 the Republic of Mexico granted Antonio Chaves a large tract of land known as the *Alamillo* or *San Lorenzo* grant (Figure 10). In order to give Chaves a water front on the Rio Grande, portions of the Socorro and Sevilleta grants were withdrawn without objection from those communities. The Mexican government anticipated that establishment of the Antonio Chaves grant would facilitate the settlement of the lands of the Bosque del Apache and San Pascual. In addition, the grant would compensate for losses suffered by Chaves at the hands of the Indians in the early 1820s and would create employment opportunities for nearby settlements.[55] The Antonio Chaves grant would later be the target of much litigation.

The Navajos continued putting pressure on Rio Abajo settlements in the late 1820s. In May, 1827 Navajos raided livestock of Antonio Chaves near Belen, and Pablo Baca requested the aid and support of 150 men and 15 days to go in pursuit. In August of the following year, Navajos stole 29 sheep from Joaquin Pedilla near Belen. In October, 1832 the military detachment at Socorro was robbed of mounts by the Navajo, and the troops were unable to give chase because they lacked horses.[56] In the 1830s the Governor granted permission to Rafael Lopez for a raid on a flock

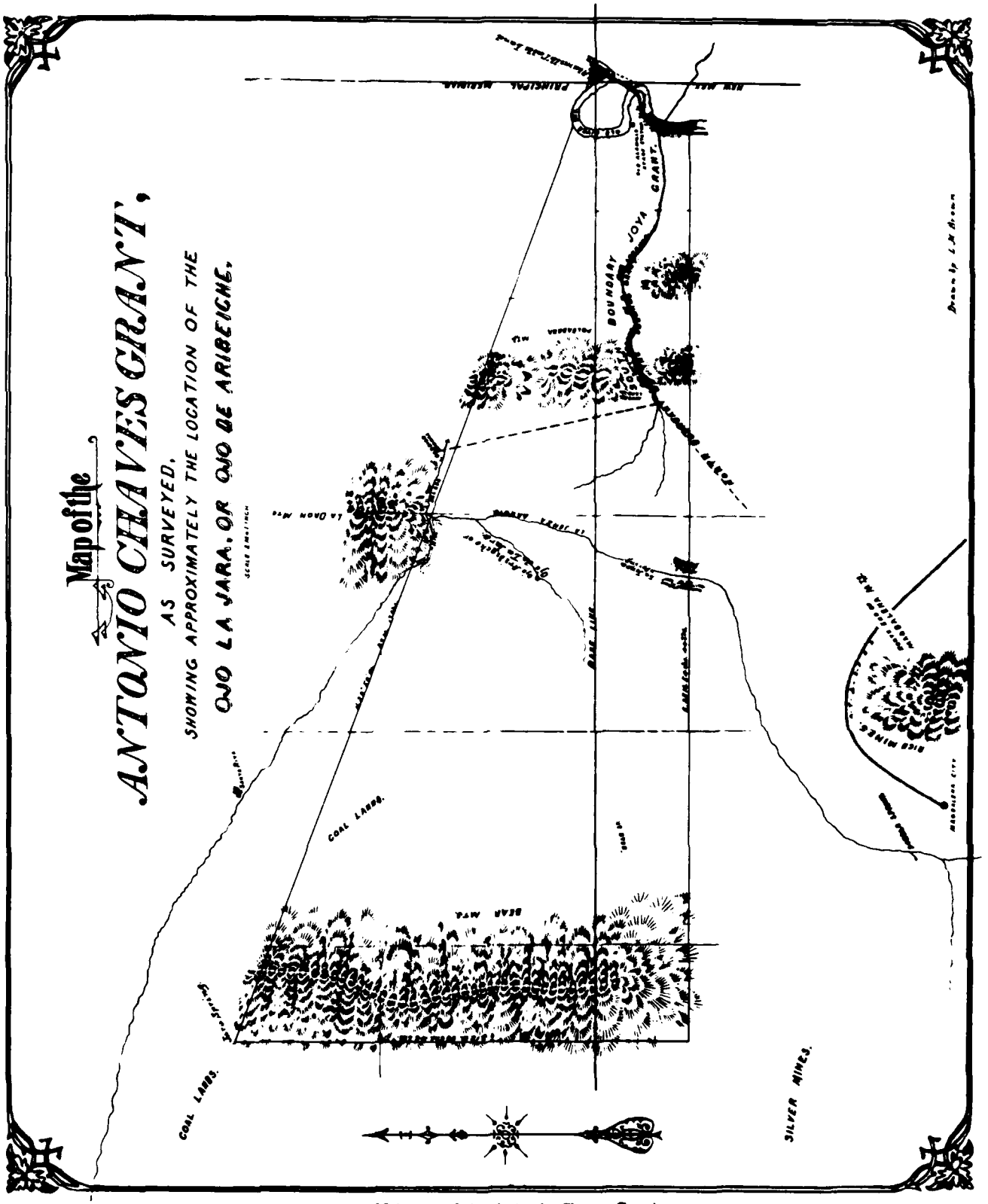


Fig. 10: 1894 map of the Antonio Chaves Grant

of sheep belonging to Apaches on the Rio Salado. Lopez set forth with 15 men and claimed to have started home with 3,500 sheep, three burros, and six horses, but the Apaches managed to recover their stock.[57]

In the spring of 1835, a general campaign against the Navajo in their own homeland was successful, although the Mexicans suffered heavy losses in a battle at Washington Pass. Navajos retaliated in June with a war party of no less than 200 attacking Lemitar on the west bank of the river in the Rio Abajo. Two thousand sheep and a sheep herder were taken; the party in pursuit suffered the loss of one man and wounding of two others. Early that same morning, the Navajo war party attacked the vicinity and plaza of Socorro, driving off several horses, cattle, and goats. A pursuit was organized and a band of townsmen pursued the Navajos to Ojo de la Culebra in the Magdalena Mountains, but being outnumbered they turned back to Socorro.[58] On August 22, 1840 Navajos raided Sabinal, taking 90 animals, killing two men and a woman and wounding two more men. They were chased by Colonel Francisco Chaves to Ojo de la Jara at the western end of the Bear Mountains. Having received notice of the Sabinal raid, the Governor ordered another campaign against the Navajo and requested that the Rio Abajo settlements raise 500 men with an equal number to be organized in the Rio Arriba.[59] It is certain that the Navajos were on the land in the area of the present Alamo Reservation by 1842.[60] In June, 1843 several Navajos attacked Los Chaves near Belen and took from Don Jose Chaves 500 livestock. Chief Juan Cristobal Chaque participated in the raid. Later that month, Chaves and others established a blockade against the Navajos which extended from Cebolleta to Socorro.[61] In 1844, a Navajo ranchería existed in the vicinity of Tome.[62]

During the Mexican period, the custom of taking slaves among the Navajos became well-established in the Rio Abajo. It was normal, for instance, for a bride to be given a Navajo serving girl about her own age with coincidence that both the bride and the Navajo servant bore their first child at about the same time.[63] In 1824 and 1827 four Navajo children were purchased by Mexicans at Socorro. In 1832, a Navajo woman was servant to a Mexican family in Socorro and in 1840 and 1843, others served the families of Jose Vicente Chaves and Jose Padilla, respectively, also of Socorro.[64] Some Navajo bands were used as mercenaries against their own. Mexicans enlisted the Cebolleta Navajo in campaigns against hostile Navajo groups. One band leader's name in particular, that of Cebolla Sandoval, finds frequent mention in the military records of the period. Other Navajos began to refer to the Cebolleta Navajo as Dine Ana'aii, or Enemy Navajo.

THE AMERICAN PERIOD 1848–1912

With the signing of the Treaty of Guadalupe-Hidalgo in 1848 putting an end to the Mexican War, a new wave of settlers arrived in New Mexico. The way for Anglo settlement was being paved by military reconnaissances and establishment of a line of forts within Apache and Navajo territories. Some were in search of mineral wealth, while a few sought to make an *honest living* from the land; little progress would be made until the Apache and Navajo menace could be subdued. The system, so far as any organized plan was followed, was to send out detachments from different posts in pursuit of raiding bands, after the fact that is. Occasionally, larger expeditions were organized to wage war on some band or district, normally resulting in short-lived treaties ignored by either party. From 1849 to 1851, a detachment of troops was stationed in Socorro. In 1851, Fort Conrad was established on the west bank of the Rio Grande across from Valverde. Fort Craig, a few miles to the south, was established in 1854. Throughout the period, volunteers were stationed at Luis Lopez and Valverde. The principal purpose of these troops was to protect trade caravans and settlements in the Rio Abajo. After the establishment of Fort Craig, the farmlands of the Rio Abajo could be farmed safely and Valverde, San Marcial, and Contadero were settled.

Trade along the Chihuahua Trail

continued as before with the annual fairs at Tome and Socorro legitimized by the legislature in 1852. Trading during the ten-to-twelve day fairs was free from taxation.[65] With the newcomers came a preference for commercial money trading to the disadvantage of Mexicans accustomed to the barter system. A major conflict would be generated by the expansion of American notions about real estate through the establishment of the Surveyor General's Office in 1854. The informality of Spanish and Mexican land grants would be hotly contested by Anglo obsession with bureaucratic detail and documentative paper work. During both the Spanish and Mexican administrations:

> *. . .surveying was not recognized as one of the finer arts. Land measurements were as wide as the prairie and as far away as a river or a mountain. Inadequate descriptions proved to be one of the principal contentions involved in land grant litigation after the American occupation.*[66]

Although translating Spanish and Mexican real estate into American legal terms was a monumental task, the major administrative headache seemed to be the Navajos and Apaches. In 1853 Apaches stole cattle from Socorro and left by way of Lemitar Pass to the northwest. The following year, they ran off Army horses south of Fort Craig, attacked a party of Mexicans in a canyon in the Magdalena, and two days later stampeded Army mules in the same canyon. In October, 1855 General Garland reported that Mogollon Apaches had stolen stock from near Sabinal and had raided Socorro, La Joya, and Los Padillas.[67] In January, 1856 Mogollones again raided the Rio Abajo, this time in the vicinity of Tome.

Navajos also raided the Rio Abajo area in the late 1850s. The various towns on the Rio Grande generally grazed their herds on the western side of the Rio Puerco where excellent grazing could be obtained.[68] In November, 1858 a large number of Navajos were reported on the Rio Puerco just west of Los Lunas and as far south as Lemitar:

> *The Mexicans say that Gordo, a brother of Zarcillo Largo, and Nack-ath-lan are among them. I recognized Jose Pilon and Vicente as rich men I have often seen at Fort Defiance. I counted within the space of 2 miles 17 different herds of sheep, and about 400 head of horses. I also saw a number of clouds in the mountains which the Indians informed me was caused by herds of sheep.*[69]

In June, 1859 a party of five Navajos drove off a small flock of sheep from the Rio Puerco just west of Los Lunas. They were pursued to Zuni Mountain where the sheep were recovered but the Indians escaped without harm.[70] The prevailing mood of anxiety in the Rio Abajo in 1860 forced Governor Rencher to approve formation of two companies of citizen militia, arming them with 2,000 muskets, over the opposition of Colonel Fauntleroy, who argued against supplying ammunition. Along with Captain George McLane's mounted riflemen from Fort Craig, the militia men, led by Manuel Antonio Chaves, took part in February in the pursuit of a Navajo party raiding from Los Lunas down the Rio Grande Valley.[71] That same year Navajos were pursued from La Joya to the mountains west of Sabinal.[72]

In 1861, on the eve of the Civil War, the southern parts of Arizona and New Mexico sympathized with the South; conventions held in Mesilla and Tucson voted for secession from the Union. Annexation of the western territories would sever Colorado and California gold fields from the Union and secure them for the South. New Mexico was also the key to westward expansion of Southern influence and economy and the dream of a southern Pacific railroad had borne this in mind. Captain H. H. Sibley, a Texan stationed at Taos, was commissioned to drive the Federal forces from New Mexico. With considerable forces, he moved up the Rio Grande from Fort Bliss, a Confederate outpost, defeating the Union forces under Colonel E.R.S. Canby at Valverde on February 21, 1862.

Even prior to Valverde, Canby had appealed to the governor of Colorado for reinforcements. Sibley considered Fort Union on the Santa Fe Trail as the key to the entire territory. If he could take Fort Union, Canby would be cut off from reinforcements from the north. Canby on the other hand, knew that the Mesilla Valley supplied the Confederates and thus he would have to hold Fort Craig. Victories at Glorieta Pass and Johnson's Ranch in the vicinity of Fort Union were shared by Confederate and Union forces, respectively, in March. Sibley, in the meantime, was camped near Albuquerque, caught between reinforcements from Colorado and Canby at Fort Craig; the Confederates decided to retreat from New Mexico on April 12th. After a hard fought battle at Peralta, the Confederates moved across the river to Los Lunas. The Confederates, on reaching the confluence of the Rio Grande and the Puerco, halted and went into camp. Sibley pondered over his next move. At the onset of the retreat he had planned routing Fort Craig as a parting gesture, but now felt that a clash with the Union forces would be inevitable if he followed the Rio Grande south. Several of his officers suggested that they leave the river road and detour around the mountains to the west, striking the river again below Fort Craig. After all, Captain Bethel Copwood was familiar with the country.

The Confederates moved out at 1 a.m., April 18. Sibley ordered every man to wear what he could and burn the rest. Thirty-eight wagons were abandoned. The retreat was to follow up the Rio Salado and through the Magdalena Mountains to the Alamosa River, following it back down to the Rio Grande. On the 19th, the Army of New Mexico, battered and hungry, moved south from the Salado, probably up La Jencia Creek (a cannon was found several years ago buried along the east bank of lower La Jencia Creek; Ross Ligon, personal communication):

> *The column, which on first setting out in the morning was perhaps scarcely one mile in length, towards the close of the day would be at least ten miles long, owing to the sick broken-down horses and men of the command.*[73]

Along their detour, the Confederates were trailed by Captain James Graydon and his Spy Company, who followed at some distance retrieving serviceable articles. Three partially-buried bodies were found along with the arm of a man half-eaten by wolves; Grayson reburied them. Wagons, harnesses, camping equipment, and a number of dead horses and mules were found along the way. At one locale, the Confederates blew up and burned six caissons, one twelve-pound howitzer, and two mountain howitzer carriages. At another spot, nineteen wagons, ten ambulances, six caissons, and three carriages were turned and several howitzers were buried.[74] A year later, a Union officer walking the trail found parts of a gun carriage, harness, camp equipment, and occasionally a white, dry skeleton of a man.[75] Sibley's command finally reached the Rio Grande and were reached by a supply train and reinforcements from Fort Bliss. Evacuation of New Mexico by the Confederates had been completed.

As the Civil War subsided, the Army again turned its attention to the Apache and Navajo, who had taken advantage of internecine warfare among the Anglos to increase their raids on settlements. During the first half of 1863, Navajos were reported on the San Augustine Plains to the west, in the vicinity of Los Lunas, in the Ladrones, at Alamo, and in the Bear Mountains. In June, 1863 General Carleton commissioned Colonel Kit Carson to subdue hostile bands of Apache and Navajo. In August, 1863 Navajos and Apaches were camping together at Ojo de Cibola west of Lemitar.[76] The Apache group was probably Coyoteros, since the Mogollones had been driven south under pressure from Navajo bands between 1858 and 1861.[77] Ojo de Cibola apparently was an established Navajo camp. Carleton commented that:

> *. . . there is a spring called Ojo de Cibola, about 15 miles west of Lemitar, where the Navajos drive their stolen cattle and jerk the flesh at their leisure. Can not you*

make a party of resolute men from our command to be stationed there for, say thirty days, and kill every Navajo and Apache they can find [78]

That the Apache and Navajo were raiding together in the Rio Abajo is well doumented. In November, 1864 some Navajos and Apaches from the west ran off 3,000 sheep belonging to Don Jose Pino y Baca near Lemitar. Major Eaton, commanding officer at Fort Wingate, was ordered to cross the country to the Rito Quemado and endeavor to intercept the raiders.[79]

By the end of 1863, Carson had succeeded in routing the Apache and Navajo throughout New Mexico. Word was sent out to the various bands of Navajo and Mescalero Apache to surrender. Carleton's plan was to encarcel both Mescalero and Navajo groups at Bosque Redondo, near a favorite Apache camping place along a bend of the Pecos River with the newly-established Fort Sumner at the center. During the *Long Walk* from the Navajo homeland, several groups dropped out and hid at the present-day Alamo Band Navajo Reservation on the Rio Salado. According to Alamo tradition, two families hiding out settled the Alamo area, and to these were added later escapees from Bosque Redondo.[80] An oral history project of the University of New Mexico, under the direction of Florence Ellis, revealed that an old chief, remembered as Viejo and his three sons fled south to Alamo Spring where they hid out. Navajos at Fort Sumner heard of Viejo's hideout and joined him and another family, whose history is unrecorded. The grandfather of one of Ellis' informants (Olson Apachito) was an Apache that had married a Navajo prior to the Long Walk. In 1868, both escaped and joined Warm Springs Apache. But the woman was pregnant and became a hindrance to the warring band. The couple was forced to join the families living at Alamo. Today most Alamo *Navajo* are at least one-quarter Apache as is indicated by the commonness of *Apache* and *Anachito* as surnames on the Alamo reservation. During the Carson campaign and the Fort Sumner period, other Navajo groups were reported in the area, notably at Ojo de Cibola, the Ladrones, and the Datil Mountains.[81] A treaty in 1868 set aside a total of about three-and-a-half million acres for a Navajo reservation in northern Arizona, and northcentral and western New Mexico.

By the 1870s, the Homestead Act of 1862 had become a valuable asset to cattle ranching in New Mexico. The notion of small farms was a tenacious Eastern dream that would misfire in the arid West. For the small operator, the Homestead Act was a wager whereby the government bet the homesteader 160 acres that he would starve to death before he proved up on the land. The effect of the Homestead Act would be to legalize the acquisition of vast acreage for grazing, requiring only that a homestead be filed wherever water was available. In between water holes was the vast public domain, on which the rancher could graze his cattle without having to pay taxes. This situation persisted until 1916 when grazing lands would be classified as such under the Stock-Raising Homestead Law.[82] Homesteads could only be filed in legally-subdivided townships, flooding the Surveyor General's Office with more requests than could be reasonably handled. Texas stockmen with Eastern and European backing began bringing Hereford cattle into west-central New Mexico rangelands. The original ranchers, with longhorn cattle and poor breeds of sheep, were rather quickly replaced by the incoming commercial operators.

With increasing commercialization the land grant became a liability instead of an asset due to the taxation of real estate for production of revenue and the need for ready cash. A case in point was the Antonio Chaves Grant, a tract of land covering some 130,000 acres. In 1850, a few years after Antonio Chaves had died, his widow Monica Pino de Chaves, sold the grant to Rafael Luna, Ramon Luna, and Anastasio Garcia. Following the death of the former two, the heirs and Anastasio Garcia continued occupying the land. At about 1870, the grant was sold to Laura A. Bond, Charles D. Adams, and Latham Higgins who turned around and sold it to Martin B. Hays in 1874.[83] Another problem with the land grants in 1870s was that some Anglos squatted on the land, sometimes with the

permission of the grantees, and later claimed it as government land. This would later cause substantial litigation involving the Nicolas Duran de Chaves Grant.[84]

In the 1870s, small settlements were again established along the floodplain of the lower and middle Rio Puerco. In 1877 there were four villages in the Montaño grant.[85] During this decade, Los Quelites was re-established and further south was a new village known as Los Cerros, at the northern end of the Rio Puerco damsite area. Referred to formally as Los Cerros Mojinos, the village was established sometime in the late 1870s. The 1880 census lists eleven Mexican families, numbering 54 residents at Los Cerros.[86] All heads of families listed their occupation as farmers and were mostly over 50 years of age in 1880, the latter item suggesting that the group had moved en masse from some other community, perhaps from the Rio Abajo to Los Cerros.

By the early 1870s, mining in the Socorro District was well established. To the southeast of Socorro in the Carthage area, coal had been found as early as the 1850s. In 1861, U.S. Army troops from Fort Craig were mining coal in this area. A significant discovery was that of silver ore at Pueblo Springs near Magdalena. By 1867 prospectors were working in the Magdalena Mountains and just west of Socorro.[87] The early 1870s witnessed increased activity in the Magdalenas, and by 1874 a mixed population of some 250 Anglos and Hispanos founded a settlement at Magdalena. A few renegade Apache bands, such as that of Victorio, raided mining camps but by 1880 the Apache menace had been lessened.

South of Magdalena on the Rio Salado, the settlement of Santa Rita (later called Riley) was founded by Lorenzo Padilla. In the 1882 survey of T2N, R4W, Daniel Curry surveyed the town and cultivated fields on the south bank of the Salado:

> *The Mexican settlement Santa Rita is in Section 24, a town containing about 100 inhabitants. Considerable land in this portion of the Township is cultivated. Whale back mining claim is in Section 8. This claim is a gold prospect that puts out well. Small prospect shafts are found in various parts of the township.*[88]

The 1880 census, taken in June, does not list Santa Rita so it is certain that the village came into being either later that year or in 1881. In July, 1881 the old Apache warrior Nana was on the warpath following Victorio's death in Mexico. After committing depredations in the Tularosa Basin of southern New Mexico, Nana was pursued up the Rio Salado by Colonel Parker and Company K troopers.[89] At Box Canyon, just east of Santa Rita, the troopers were ambushed and three buffalo soldiers were killed. Today, rock cairns marking the graves of these soldiers are found at the western end of Box Canyon on the south bank. By the end of the summer, Nana had fled into Mexico for the last time, putting an end to Apache raiding in the Rio Abajo area.

In 1880, the Atchison, Topeka, and Santa Fe Railroad built its section from Albuquerque to Belen, then west to Bluewater and on to Gallup. By 1881 the line was extended through Socorro to Deming, contributing greatly to the growth of Socorro and providing transporation outlets for the mining and livestock industry of the area. In 1883, a spur was built from Socorro to Magdalena, and then south to Kelly to tap the rich lead deposits, a total extension of 30 miles. A smelter was built at Socorro to handle the lead carbonate ores and coke reduced from Carthage coal was moved to the smelter across a newly-built railbridge on the Rio Grande. By the 1880s decreasing lead prices forced both mining and smelting to shut down in the Socorro area. By then, though, the enthusiasm for mining in the 1880s led the Territorial legislature to locate the New Mexico School of Mines at Socorro.[90]

The livestock industry continued to expand in the area during the 1880s. Between 1882 and 1884, the number of cattle in Socorro County increased from 9,000 to 70,000, mostly as a result of the coming of

the railroads and the facility of reaching distant markets. Annual drives were made from Arizona to the rail head at Magdalena after 1883.

By 1890, the Administration's headache created by the Spanish and Mexican land grants remained unsolved. In 1891 the U.S. Court of Private Land Claims was established with offices in Denver and consisted of five judges with appeals to the Supreme Court allowed. In many cases, what transpired between 1891 and 1910, when the Court completed its work, was the alienation of the old private land grants. In the majority of cases, when question over the ill-defined boundaries or legal documentation came up, the user of the land took precedence. The land claimant, usually heirs of the original grantee, was charged the costs of surveying and legitimizing the claim, thus preventing poor land owners from establishing ownership. If indeed the claimant won the case, he was still faced with lawyer's fees, and often had to sell his principal negotiable asset, land, to obtain cash or directly transfer land to the lawyer in lieu of money. In some cases, lawyers were called upon to assert the claims of numerous heirs to the grant. Determination of heirship would be of little value without partition and unsatisfactory to the lawful heirs. Sale of the grant following partition seemed the practical remedy and provided a means by which outsiders could obtain large tracts of land within the original grant.[91] A characteristic example of the grant conflict involved the Nicolas Duran de Chaves Grant.

By the 1890s Los Cerros had been abandoned and the Huning family of Los Lunas had established a large ranch on the former Nicolas de Duran de Chaves Grant. In 1897 Santa Rita (Riley) was a settlement of 150 with mining reported as its principal economy, with four producing mines:

> *Gold, silver, and lead were sent to Denver treatment, and wages were $1.75 a day. The Riley School ran five months of the year, and mass was held at the church once every four months. There were two general merchandise stores, run respectively by Anastacio Baca and C. Nelson. A. R. Cordova was postmaster and Porfirio Sanchez the justice of the peace.*[92]

The 1900 census for the precinct of Santa Rita, which included the Alamo Reservation and surroundings of the town, listed 81 households of 398 non-Indians.[93] Of these, 105 listed their occupation as livestock raisers, 27 as sheep herders, 40 as farmers, 38 as day laborers, 4 store keepers, 1 bartender, and 1 blacksmith. On the Alamo Reservation were 31 households totaling 136 people of Indian descent living in fixed dwellings. Of these, 30 were reported living in movable dwellings. Sixteen were reported as farmers, 4 as stock raisers, 5 as sheep herders, 5 as day laborers, 1 carpenter, and 1 hunter. Apachito, grandfather of Ellis' informant and one of the escapees from Fort Sumner who first settled the Alamo area, is listed as 71 years old in 1900 and his wife as 75 years old.

In the 1910s residents of Santa Rita discovered that their town was in one of the odd-numbered sections granted to the Atlantic and Pacific Railroad, and thus belonged to its successor, the Santa Fe system. Fortunately, the General Land Office supported their application to declare the land a public townsite in 1918.[94] Also in 1918 the New Mexico Cattle Growers Association convinced the Secretary of the Interior to withdraw lands for the Magdalena Stock Driveway. The driveway improved the trail established in the 1880s, with fencing and wells constructed at about ten mile intervals.[95] It joined the large cattle ranches in western New Mexico with a railroad at Magdalena. An extension to the southeast gave Santa Rita (Riley) access to the railhead, but would be short-lived due to the abandonment of the town a decade or so later.

Part III
HISTORICAL FIELD RECONNAISSANCE: METHODOLOGY AND FINDINGS

A field reconnaissance was conducted to obtain preliminary information on potential

location and nature of historic sites within the proposed damsite areas. Prior to field work, several days were invested in reviewing field survey notes of the original surveys and resurveys of the several townships included. These records are on file at the Records Division of the Bureau of Land Management in Santa Fe. In addition, other primary sources encountered during the overview literature search furnished both new locations and details about locations already noted on the old survey plats. Table 5 lists 17 features within the Rio Salado proposed damsite and 3 within the Rio Puerco proposed damsite. Also listed under the *comments* heading are the names, whenever available, of settlers requesting subdivision of each township.

Features on the old survey plats vary and include houses, roads, corrals, cultivated fields, ditches, mines, fences, springs, etc., extant at the time of the survey. The temporal range of survey plats listed in Table 5 is between 1881 and 1912. Features located on the plats probably are representative of both the type and relative number of sites to be found for the period documented. This particular method of historical survey, however, should not be taken as quantitively predictive. In general, it became obvious at the onset that a far greater number of historic sites would be found in the Rio Salado than the Rio Puerco damsite area. Consequently, more field time was spent reconnoitering the Rio Salado area.

One avenue of research that was not followed involved the various roads noted on the survey plats. Future historical site surveys should utilize this data both for environmental and cultural purposes. Roads sometimes serve to concentrate drainage, resulting in gullies (Part I of this report). Thus, any attempt to document historic erosion should employ this data to correlate location of gullies with that of historic roads. As transportation routes, the location of roads may also provide leads as to the direction and purpose of movement within a given area. In the Rio Puerco area, for instance, most of the roads seem to originate at settlements along the Rio Grande and for the most part, bypass the bottomlands of the Rio Puerco in route west. These roads continue across the Ceja del Rio Puerco through extensive remnants of pediments between the deep canadas of western tributaries to the Puerco. Their destination lies farther to the west in the mesa country and the northern side of the Sierra Ladrones, where are found excellent sites for fuel procurement, grazing, and perhaps a small homestead nearby a spring.

The field reconnaissance consisted of contacting ranchers and area residents with the old survey plats in hand. Inquiries were made as to the exact location, nature, and condition of historical features on the plats. An attempt was made to locate these features in the field and those found were recorded. This methodology proved most useful in the Rio Salado area. Ross and Pat Ligon of the Grey and Ligon Ranch at Ariveche Spring knew firsthand some of the historical features on the survey plats and provided both locations and recent histories of each feature. On the other hand, the absence of features on plats of the Rio Puerco area rendered this methodology less useful. Ranchers in the Rio Puerco area were unable to recall historic sites, whereas locations of the larger prehistoric pueblos were well known to them. In addition to sites already documented on the survey plats, a *windshield* and general foot reconnaissance located several other historical features for which we lack documentation. In the Rio Salado area, I was aided by Ross and Pat Ligon, who knew of several *homesteads*, etc. Nine features from the old survey plats were relocated, while seven additional features were found in the field. I was unable to find some of the features indicated in the survey plats.

Temporary site numbers were assigned to each site location in the field. For those sites that could be correlated with a historical feature documented in the survey plats, the same designation was retained. As in Table 5, the prefix RS refers to the Rio Salado damsite area, while RP refers to the Rio Puerco damsite. The suffix is a consecutive number and is continued from the list in Table 5 for those sites not shown on the survey plats. Below are site descriptions of all locations found during the reconnaissance.

Figure 11: Office of the Chief of Engineers, USA, 1885

Photos 7, 8, 9: Padilla Spring, a turn-of-the-century homestead on the Salado, evidences at least three examples of Historic period construction.

Table 5

HISTORIC FEATURES IN THE RIO SALADO and RIO PUERCO DAMSITE AREAS: DOCUMENTATION IN THE ARCHIVES

Feat. No.	Description	Reference	Comments
RS-1	House on south terrace of Rio Salado at eastern end of the Box	Pradt, George H. (1884) Field survey plat of T1N, R2W	Twnshp. survey requested by Jesus Maria Chaves, 1883; designated as saline land
RS-2	"Neller's Ranch" and "Salt Spring"	"	Shows road from Alamillo to Santa Rita across north half of Sec. 7 entering the Box
RS-3	Corral at junction of two roads 1 km west of west boundary of Sevilleta Grant	Devendorf, G.W. & W.H. Richards (1911) resurvey plat of T1S, R2W	Outside of the study area
RS-4	House of Antonio Luna west of n/s road on west bank of La Jencia Creek	Otto, Leslie J. (1902) survey plat of T1S, R2W	Luna family purchased Antonio Chaves grant from his widow in 1850
RS-5	House of Juan Luna just SW of Antonio Luna	"	"
RS-6	"Field" on west bank of La Jencia Creek and east of both Luna houses	"	"
RS-7	"Acequia" on west side of La Jencia Creek and west of north-south road	"	—
RS-8	Name "Valor Lopez" along minor southern tributary of Rio Salado	"	—
RS-9	"Corrals" on dissected mesa south of Rio Salado	"	—
RS-10	House of Tuildy on north bank of Rio Salado	"	Pablo Sanchez in PLC case, Antonio Chaves Grant, talked of selling improvements at Ariveche Spring in 1886-1887 to man named Tinguily (?)
RS-11	Town of Santa Rita and cultivated fields; houses shown on both sides of the Rio Salado	Curry, Daniel and Jones (1882) survey plat of T2N, R4W	Twnshp. survey requested by Antonio Marquez; designated as mineral land
RS-12	Cultivated field between road to Santa Rita in southern half of Sec. 24 and Rio Salado in in northern half of Sec. 25	"	"

Feat. No.	Description	Reference	Comments
RS-13	Cultivated field on south of Rio Salado	Curry & Jones (1882) survey plats for T2N, R4W and T2N, R3W	Twnshp. survey requested by Antonio Marquez; designated as mineral land
RS-14	House and corral northeast of bend in Rio Salado. Shows corral attached to east of house	Curry & Jones (1882) survey plat for T2N, R3W	Twnshp. survey requested by Marcelim Chaves
RS-15	Wagon road from Magdalena to Santa Rita, old road follows Baca Canyon	Otto, Leslie J. (1902) survey plat of T2N, R3W	Today the Magdalena to Santa Rita; road crosses S.36
RS-16	"Wire Fence" running SW-NE across so. half of twnshp.	Otto, Leslie J. (1902) survey plat for T2N, R4W	–
RS-17	"I had a ranch there on what they call Carbon Piedra (Carbon Spring)"	Melquiades Luna (1893) testimony on PLC case, Antonio Chaves Grant	–
RP-1	Village of Los Cerros	Cunningham (1881) survey plat for T2N, R4W	Plat also shows Rio Puerco as west boundary of Ana de Sandoval y Manzanares Grant. Survey req. by Ignacio Baca
	Request for survey of twnshp.	Cunningham (1881) survey plat for T5N, R1W	Request for survey by Estanislado Pino
	"	Taylor & Holland (1882) survey plat for T5N, R1W	Request for survey by Ovidion Chaves
	"	Taylor & Holland (1882) survey plat for T5N, R1E	Request for survey by Pedro Perea
	"	Cunningham (1881) survey plat for T4N, R1W	Request for survey by Ranaldo Chaves
	"	Cunningham (1881)	Request for survey by Antonio Zeina
	"No improvements except fences in Sec. 6"	Pradt (1898:35) field survey notes for T6N, R1W	–
	"Road to Huning's Hill"	Sawyer, J.T. (1882:19) field survey notes for T6N, R1W	Huning's mill in Sec. 24, outside of the study area
RP-2	"Dismantled cabin but no settlers"	Richards, W.H. (1912:448) field survey notes for T3N, R1E	–
RP-3	Ruins of Mateo Pino House	Survey plat of Antonio Sedillo Grant; PLC-case of Antonio Sedillo Grant (1894)	According to PLC testimony, the ruins of this house were destroyed when the railroad was built

RS = Rio Salado area
RP = Rio Puerco area

Photo 10: Looking north along collapsed east wall and foundations of RS-1 with Ladrones in background.

RS-1
(This site may be the same as that listed as #05 under *unrecorded sites noted during reconnaissance*)

County: Socorro
Elevation: 5240 feet (1597 m)
Historic documentation: See Table 5

Site includes the remains of a house on a gravel terrace on the south side of the Rio Salado, just east of the Box. House was probably a three-room structure, mostly of stone rubble construction. The mound created by dilapidation of the structure is from 30-50 cm high. Some wall fall was found on slope of terrace at the northern end of structure, where wall fall composed of stones roughly 10-15 cm in diameter stands 50 cm above the surface of the gravel terrace (Photo 10). There are two entrances, one to the east and another to the west. Except for the northern wall, only the foundations to the walls remain. What appears to be a *corner* fireplace is in the northwestern section of the house. Half-way along the west wall protrudes a small H-shaped alignment of rocks. Area of site is also a prehistoric sherd scatter. Historic trash scattered throughout the site, with greatest concentrations southwest of structure.

RS-2
(This site may be the same as that listed as #04 in *unrecorded sites noted during reconnaissance*)

County: Socorro
Elevation: 5240 feet (1597 m)
Documentation: See Table 5

Pat and Ross Ligon refer to this site as the old Sarcedo house. According to them, the adobe structure (Photo 11) was in fairly good condition until the late 1960s,

Photo 11: Looking south at front of Sarcedo House (RS-2)

when the Ligons were forced to tear the place down because hunters were building fires inside. This ranch site is fairly extensive and consists of the adobe structure (13 m E-W x 4.6 m N-S), a small stone cabin with dirt roof (2.9 m E-W x 2.8 m N-S), and a large corral. The stone cabin (Photo 12) has a roof constructed by placing a large juniper beam on top of the east and west walls with 1 x 6" planks perpendicular to the center beams holding up a makeshift tin roof (dirt and rocks are piled up on top of the tin). The complex dates to post 1920s. Ten meters to the northwest on the edge of the terrace are foundations to a stone house overlooking a ponded spring at the base of the terrace. The trash around this structure is pre 1900 and probably indicates that this was the old *Neller Ranch* referred to in Table 5.

Photo 12: Stone cabin (RS-2) looking northwest.

RS-3
Feature from Table 5; not located.

RS-4
House of Antonio Luna.

County: Socorro
Elevation: 5400 feet (1646 m)
Documentation: See Table 5

Ross and Pat Ligon directed me to this site, saying that all that remained was a fireplace and part of a stone dugout. Site is located on east slope of interfluve ridge between La Jencia and Ariveche Creeks just west of La Jencia. Fireplace (Photo 13) is constructed of consolidated alluvium. Small stone dugout is ca. 30 m south of fireplace. Historic trash includes Mexican ceramics, aquamarine, brown, and purple glass. Occupation of site probably dates between 1880 and 1910 and possibly earlier.

Photo 13: (right) Fireplace of Antonio Luna's house (RS-4) looking northeast with La Jencia Creek in background.

Photo 14: Stone dugout at RS-5.

RS-5
House of Juan Luna

Elevation: 5400 feet (1646 m)
Documentation: See Table 5

Site consists of six stone dugouts on the east side of erosional terrace remnant on the west floodplain of La Jencia Creek. The main structure consists of a two-room dugout 10 m E-W x 4 m N-S. The wall remains are about 50-75 cm high. Remnants of an adobe wall found 1.5 m west of structure. Structure is no longer roofed. The front side of the dugout has brush piled up, presumably a makeshift sheep corral that post-dates earlier occupation. Five similar one-room dugouts (Photo 14) were found within 75 m of the
main structure. Historic trash is similiar to RS-4.

RS-6
Cultivated field to the east of RS-5 and RS-6; currently covered with mesquite.

RS-7
Feature listed in Table 5; not located.

RS-8
Feature listed in Table 5; not located.

RS-9
Corrals on dissected mesa south of Rio Salado along minor tributary.

County: Socorro
Elevation: 5360 feet (1634 m)
Historic Documentation: See Table 5.

Site consists of three makeshift sheep pens of brush corrals consisting of alternate pilings of juniper branches around a circular to oval-shaped area. Two corrals are located on the west side of minor southern tributary of the Rio Salado, while one corral is located on the other side of the drainage. All corrals are on the valley slopes and average 10-12 m in diameter (Photo 15). No cultural debris was found on the site. One of the corrals has been dissected by a gully in the western slope of the valley. Several juniper stumps in the immediate area appear to have been cut with an axe. Age of this site is undetermined.

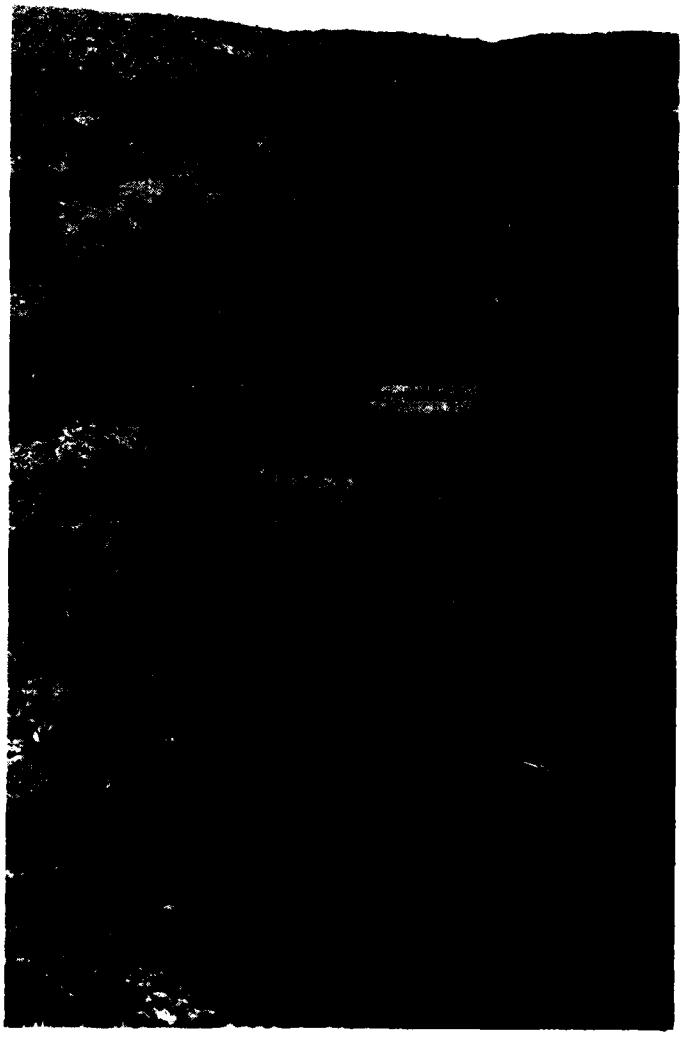


Photo 15: Remains of brush corral at RS-9.

Photo 16: Remains of Carbon Springs ranch house.

RS-10
Feature listed in Table 5; not located.

RS-11
Town of Santa Rita (Riley) — site recorded by BLM, Socorro District as NM-02-174.

RS-12
Feature listed in Table 5; not located.

RS-13
Feature listed in Table 5; not located.

RS-14
Remains of historic stone structure.

County: Socorro

This site consists of a one-room stone house in sand dune area on north banks of the Rio Salado. Historic trash is mostly 1880-1900. This may be the same structure as listed in Table 5, but could not be determined.

RS-15
Feature listed in Table 5; not located.

RS-16
Feature listed in Table 5; not located.

RS-17
Carbon Spring Ranch (Melquiades Luna).

County: Socorro
Elevation: 5740 feet (1750 m)
Documentation: See Table 5.

Foundations and dilapidated walls of a two-room shale-slab constructed house (Photo 16) south of Carbon Springs on level bench between drainage and south valley slope. There are also remains of two small one-room structures to the north and opposite side of the drainage downstream, where the road crosses the drainage. This is probably the same ranch as listed in Table 5.

RS-18
Sheep brush corral.

County: Socorro
Elevation: 5400 feet (1646 m)
Historic Documentation: None

This site is a brush corral (10 x 12 m) constructed in an oval shape by piling up alternate branches of juniper (Photo 17) Site is on level west bench one meter above southern tributary of the Rio Salado. No cultural debris was found in immediate area. The corral has deteriorated almost to the point of not being discernible.

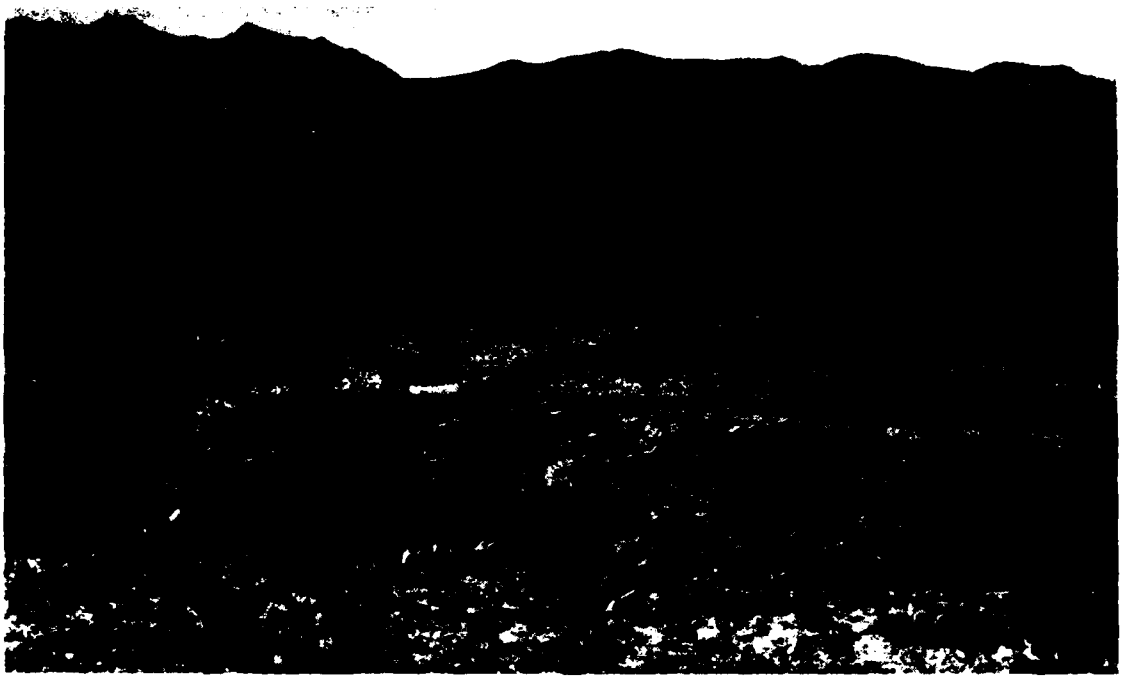


Photo 17: Remains of brush corral at RS-18 looking downstream with Ladrones in background.

RS-19
The *old Garcia Ranch*
(Photo 18)

County: Socorro
Elevation: 5340 feet (1628 m)
Historic Documentation: None

Site was reported as the *old Garcia Ranch* by Ross and Pat Ligon and is located along minor southern tributary that empties into the Rio Salado at the western end of the Box. To the south ca. 20-30 cm high are stone foundations. On the north wall is a probable doorway. Historic trash is mostly post 1900.

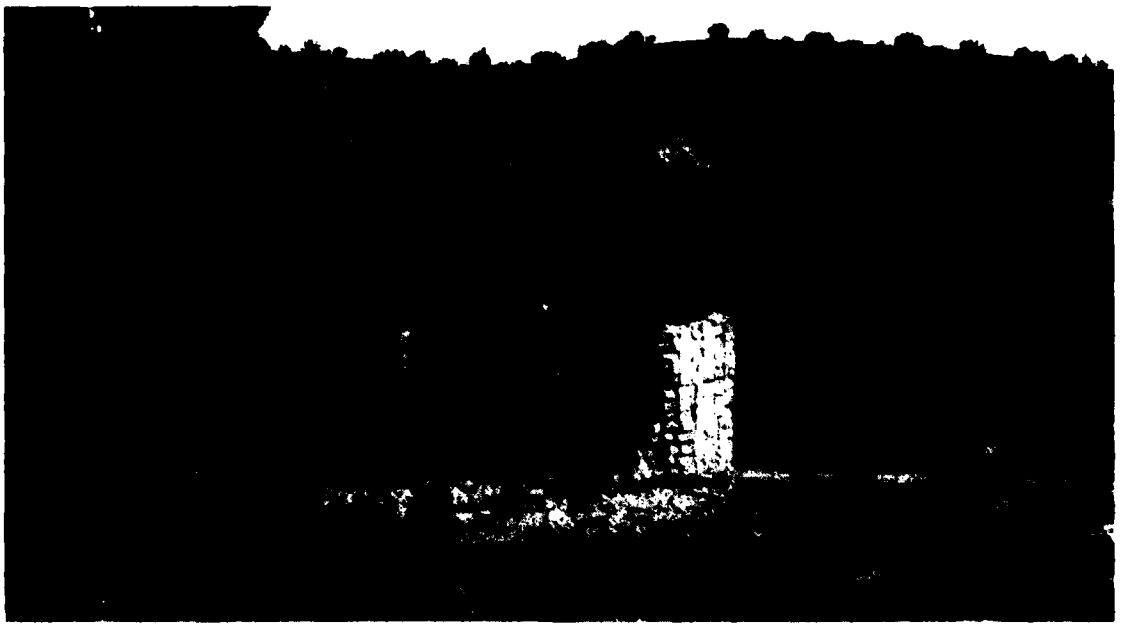


Photo 18: Looking northwest at old *Garcia Place* (RS-19).

Photo 19: 1930s Stone house with Ladrones in background (RS-20)

RS-20
Stone house on west side of La Jencia Creek

County: Socorro
Elevation: 5400 feet (1646 m)
Historic Documentation: None

This is a large two-room stone house with the walls still standing (Photo 19). The house is located on the west side of La Jencia Creek and has several sheep or goat pens behind it. House is roughly 10 m N-S x 4.6 m E-W, with the walls standing about 2 m high. Historic trash is post 1920s and the house was probably built in the 1930s.

RS-21
Rock cairns of graves of three buffalo soldiers killed in western end of Box Canyon in 1881 by Nana's band of Apaches.

County: Socorro
Elevation: 5280 feet (1610 m)
Historic Documentation: Ross Ligon interview.

Cairns were pointed out to me by Ross Ligon, who also said that a few years ago wooden crosses were stolen from the graves. At present, the cairns are difficult to discern because some of the rocks have been moved.

RS-22
Site of buried cannon left by Sibley's Brigade during the retreat up the Salado.

County: Socorro
Elevation: 5240 feet (1597 m)
Historic Documentation: See text, page 41.

See discussion in the text for background on retreat of Sibley's Brigade during the Civil War. Locale was shown to me by Ross Ligon and is basically a gash in the east bank of La Jencia Creek where a Civil War cannon was excavated by Sarcedo and an electrician from Socorro. No other material was found on this site, but Ross Ligon has a Civil War button he picked up in the vicinity.

RS-23
Old Padilla Place

County: Socorro
Elevation: 5400 feet (1646 m)
Historic Documentation: None

According to Ross Ligon, this ranch was owned by a man named Padilla from Santa Rita. There are two houses at the Padilla place and one large barn. According to Pat Ligon, Padilla's son hung himself in

the older house (Photo 20) due to an abortive love affair and Padilla then built another house below. This second house I was unable to find. The small adobe on the road into the ranch was built from materials after the second house was torn down. The oldest parts of the oldest house are of stone construction (Photo 21), although two rooms with adobe walls were later added. The oldest parts of this house probably were built in the early 1900s.

RS-24
Ariveche Spring Ranch

County: Socorro
Elevation: 5600 feet (1707 m)
Documentation: Ross Ligon interview.

Ariveche Spring received its name from a common herder who was killed by the Apaches in 1862. By the 1880s, a man

Photo 20 (right): The old Padilla place (RS-23) with Rio Salado in background.

Photo 21 (below): Later adobe construction over masonry at the old Padilla place (RS-23).

named Pablo Sanchez was working at the spring. In 1886 or 1887, Sanchez apparently sold his improvements to a man named Tinquily. Otto's 1902 survey plat for the township shows a short segment of an *old wagon road* leading from the direction of La Jencia Creek to Ariveche spring but no houses are indicated. At the Grey and Ligon Ranch, Neely Grey's house, currently occupied by Mrs. Neeley Grey, purportedly was built in the early 1900s. About 200 m upstream from the ranch are the stone foundations to a small one-room house (on the south side of the spring) and a historic trash scatter that may date to the 1880s.

RS-25
Mining camp and prospects.

County: Socorro
Elevation: 5400 feet (1646 m)
Historic Documentation: None

This site is a mining camp with several prospects along an unnamed northern tributary of the Rio Salado just west of the Box. Three prospecting holes are on the eastern slopes of the tributary, while the mining camp is on the western side. Ross and Pat Ligon claim that the shack across from the prospects still stood about 25 years ago. All that remains today is a concrete platform 10.7 m N-S x 5.6 m E-W, post 1930s trash and an old sedan. There is also a small stone oven, much like a lime kiln, 20 m south of the platform.

RP-1
Village of Los Cerros (1870s—1890s)

County: Valencia
Elevation: 5020 feet (1530 m)
Historic Documentation: See Table 5

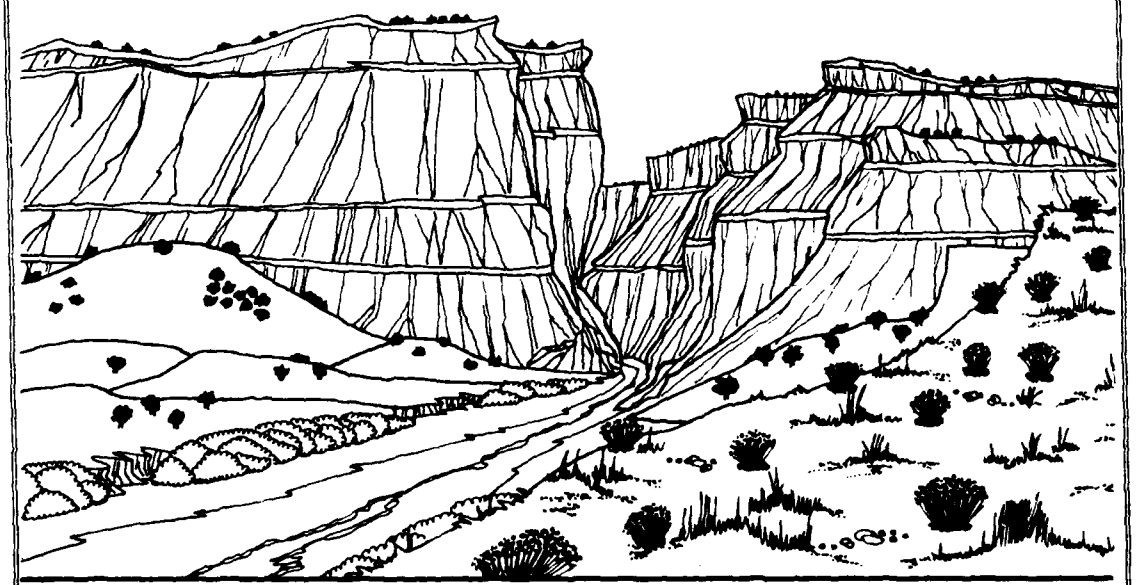
This site was too large to record formally, so only a few structures were mapped. Only two of the 11 houses reported in the 1880 U.S. Census were found and only one of these is easily discernible on the surface. The structure in Photo 22 is 6.5 m N-S x 4.3 m E-W, and consists of basalt foundation stones obtained from the hill to the west. Just south of the foundations are the remains of a ramada. This site should be mapped entirely and might require some test excavations.

Photo 22: (RP-1) Stone foundations of small one-room structure at Los Cerros.

CHAPTER III

RECONNAISSANCE ECOLOGICAL DESCRIPTION OF THE LOWER RIO PUERCO–RIO SALADO DRAINAGES, N.M.

By Buck Cully



Lower end of the Box, Rio Salado, looking west.
[E. Shearin]

Photo 25 **Rio Salado near La Jencia**

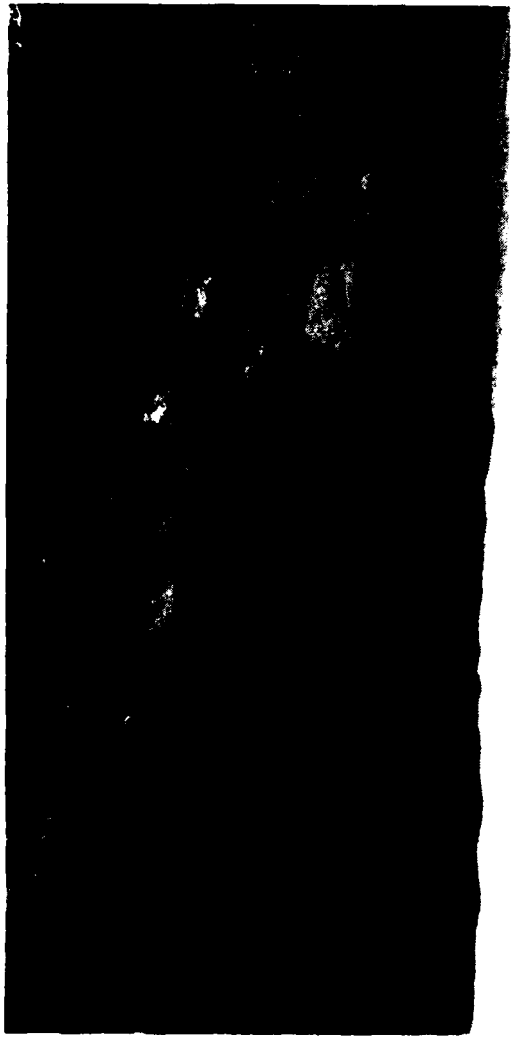


Photo 24 Lower Rio Salado

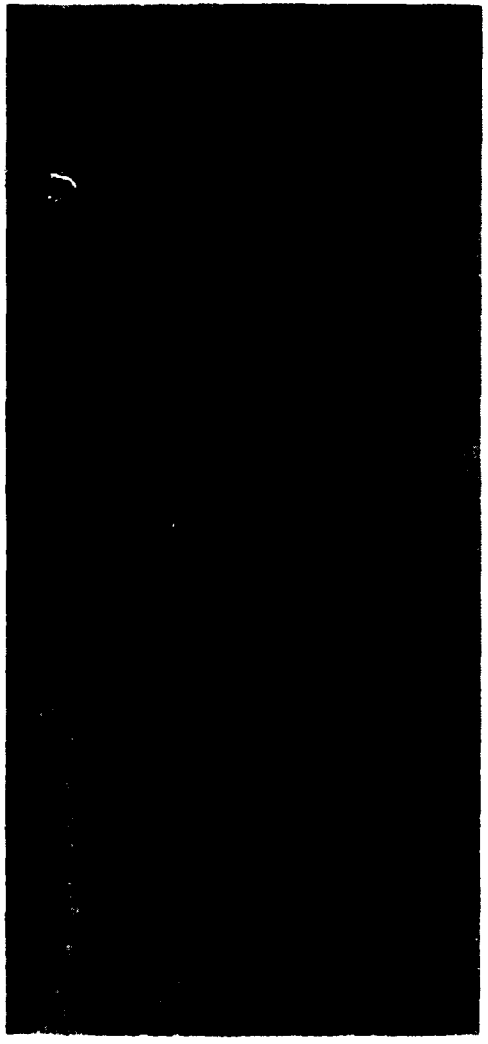


Photo 23 Lower Rio Puerco

RECONNAISSANCE ECOLOGICAL DESCRIPTION OF THE LOWER RIO PUERCO–RIO SALADO DRAINAGES, N.M.

By Buck Cully

PREFACE

The Rio Puerco study area lies between approximately 4,800 and 5,000 feet elevation in the Rio Puerco Valley south of New Mexico Highway 6. It is in Valencia and Socorro Counties. The habitat is primarily desert grassland with some shrubs and sparse Juniper woodland occurring on the valley slopes. The valley bottom is deeply eroded by the primary channel of the Rio Puerco and tributary arroyos on the east and west.

The major limiting factor on productivity in this habitat is water. Precipitation is generally in the range of 8 to 14 inches (BLM 1979), and there is not much variability in rainfall from one part of the area to another. Microhabitat differences do occur, however, and these are associated with such factors as the slope of the land, soil permeability and ability to hold water.

The Rio Puerco study area is mainly covered by soils of the Tome-Adelino group (NMSU 1974). Tome soils, which are found in the lower areas of the valley, consist of very fine, calcareous sandy loam with relatively low permeability. These soils can support annual weeds and some bunch grasses, but perennial cover will be low due to rapid water loss through surface evaporation. Intermixed with the Tome soils in the valley bottom are Armijo soils, which are deep, fine-textured soils with very slow permeability. Armijo soils are frequently saline and alkali affected and are largely devoid of plant cover.

Adelino soils are gently sloping (3% or less), range from loam to fine sandy loam and are slightly calcareous to noncalcareous. These soils have good permeability and should support good grassland if not overgrazed.

The soils of the steeper sides of the valley and at higher elevations are in the Bluepoint-Caliza association. This association is dominated by gently to strongly sloping and undulating landscapes interspersed with gravelly ridges. Due to their steep slope and coarse nature, these soils have very low water-holding capacity (NMSU 1974). Grasses should be sparse and the primary vegetation will be various shrub species with limited stands of Juniper.

Animal groups are generally associated with vegetation types, which in turn are associated with soils. Grainivorous rodents are most abundant in areas dominated by grasses or annual weeds. Some also need soils which are well enough consolidated for the construction of burrows. These types are likely to be associated with the Tome-Adelino soils. Herbivorous rodents, such as Spotted Ground Squirrels and Prairie Dogs, will also be found in these soils. Most bird species, Rock Squirrels and Antelope Ground Squirrels, prefer shrubs and/or rocky soils and will tend to be restricted to the Bluepoint-Caliza association. Other breeding and migrating bird species will be restricted to the riparian habitat along the primary erosion channel of the Rio Puerco.

Larger herbivorous species, such as Mule Deer and Pronghorn Antelope, have large enough ranges to cross several microhabitat boundaries in the study area. Antelope are generally found in open grassland and deer are generally associated with brushy or wooded areas. The differences between zones in the Rio Puerco study area are probably not strong enough to exclude either species.

RIO PUERCO STUDY AREA

Predatory species (hawks, owls, coyotes, foxes, etc.) generally range over a wide area and a number of zones. Some foxes require sandy soils for their burrows, and hawks and owls like trees or cliffs for nest sites, but during foraging trips, most range widely and are probably to be found in any zone.

METHOD

> The purpose of my research is to describe the various floral and faunal components of the present day biotope which will evaluate the relationship of biotic systems to land units stratified on the basis of observable differences on Landsat imagery of the valley.
>
> My work is divided into three components: 1) Floral analysis, including species lists with habitat associations, cover analysis of sample plots within each of the important habitat areas, and relative perennial plant densities in the same plots; 2) Mammal species diversity and relative abundance in the most extensive (by area) habitats in the study area, and an overall species list; 3) Bird species diversity and abundance from the same habitats as 2, and an overall list of birds observed in the area.

Study plots were selected in seven of the eight areas stratified by Camilli (In Wimberly and Eidenbach 1979) from the plots used by the archaeologists in their 3% sample. I chose my study plots from among theirs on the basis of ease of access rather than by a random choice. Their study plots were selected at random from plots falling wholly within the Landsat stratifications. My areas were selected from a map of these locations. Any biases of choice based on field observation should have been avoided.

After the study sites were selected, perennial vegetation was measured by the line intercept method (Cox 1972). This method determines cover dominance by species in each area as well as relative density of measured species. At each plot the intercept lines were 15 m long and spaced at 15 m intervals. Ten lines were run at each plot. Since annuals vary so greatly from year to year and season to season, and their cover is ephemeral, they were not included in these measures. Annual species observed were included in the species lists for each area. In addition to the intercept data, belt transects were run on each line to count shrubs in a belt 3 m x 15 m. Data from the belt transects as well as the intercept density calculations are presented with the plant cover tables at each area. Species area curves were examined for the plant data, and the above sampling strategy was found to be adequate. At most grids, asymptote was reached on line 1, and in all cases it was reached by line 6 out of 10 (see Figure 12).

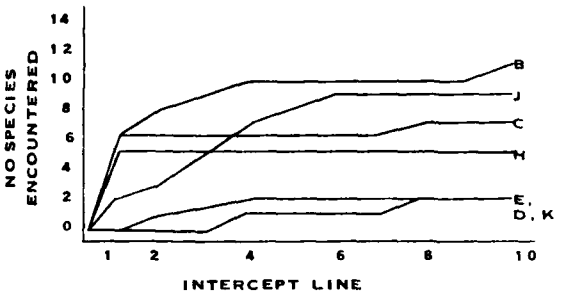


Fig. 12: Species area curves for plants at seven plots on the Rio Puerco.

The three largest areas from Camilli's Landsat stratification were selected to sample birds and mammals. These were areas C (3133 ha), D (3217 ha), and J (3656 ha). These three units comprise 69% of the total area of the Rio Puerco study area. Due to limited time, I made no effort to verify the boundaries of Camilli's zones.

Mammals were sampled by using a 100 trap grid of 3" x 3" x 10" Sherman aluminum live traps baited with rolled oats. The traps were set 20 m apart in 10 rows of 10 traps each, producing a 4 ha grid. The traps were left in place for three successive nights and were run each morning when animals were marked and released after species, sex, their mark, and whether they had been previously captured were noted. Data were recorded onto a standard form. In area C the animals were marked with ink which was not sufficiently durable, so at areas D and J marking was accomplished by toe

clipping. For this reason, mammal population data from area C are not directly comparable with the other two areas where I used the Schnaleel method (Tanner 1978) of estimating numbers in my sample area. This method is that

$$\hat{N} = \frac{\Sigma (M_i C_i)}{\Sigma R_i}$$

where $\hat{N}$ is the population estimate, M_i = the total number of individuals in the sampling unit which are previously marked, C_i = the total number of individuals captured during trap session i, and R_i = the number of marked individuals captured in trap session i. The $\hat{N}$ for area C is merely the largest number of individuals of each species caught in any one night.

Avian population data and species diversity information were gathered using a belt transect 1.6 m x 60 m. The transects were walked on three mornings at each of the bird sample areas. All census walks were completed within three hours after sunrise. Data were recorded on bird census forms. Birds observed outside the belt or flying overhead were indicated by a check in the last column on the census form, and by an x in the bird data tables. Emlen (1971) has devised a method for estimating absolute densities of birds along a transect which requires establishing *coefficients of detectability* for each species in different habitats. I haven't accumulated sufficient data to do this. (The U.S. Fish and Wildlife Service is going to continue this study and at the end of their project these estimates may be possible.) As with the mammals in area C, the bird data tables show the numbers seen within the belts on the three censuses, and $\hat{N}$ is the largest number seen at each area.

I calculated Shannon-Weaver indices of diversity

$$H' = -\Sigma_{i=1}^{s} P_i \log P_i$$

where s is the number of species encountered and P is the *proportion* of individuals of species i (Pielou 1974, 1975) for plants, using cover rather than density, mammals and birds to see if this index was correlated for the three taxanomic groups. This index is taken from information theory, the idea being that the higher the value of H' (which lies between 0 and 1) the greater the information content of the system and, consequently, the greater its stability. I believe that this index should be useful in that disturbed areas with little diversity, or areas dominated by increasers or invaders can be seen as unstable.

Table 6

VEGETATION ANALYSIS AT AREA B

Species	Intercept Line 1	2	3	4	5	6	7	8	9	10	%	$\Sigma\frac{1}{M}$	D_{belt}
Sporobolus sp.	6				42			12		7	0.45	0.46	
Dalea terminalis	94		24								0.79	0.02	0.02
Artemisia filofolia	33	150	25						110		2.12	0.29	0.10
Gutierrezia sarothrae	29	127	31	198	217	29	42	232	56	181	7.77	1.22	0.86
Atriplex canescens	8					150	60				1.45	0.04	0.04
Hilaria jamesii	19	33		42		116	65	24		12	2.09	6.88	
Yucca elata		79									0.53	0.01	0.02
Oryzopsis hymenoides		30	39	14	23		12				0.79	0.62	
Tridens pulchellus			6								0.04	0.1	
Chrysothamnus nauseosus			62	106		25	8			36	1.58	0.08	0.03
Aristida sp.										8	0.05	0.10	
TOTAL	189	419	187	360	282	320	187	268	166	244	17.48		

(Densities, $\Sigma\frac{1}{M}$ and D_{belt} are estimates per meter^2 in this and succeeding tables.

STRATIFICATION AREA DESCRIPTIONS

AREA B

Area B is found along the eastern slope of the Rio Puerco valley. This zone is fairly steep and is strongly eroded. Soils are in the Bluepoing-Caliza association (Maker, et al. 1974), are coarse to gravelly, and appear to have little water holding capacity. The area seems to be similar over the entire length of the study area and Camilli's map boundaries appear to accurately portray the community.

The sample area for B is located along a dirt road which enters Belen by way of the town dump. Section lines are not indicated on the U.S.G.S. quadrangle maps at this area, but the sample area should be in Section 19, T5N, R1E, Valencia County, New Mexico, at 5100 feet elevation. The vegetation analysis for area B is presented in Table 6.

Cover in area B averaged 17.48%, and $H' = .7736$ indicating that the area is in a fairly mature state and doesn't seem to be suffering too much from overgrazing, however the absence of highly palatable grasses in this zone may be a result of that. Area B can be characterized as shrub-grassland. Plant species observed in area B follow:

Aristida sp.	Three awn
Artemisia filifolia	Sand sagebrush
Atriplex sp. (annual)	
Chrysothamnus nauseosus	Rubber rabbitbrush
Cryptantha micrantha	Hidden flower
Dalea terminalis	Indigo bush
Ephedra torreyana	Joint fir
Gutierrezia sarothrae	Broom snakeweed
Hilaria jamesii	Galleta grass
Juniperus monosperma	One-seed juniper
Lycium pallidum	Pale wolfberry
Opuntia sp.	Prickly pear
Oryzopsis hymenoides	Indian rice grass
Prosopis glandulosa	Mesquite
Salsola kali	Russian thistle
Sphaeralcea sp.	Globe mallow
Sporobolus gigantea	Giant dropseed
Sporobolus sp.	Dropseed
Tridens pulchellus	Fluff grass
Yucca sp.	Yucca

AREA C

Area C occupies the area between area B and the primary erosion channel of the Rio Puerco which is in area D. Erosion is generally light, although there are occasional gullies which cut deeply where they enter the Rio Puerco. Slope is generally between 5-10%, and the soil is an eolian deposited sandy or sandy loam. The area is fairly uniform in appearance throughout the valley, the main variable being loosely consolidated eolian sand deposits. Soils are of the Adelino type (Maker, et al. 1974) and water holding characteristics are good. Camilli's map boundaries appear to accurately portray the community.

The study area for C is in the NE¼, NE¼, SE¼ of Section 14, T6N, R1W, Valencia County, New Mexico at 5080 feet elevation. The plant, mammal, and bird data for area C are presented in Table 7. Plant species found in area C are as follows:

Amaranthus graecizans	
Artemisia filifolia	Sand sagebrush
Atriplex canescens	Four-wing saltbush
Chenopodium sp.	
Franseria acanthicarpa	
Dalea terminalis	Indigo bush
Dithyrea wislizeni	
Eriogonum sp.	
Euphorbia sp.	
Gutierrezia sarothrae	Broom snakeweed
Hilaria jamesii	Galleta grass
Juniperus monosperma	One-seed juniper
Lesquerella fendleri	
Mentzelia pumila	
Oryzopsis hymenoides	Indian rice grass
Phacelia sp.	Scorpion weed
Polanisia trachysperma	West. clammy weed
Proboscidea parviflora	Devil's claw
Salsola kali	Russian thistle
Solanum eleagnifolium	

Sphaeralcea sp.	Globe mallow
Sporobolus airoides	Alkalai sacaton
Sporobolus gigantea	Giant dropseed
Sporobolus sp.	Dropseed
Tribulus terrestris	Goathead
Trypterocalyx sp.	
Yucca sp.	Yucca

Total perennial cover in area C = 19.87%. H′ = .6528 for plants., .8003 for birds, and .5174 for mammals. The dominant plant species at the area C study area were *Dalea terminalis* and *Oryzopsis hymenoides*, both of which are increasers on active sandy soils such as those found at area C. Mammal diversity is low, probably because of the relative lack of variety of seed producing plants in the study area. Bird diversity is highest as measured by the Shannon-Weaver index, in area C, but there are more species in area J.

Table 7

A – VEGETATION ANALYSIS AT AREA C

Species	Intercept Line 1	2	3	4	5	6	7	8	9	10	%	$\Sigma\frac{1}{M}$	D belt
Eriogonum sp.	27										0.18	.09	
Hilaria jamesii	48	57	2	67							1.2	5.84	
Yucca sp.	90						30	100	210		2.87	0.11	0.05
Oryzopsis hymenoides	11			34	80	151	6	79	66	32	3.06	15.52	
Gutierrezia sarothrae	28	166	90	17					85		2.57	0.27	0.19
Dalea terminalis	90	130	370	222	260	70	330			100	9.08	0.22	0.17
Sporobolus airoides								25			0.17	0.08	
TOTAL	294	353	462	340	340	221	366	204	361	132	19.87		

B – MAMMALS TRAPPED AT GRID C

Species	Night 1	Night 2	Night 3	$\hat{N}$
Dipodomys ordi	6	7	11	11
Perognathus flavus			2	2
Peromyscus maniculatus		1	1	1
Onychomys leucogaster		1	4	4
Spermophila spilosoma	1		1	1
TOTAL/4 ha.				19

H′ = .5174

See text for an explanation of $\hat{N}$.

C – BIRD CENSUS DATA FROM AREA C

Species	Day 1	Day 2	Day 3	$\hat{N}$
Red Tail Hawk	2			2
Rock Wren	4	2		4
Loggerhead Shrike	2	1	1	2
Mourning Dove	15	6	12	15
Western Kingbird	2			2
Horned Lark	1	4	11	11
Say's Phoebe	1		1	1
Black-throated Sparrow		1	1	1
House Finch		1	2	2
Bendire Thrasher		1		1
Common Raven			x	
Common Nighthawk			1	1
TOTAL/20 ha.				41

Table 8

A – VEGETATION ANALYSIS AT AREA D

Species	Intercept Line 1	2	3	4	5	6	7	8	9	10	%	$\Sigma\frac{1}{M}$	D belt
Atriplex canescens				27				20		135	1.21	0.18	0.06
Oryzopsis hymenoides										20	0.13	0.23	
Leguminoisae sp.								3			0	0.5	
TOTAL	0	0	0	27	0	0	0	23	0	155	1.37		

B – MAMMALS TRAPPED AT GRID D

Species	Night 1	Night 2	Night 3	$\hat{N}$
Perognathus flavus	5	3	8(4)	19.75
Dipodomys ordi	1	1(1)	2(1)	4.0
Onychomys leucogaster	2	3(1)	4(3)	9.75
Peromyscus maniculatus	3	6(1)	7(5)	12.3
Neotoma micropus		1		1.0
Spermophilus spilosoma			1	1.0
TOTAL/4 ha.				47.8

The number in parenthesis is the number recaptured on that night.

C – BIRD CENSUS DATA FROM AREA D

Species	Day 1	Day 2	Day 3	$\hat{N}$
Long-billed Curlew	x			
Horned Lark	12	20		20
Sparrow Hawk	1		x	1
Western Kingbird	x		x	
House Finch	x	x	x	
Meadowlark	x	x		
Loggerhead Shrike	x	x	x	
Scaled Quail		x		
Mourning Dove		x	x	
Blue Grosbeak		x		
Mountain Plover		x		
TOTAL/20 ha.				21

Table 9

VEGETATION ANALYSIS AT AREA E

Species	Intercept Line 1	2	3	4	5	6	7	8	9	10	%	$\Sigma\frac{1}{M}$	D belt
Leguminosae sp.		9	5	19	22	58		11	2	6	0.88	5.36	
Atriplex canescens					118			27			0.97	0.04	0.06
TOTAL	0	9	5	19	140	58	0	39	2	6	1.85		

Please note: each line is 1,500 cm long; these areas are nearly bare of vegetation.

AREAS D, E, and G

Areas D and E are found in the bottom of the Puerco valley and the soils in these zones are alluvially deposited silts and very fine sandy loams of the Tome and Armijo soil groups. In places they are apparently saline affected (Armijo) and support little or no vegetation. These two areas seem to be the same with respect to soil type and vegetation, and represent a mosaic of local patches of halophylic grasses and shrubs with barren areas and annual weed barrens scattered throughout. The primary erosion channel of the Rio Puerco (which is a distinct habitat) lies within area D. The erosion channel is dominated vegetationally by *Tamarix* sp., *Salix* sp., and *Chrysothamnus nauseosus*. No direct vegetational measurements were taken from the channel.

Zones D, E, and G represent an area where I believe Landsat stratification, as an expression of vegetative community, broke down. I examined the Landsat imagery of the area with Camilli, and fully concurred with her placement of zonal boundaries on the basis of the imagery. Ground checking showed the lines to be both artifactual (distinguishing D and E) and misplaced where D-E encounters G which also does not properly reflect present biotic boundaries. G is not as extensive as area C, but it corresponds with C in slope and soil type, being of the Adelino type. G was represented by a very small incursion into the study area on the stratification map, and vegetation measurements were not taken. Future work in the study area should concentrate on remapping areas D, E, and G to clarify the problems of biotic community boundaries versus Landsat stratifications. Bird, mammal and plant data for area D are presented in Table 8. Plant data for area E are presented in Table 9. These data were gathered at two areas which were particularly low in vegetation, and should not be taken as representative of the entire area.

The sample area for D was in the SW¼, NE¼, NW¼ of Section 12, T5N, R1W, Valencia County, New Mexico, at 4938 feet elevation. Sample area E was in the SW¼, SE¼, SW¼ of Section 23, T6N, R1W, Valencia County, New Mexico at 4960 feet elevation. H' values were .1713 for perennial plants, .5630 for mammals, and 0 for birds in area D. In area E, $H' = .3006$ for perennial plants. As mentioned above, no measurements were taken in area G; they would probably be similar to area C. Perennial cover averaged 1.3% in area D, and 1.85% in area E. The high value of H' for mammals in area D can probably be attributed to the grainivorous habits of these animals corresponding to the relatively high seed production of the annual Chenopods found in the area.

Plant species observed in areas D, E, and G are as follows:

Atriplex canescens	Four-wing saltbush
Atriplex powelii	
Bouteloua curtipendula	Sideoats grama
Bouteloua gracilis	Blue grama
Chrysothamnus sp.	Rabbit bush
Gutierrezia sarothrae	Broom snakeweed
Hilaria jamesii	Galleta grass
Opuntia sp.	Prickly pear
Oryzopsis hymenoides	Indian rice grass
Populus freemonti	Valley cottonwood
Salsola kali	Russian thistle
Salix sp.	Willow
Sarcobatus vermiculatus	Greasewood
Sporobolus airoides	Alkalai sacaton
Sueda suffrutescens	

AREA H

Area H is the habitat of the mesa top west of the Rio Puerco. It enters the study area in the southwestern portion and occupies approximately 832 ha. The area H study plot lies in the NW¼, SE¼, NW¼ of Section 26, T4N, R1W, Socorro County, New Mexico at 5020 feet elevation.

Vegetational data is presented in Table 10. Perennial cover averaged 24.24% and $H' = .5783$. The dominant plants were *H. jamesii*, *Gutierrezia sarothrae*, and *Munroa squarrosa*. *Bouteloua gracilis*, which should be a dominant grass in this area, was not encountered.

Table 10

VEGETATION ANALYSIS AT AREA H

Species	Intercept Line 1	2	3	4	5	6	7	8	9	10	%	$\Sigma \frac{1}{M}$	D_{belt}
Hilaria jamesii	141	255	143		295	187	67	69	308	242	11.38		
Aristida sp.	65	24		12				6	10	33	1.01		
Gutierrezia sarothrae	17	113	69	27	77	179	77	66	13	26	4.43		
Sporobolus sp.	52	52			8	17		111	43		1.89		
Munroa squarrosa	226	55	42	93	100	20	109	123	54	10	5.23		
TOTAL	501	499	254	132	480	403	253	375	428	311	23.94		

Density data were not gathered at area H.

That, coupled with the presence of extensive stands of *Gutierrezia sarothrae*, seems to indicate that the range here is overgrazed and in a disturbed state.

Although birds and mammals were not sampled in area H, Wimberly (personal communication) reported seeing a small herd of Pronghorn Antelope in this area.

AREA J

Area J is the steep and eroded region on the upper west slope of the Rio Puerco. The soils in this area are of the Bluepoint-Caliza association which are characterized as steep and rocky. They have very low water retention and the gullies are quite shrubby. The study plot for area J is in the middle of Section 22, T5N, R1W, Valencia County, New Mexico at 5050 feet elevation. Perennial cover was 12.74%, and $H' = .6453$ for vegetation, .7110 for mammals, and .6453 for birds. The area appears to be in stable condition for all groups sampled, and probably would not change much if cattle grazing was eliminated. Plant, mammal, and bird data are presented in Table 11. Plant species observed in area J are as follows:

Aristida sp.	Three awn
Artemisia sp. (annual)	
Atriplex canescens	Four-wing saltbush
Atriplex sp. (annual)	
Chenopodium incanum	
Dalea terminalis	Indigo bush
Ephedra torreyana	Joint fir
Eriogonum sp.	Wild buckwheat
Gutierrezia sarothrae	Broom snakeweed
Hilaria jamesii	Galleta grass
Juniperus monosperma	One-seed juniper
Mentzelia pumila	
Muhlenbergia torreyana	Ring muhley
Munroa squarrosa	False buffalo grass
Opuntia sp.	Prickly pear
Oryzopsis hymenoides	Indian rice grass
Prosopis glandulosa	Mesquite
Psoralea lanceolata	Lemon scurf-pea
Salsola kali	Russian thistle
Solanum eleagnifolium	Trompillo
Sphaeralcea coccinea	Globe mallow
Sporobolus airoides	Alkalai sacaton
Sporobolus torreyana	Sand dropseed
Sporobolus gigantea	Giant dropseed
Tridens pulchellus	Fluff grass

AREA K

Area K is in the SW¼, SE¼, SE¼ of Section 36, T3N, R1W, Socorro County, New Mexico at 4850 feet elevation. Area K habitat represents a tributary wash bottom, and is generally of a very fine sandy loam of the Tome soil type. Plant diversity and cover

Table 11

A – VEGETATION ANALYSIS AT AREA J

Species	Intercept Line 1	2	3	4	5	6	7	8	9	10	%	$\Sigma \frac{1}{M}$	D belt
Hilaria jamesii	59			25							0.56	2.23	
Sporobolus sp.	180	130	64	62	127	73	257	20	95	62	6.91	3.51	
Gutierrezia sarothrae		46	48	14	26	33	29	101			1.98	0.59	0.22
Atriplex canescens			47								0.31	0.23	0.02
Aristida sp.				30	86	29	42	36		60	1.89	0.92	
Muhlenbergia torreyi				10							0.07	0.03	
Oryzopsis hymenoides				6	15	23					0.14	0.18	
Bouteloua curtipendula						51	12				0.34	0.02	
Tridens pulchellus						3				9	0.08	0.33	
Munroa squarrosa									101		0.67	1.15	
TOTAL	239	176	159	147	254	212	340	157	196	131	12.74		

B – MAMMAL TRAP DATA FROM AREA J

Species	Night 1	Night 2	Night 3	$\hat{N}$
Perognathus flavus	1			1
Dipodomys ordi	2	12(2)	8(6)	15
Ammospermophilus leucurus			1	1
Spermophilus spilosoma		5(3 dead)	2(1)	7
Neotoma albigula	2	4(1)	6(4)	7.6
Onychomys leucogaster		2		2
Dipodomys merriami		2	4(2)	4
Dipodomys spectabilis		2	2(2)	2
Peromyscus maniculatus		1		1
Peromyscus truei		1	1	2
TOTAL $\hat{N}$/4 ha.				42.6

C – BIRD DATA FROM AREA J

Species	Day 1	Day 2	$\hat{N}$
Cassin's Kingbird		3	3
Western Kingbird	3	2	3
Scaled Quail	4	x	4
Mourning Dove	x	1	1
Black-throated Sparrow	13	6	13
Eastern Meadowlark	x		
House Finch	x		
Lark Bunting	x		
Loggerhead Shrike	x	x	
Horned Lark	2	14	14
Lark Sparrow	1		1
Bendire's Thrasher	x	x	
Mockingbird		x	
Black-chinned Hummingbird		1	1
TOTAL $\hat{N}$/20 ha.			40

Table 12

VEGETATION ANALYSIS AT AREA K

Species	Intercept Line 1	2	3	4	5	6	7	8	9	10	%	$\Sigma\frac{1}{M}$	D belt
Sporobolus airoides				51				259	85	218	4.09		
Gutierrezia sarothrae								9	11		0.13		
Atriplex canescens								47		189	1.57		
Munroa squarrosa									18	44	0.41		
TOTAL	0	0	0	51	0	0	0	315	114	451	6.20		

Density measures were not recorded at area K.

in this area was very low, as indicated in Table 12. This habitat should be included in the D, E, G group discussed above. Perennial cover averaged 6.21% and H′ = .3848 which is low. The low diversity here is probably related to poor soils more than to overgrazing, although trampling by cattle may provide significant disturbance to the area. Plants observed in this area are as follows:

Atriplex canescens	Four-wing saltbush
Gutierrezia sarothrae	Broom snakeweed
Munroa squarrosa	False buffalo grass
Opuntia sp.	Prickly pear
Salsola kali	Russian thistle
Sporobolus airoides	Alkalai sacaton

DISCUSSION

Examination of Figure 12, and comparison of diversity indices, seems to put the stratified zones into four groups of habitats. These are D, E, K, which are in the valley bottom and are characterized by very fine, deep, sandy loam soils with slow water penetration. They provide a water stress habitat which is poor for perennial plants, but can provide an opportunity for fast growing, high seed-producing species of annual weeds. The area contains fair mammal diversity which includes some very large, abandoned, probably Black-tailed Prairie Dog towns. There are small colonies of White-tailed Prairie Dogs present now, but they are uncommon. The old towns were probably the beneficiaries of government poison campaigns during the 1950s. There are some burrowing owls present in these old towns, but if there were ever Black-footed Ferrets, they undoubtedly went with the Prairie Dogs. Birds do not make extensive use of this area except in the riparian zone along the primary erosion channel. Their absence is probably related to the lack of cover in this habitat. The only species counted in zone D was Horned Larks, and their numbers were low.

Areas C and G have sandy soils of the Adelino type. Although area G wasn't sampled in this study, its location, overall vegetative appearance, and vegetation mix are similar to those in area C. Areas G and C are both gently sloping and lie between the Tome soils of the valley bottom, and the Bluepoint-Caliza soils of the steeper sides. The main vegetation types in areas C and G seem to be *O. hymenoides*, *Gutierrezia sarothrae*, and in area C, *Dalea terminalis*. In places this habitat seems to be overgrazed. *O. hymenoides* is usually a decreaser under grazing pressure, but it is a very successful increaser on very sandy, disturbed soils, probably because of its good germination characteristics. The absence of *Bouteloua* sp. from these areas is probably an indication of overgrazing. Bird and mammal diversity was high in area C, reflecting a combination of good food resources and adequate cover.

Areas B and J are on Bluepoint-Caliza soils, are heavily eroded, and show high diversity of all groups measured. The absence of highly palatable grasses indicates that these habitats are somewhat overgrazed, although the high values of H′ seem to indicate a balance has been struck in response to grazing pressure.

Area H is on the mesa top west of the Rio Puerco. Again, the absence of highly palatable grasses, combined with high concentrations of *Gutierrezia sarothrae*, indicates disturbance. The predominance of *H. jamesii*, however, may indicate that edaphic factors are involved.

SOME TENTATIVE COMMENTS ON LANDSAT STRATIFICATION

Landsat stratification has a great deal of appeal because one seems to be able to clearly see physiographic boundaries over a large area. Its advantage over aerial photography seems to be that it eliminates alot of confusion caused by small scale patchiness that does not belong on habitat, or vegetation type maps. Looking at a false color composite, one has the impression that it is possible to outline ecologic zones in a matter of hours that would require weeks to outline by other methods.

The problem with the imagery is that sometimes the boundaries are correlated with vegetative zones, but often they are not, as show for the D, E, G group in the present study. Areas G, H, and J, similarly were ill defined where they were mapped outside the study area. In the Rio Salado area, which will be reported in the next section, the boundaries are almost entirely artifactual, having very little correlation with vegetative factors. Rather, stratification may be more directly correlated with edaphic and physiographic factors, but it should be borne in mind that these factors are usually tightly correlated with vegetation.

I would suggest Landsat imagery can be made use of again to best advantage after ground work has established quantification for vegetative zones, and after the ecologist has become familiar with the study area. At that point, Landsat stratification can provide an interpretive base for mapping vegetative community boundaries. As a primary source of ecological mapping information, it is my feeling that Landsat imagery can be misleading. Great care should be exercised in applying perceived Landsat differences to biotic reality.

CONCLUSIONS

From Landsat imagery, eight zones were defined in the Rio Puerco study area. Ground work indicates that, ecologically, there are four habitats: 1) Valley bottom (D, E, K) composed of halophytic perennial grasses and shrubs with extensive areas populated by annuals. Part of this zone, the riparian erosion channel of the Rio Puerco, should be separate; 2) Gently sloping valley sides (C, G) with very sandy soils characterized by *O. hymenoides* and, in places, *D. terminalis*; 3) Steep, rocky valley sides (B, J) which can be described as desert shrub grassland; and 4) the Mesa tops (H) which are desert grassland.

MAMMALS OBSERVED AT THE RIO PUERCO STUDY AREA

Species	Common Name
Sylvilagus auduboni	Desert Cottontail
Lepus californicus	Black-tailed Jackrabbit
Ammospermophilus leucurus	White-tailed Antelope Squirrel
Spermophilus spilosoma	Spotted Groundsquirrel
Cynomys ludovicianus	Black-tailed Prairie Dog
Cynomys gunnisoni	White-tailed Prairie Dog
Perognathus flavus	Silky Pocket Mouse
Dipodomys ordi	Ord's Kangaroo Rat
Dipodomys spectabilis	Banner-tailed Kangaroo Rat
Dipodomys merriami	Merriam's Kangaroo Rat
Peromyscus maniculatus	Deer Mouse
Peromyscus truei	Pifion Mouse
Onychomys leucogaster	Northern Grasshopper Mouse
Neotoma micropus	Southern Plains Woodrat
Neotoma albigula	White-throated Woodrat
Canis latrans	Coyote
Antilocapra americana	Pronghorn Antelope

*Names follow Findley, et al. 1975.

BIRDS OBSERVED AT THE RIO PUERCO STUDY AREA

Species	Common Name
Cathartes aura	Turkey Vulture
Circus cyaneus	Marsh Hawk
Buteo jamaicensis	Red-tailed Hawk
Falco spaverius	Sparrow Hawk
Callipepla squamata	Scaled Quail
Eupoda montana	Mountain Plover
Charadrius vociferus	Killdeer
Numenius americanus	Long-billed Curlew
Zenaidura macrura	Mourning Dove
Bubo virginianus	Great-horned Owl
Speotyto cunicularia	Burrowing Owl
Chordeiles minor	Common Nighthawk
Archilochus alexandri	Black-chinned Hummingbird
Tyrannus verticalis	Western Kingbird
Tyrannus vociferans	Cassin's Kingbird
Sayornis saya	Say's Phoebe
Eremophila alpestris	Horned Lark
Hirundo rustica	Barn Swallow
Corvus corax	Common Raven
Campylorhynchus brunneicapillus	Cactus Wren
Salpinctes obsoletus	Rock Wren
Mimus polyglottos	Mockingbird
Toxostoma bendirei	Bendire's Thrasher
Lanius ludovicianus	Loggerhead Shrike
Sturnella magna	Eastern Meadowlark
Sturnella neglecta	Western Meadowlark
Euphagus cyanocephalus	Brewer's Blackbird
Guiraca caerulea	Blue Grosbeak
Carpodacus mexicanus	House Finch
Calamospiza melanocorys	Lark Bunting
Pooecetes gramineus	Vesper Sparrow
Chondestes grammacus	Lark Sparrow
Amphispiza bilineata	Black-throated Sparrow
Spizella breweri	Brewer's Sparrow

*Names were taken from Robbins, et al. 1966.

RIO SALADO STUDY AREA

PREFACE

The Rio Salado study area is in Socorro County, New Mexico at the southern end of the Sierra Landrones, and ranges in elevation from about 5160 to 5900 feet. The study area falls within the Rockland-Lehmans-Lozier soil association and is in land Class 6 (NMSU 1972). This association is characterized by steep to very steep slopes and rocky soils. The area is presently used for grazing and recreation (Manthey 1976), and is considered too rough for irrigation (NMSU 1972).

Manthey (1977, in Scott 1978) recognized four plant associations in that part of the proposed Ladron Peak Primitive Area, which falls within the project's area of effect. These are desert shrubland, grassland wash and arroyo, Juniper woodland, and Pinon-Juniper woodland. Scott (1978) had a permanent transect near a spring at the lower end of the Box and reported that the Rio Salado is a perennial stream in and east of the Box. In the year that he worked there, Scott observed 51 species of birds, 21 species of mammals, 4 species of reptiles, and 2 species of amphibians from his transect below the Box.

Due to its greater range of elevations and topography, there is greater floral and faunal diversity in the Rio Salado study area than in the Rio Puerco; however, productivity is probably greater in the Rio Puerco Valley.

During September, October and November 1979, I spent twelve days in the Rio Salado study area. Unlike the Rio Puerco Valley, there have been several previous studies of ecological aspects of the Rio Salado. These are associated with the Sierra Ladrones (Howard and Sutcliff 1972; Manthey 1976; Scott 1978) and the Sevilleta Wildlife Refuge (Hernandez et al. 1971; Manthey 1977).

As at the Rio Puerco, study plots in the Rio Salado study area, including the Sevilleta Wildlife Refuge, were chosen from the archaeologist's sample areas D, H, M, N, O and P. For this report, information on birds and mammals are based on literature accounts and on opportunistic encounters. My attempt to census wildlife at area M was curtailed by heavy rain. The vegetation analysis at area M was identical to the methodology used at the Rio Puerco. At the other locations the intercepts were changed from ten 15 m lines to three 30 m lines, a distance demonstrated as adequate at the Rio Puerco. Vegetation cover data should be comparable to that in the Rio Puerco report. Density data on plants in the Rio Salado are equivalent to the Rio Puerco density divided by 1.5, a conversion which produces an estimate of density per square meter (Strong 1966).

Manthey (1977) suggested several floral associations for the Sevilleta Wildlife Refuge. He collected specimens from each of these associations to compile a taxonomic list of plants for the Refuge, but he made no attempt to analyze cover or density. The biomes that he described within the present study area follow.

1. The desert biome occurs in a narrow band along the eastern base of the Sierra Ladrones between 4900 feet and 5500 feet. The dominant indicator of this zone is the presence of *Larrea divaricata* (syn. *tridentata*). This zone intergrades with grassland and the river riparian biome. It is most common in the present stratification, I.

2. The grassland biome is the most extensive in the Sevilleta Wildlife Refuge, and roughly corresponds to stratification H in this study.

3. The river riparian zone lies along the Rio Grande and consists largely of cottonwood, willow and tamarix, with local stands of *Chrysothamnus nauseosis* and *Atriplex canescens*. I choose to include in the riparian zone the Rio Salado and its major tributaries (i.e., stratification D).

4. The woodland biome in the study area consists of the Juniper and Pinon-Juniper woodland of the Sierra Ladrones and the Grey and Ligon Ranch west of the Refuge. This biome is variously composed of stratifi-

cations I, M, N, O, P, and intergrades with D in all major valleys. H includes areas of chained Juniper woodland.

During the course of his work at the Sevilleta Wildlife Refuge during 1974 and 1975, Manthey (1977) found *"1140 taxa, including 84 families, 328 genera and 728 species"*. For a list of plants and their community associations, please refer to his paper.

AREA ACCOUNTS

Area D occurs along the Rio Salado within the study area, and extends up all major tributaries. It is more similar to stratification K of the Puerco study area than D along the Puerco. This is probably because of the Rio Salado's steeper fall, limiting silt deposition characteristic of area D in the Puerco valley. The soils tend to be considerably sandier than at the Puerco and the zone shows signs of greater water availability. As at the Puerco study area, vegetation is highly variable, cover ranging from (estimated) 25% to the low of 6.8% measured at the confluence with the Rio Grande. H′ was .3844 at La Jencia Creek and O at the confluence. The limiting factor on vegetation along the Rio Salado appears to be the scouring action of flooding rather than water stress as at the Rio Puerco. Area D was measured in La Jencia Creek in the NW¼, NW¼ of Section 19, T1N, R2W, Socorro County, New Mexico. Data are presented in Table 13. Area D was also measured at the confluence of the Rio Salado and the Rio Grande. Data from this location are presented in Table 14.

The data in Table 13 are probably typical of stratification D along the tributaries of the Salado from Silver Creek west. This zone along the Rio Salado varies in vegetation, occurring as dense stands of

Table 13

VEGETATIVE ANALYSIS AT STRATIFICATION D AT LA JENCIA CREEK

Species	Line 1	Line 2	Line 3	Σ x	D/M²
Distichlis stricta	317	186	178	681	30.34
Sporobolus sp.	8			8	0.07
Bouteloua curtipendula		10	12	22	0.33
Atriplex canescens		396	121	517	0.04
Gutierrezia sarothrae		28		28	0.02

Total cover cm. = 1,256
Total cover % = 13.96%
Shannon-Weaver Index of diversity, H'_{10} = .3844

Table 14

VEGETATIVE ANALYSIS AT STRATIFICATION D AT THE CONFLUENCE OF THE RIO SALADO AND THE RIO GRANDE

Species	Line 1	Line 2	Line 3	Σ x	D/M²
Tamarix pentandra	214	109	288	611	0.15

Total cover cm. = 611
Total cover % = 6.8%

Atriplex canescens, *Chrysothamnus nauseosus*; rather extensive impenetrable stands of *Tamarix pentandra* with isolated cottonwoods; open, desert grassland, and nearly bare flood sands.

This zone provides habitat for many species of birds and mammals. Scott's (1978) Rio Salado vertebrate transect began and ended in stratification D about 2 km east of the Box. This transect also looped into area M, but his report does not say from which zone his individual species came. He found 51 species of birds, 21 species of mammals, 4 species of reptiles and 2 species of amphibians along this transect during his eight month study (see species lists at end of this section).

The low value of the Shannon-Weaver index in area D reflects the disturbed nature of this biome.

Area H is very extensive and is primarily grassland in the Sevilleta Wildlife Refuge. This area is also highly variable, and intergrades with areas I and J. The study plot for stratification H is located approximately 1.5 km north of the Rio Salado between river miles 6 and 7. This part of area H is dominated by *Oryzopsis hymenoides* and *Sporobolus giganteus*. In other, less sandy areas, H appears to be dominated by *Hilaria jamesii*, *Sporobolus flexuosus* and *Sporobolus cryptandrus*. *O. hymenoides* and the *Sporobolus* species were absent from stratification H at the Rio Puerco study area, probably a result of grazing. Data from area H are presented in Table 15. Total cover was 25.86% and H'_{10} = .5019. It is entirely possible that H′ associated vegetation will extend to higher elevations in areas not affected by blowing sand.

The stratification H area surrounding Loma Blanca is covered by extensive creosote bush shrubland. That fact, plus the rough topography involved should probably place that land in stratification I. Stratification H is generally rather smooth topographically.

Area H′ is an extensive zone southwest of the study area and it enters the study area in Section 35, T1N, R3W, Socorro County, New Mexico. The study plot was in the NW¼, NW¼, SW¼ of Section 35. Data are tabulated in Table 16. The area measured was a chained area of juniper woodland and doesn't appear typical of the shrub grassland that this zone represents. The area appears to be recovering from disturbance (probably caused by chaining). *Gutierrezia sarothrae* is dominant and is a good disturbance indicator at high density. The dominant grasses are *Muhlenbergia torreyi* and *Bouteloua curtipendula*, both of which are decreasers under grazing pressure.

Table 15

VEGETATIVE ANALYSIS AT AREA H

Species	Line 1	Line 2	Line 3	Σ x	D/M²
Oryzopsis hymenoides	430	603	515	1,548	3.71
Sporobolus giganteus	221	9	47	277	1.01
Hilaria jamesii	32			32	0.61
Penstemon sp.	27			27	0.04
Atriplex canescens			124	124	—
Gutierrezia sp.		62	132	194	0.16
Aristida sp.			125	125	0.08

Total cover cm. = 2,327
Total cover % = 25.86%
Shannon-Weaver Index of diversity H'_{10} = .5019

Table 16

VEGETATIVE ANALYSIS AT AREA H′

Species	Line 1	Line 2	Line 3	Σ x	D/M²
Hilaria jamesii	235	245	14	494	5.85
Gutierrezia sarothrae	579	513	270	1,362	2.63
Muhlenbergia torreyi	269	426	185	880	2.81
Sitanion hystrix	7			7	0.09
Tridens pulchellus		37	68	105	0.50
Aristida sp.			146	146	0.59
Yucca elata			4	4	0.02

Total cover cm. = 3,246
Total cover % = 36.07%
Shannon-Weaver Index of diversity H'_{10} = .6398

Cover in area H′ averaged 36% and the Shannon-Weaver index H'_{10} = .6398. (Cover appeared even higher than this in stratification H′ outside the study area, dominant shrubs being *Artemisia tridentata*, *Atriplex canescens*, *Yucca elata.*) Diversity and cover are probably higher in the older shrub grasslands of this stratification. The topography of H′, like that of H is rather smooth, but the vegetation appears to have a stronger shrub component than H.

Area I is the area characterized by Manthey (1977) as the desert biome, and is dominated by *Larrea tridentata* over most of its extent. It intergrades with Pinon-juniper woodland of area M at its western edge, with H to the east and with D along the northern bank of the Rio Salado from river mile 7 west.

Manthey (1977) suggests that this is a stable community in southern New Mexico, reaching its northern boundary at the location of stratification J along the Rio Salado. He suggests further that *Larrea* shrubland is not necessarily an invader of disturbed conditions. A more conventional view is that *Larrea* is an invader and that it is a reliable indicator of past overgrazing. Although cursory, my feeling was that most of the *Larrea* stands consisted of plants of uniform size and presumably age. If true, this would suggest that the species did invade at one time, and that perhaps since the removal of grazing, reproduction has mostly stopped. Perhaps in a few more years, as the plants senesce, succession will yield a more varied community.

The sample plot for area I was on the first terrace above the Rio Salado opposite Silver Creek Canyon, adjacent to river mile 12. At this location, I was in contact with D, and it is not typical of the majority of area I. Vegetation data are presented in Table 17. Cover averaged 24.88% and H'_{10} = .8435, a value probably substantially higher than in more typical areas of I.

Area J is topographically similar to area J in the Rio Puerco valley. Due to the east-west orientation of the Rio Salado however, westerly spring winds blow sand up from the Rio Salado, depositing it along the northern rim of the valley near the upper edge of the area. This is the area that Hernandez et al. (1971) refer to as bare sand. It is still an area of active sand dunes, although the vegetation appears to be considerably denser than what they recorded. The sample area for area J was approximately .5 km south of the study plot for area H, above and between river miles 6-7. Vegetation data are presented in Table 18. Cover averages 27.4% and H'_{10} = .7887.

The dominant plants were *Oryzopsis*, as is typical of loose sandy soils, *Gutierrezia sarothrae*, and *Sporobolus giganteus*. In other, rockier areas, woody shrubs such as *Atriplex*

Table 17

VEGETATIVE ANALYSIS AT AREA I

Species	Line 1	Line 2	Line 3	Σ x	D/M²
Tridens pulchellus	12	8	14	34	1.03
Gutierrezia sarothrae	150	59	55	264	1.03
Prosopis glandulosa	179	209		388	0.01
Sporobolus flexuosis	304	39		343	1.16
Larrea tridentata	214	113	316	643	0.03
Hilaria jamesii		154	20	174	0.73
Atriplex canescens		54	56	110	0.04
Bouteloua barbata			49	49	0.09
Dysodia acerosa			28	28	0.06
Bouteloua eriopoda			156	156	0.28
Aristida sp.			50	50	0.11

Total cover cm. = 2,239
Total cover % = 24.88%
Shannon-Weaver Index of diversity H'_{10} = .8435

Table 18

VEGETATIVE ANALYSIS AT AREA J

Species	Line 1	Line 2	Line 3	Σ x	D/M²
Tridens pulchellus	12	15		27	0.61
Gutierrezia sarothrae	102	78	216	396	0.43
Sporobolus giganteus	98	92	103	293	1.98
Oryzopsis hymenoides	401	176	438	1,015	2.28
Sporobolus flexuosus	46			46	0.31
Larrea tridentata	185			185	0.02
Penstemon sp.	23	148		171	0.17
Dalea sp.		40		40	0.02
Atriplex canescens		223		223	—
Krameria lanceolata		15		15	0.07
Unknown	42	14		56	0.17

Total cover cm. = 2,467
Total cover % = 27.41%
Shannon-Weaver Index of diversity H'_{10} = .7887

canescens and *Prosopis glandulosa* are probably more important.

Area M is the most extensive stratification in the study area outside of the Sevilleta Wildlife Refuge. It consists of steep, hilly country and ridges south of the Rio Salado and at the higher elevations within the study area north of the Rio Salado. The parent soil material is primarily of igneous or metamorphic rock and is generally very gravelly. This area is almost entirely Juniper or Pinon Juniper woodland. Other dominant plants are *Rhus microphylla* and New Mexico olive. Along the arroyo bottoms are local stands of mesquite and four-wing saltbush. Dominant grasses were *Bouteloua gracilis*, *Bouteloua eriopoda*, and *Tridens pulchellus*. Total cover averaged 19% and H'_{10} = .7806. This area appears to be under careful grazing management, and the range is in very good condition. The study plot for area M was in SW¼, SE¼, NE¼ of Section 10, T1N, R3W, Socorro County, New Mexico. Vegetation data are presented in Table 19.

This was the only area in the Rio Salado study area which I attempted to sample for mammals and birds. My efforts were defeated by a rainstorm which dropped 1.35 inches of rain in 24 hours, causing extensive flooding. I did trap one night, however, in which the following species were taken: *Peromyscus truei*, *P. maniculatus*, *Neotoma albigula*, *Perognathus intermedius*, *Dipodomys merriami*, and *Dipodomys spectabilis*. Because of the weather, and later the season, no bird census walks were conducted. Birds seen here and throughout the Rio Salado study area are listed at the end of this section.

Area N consists of a limestone hogback that enters the study area north of the Rio Salado at the east end of the Box. The sides of this formation are very steep, and probably limit grazing by cattle. The soil is derived from limestone, unlike the rest of the study area. The vegetation study plot is in the NE¼, NE¼, SW¼ of Section 6, T1N, R2W, Socorro County, New Mexico. Vegetative data are presented in Table 20. Total cover averaged 48%,

Table 19

VEGETATIVE ANALYSIS AT AREA M

Species	Intercept Line 1	2	3	4	5	6	7	8	9	10	Σ x	D/M²
Bouteloua gracilis	13	16	10	149	23	104	108		3	17	443	4.18
B. eriopoda	253	50	152	78	228	153	148		110	105	1,277	5.84
Tridens pulchellus	142	3	6	3	60	16	6		11	38	285	6.92
Hilaria jamesii		85					60				145	1.34
B. curtipendula		41	31	47		29					148	0.50
Juniperus monosperma		102									102	—
Unknown grass				10						16	26	0.11
Krameria lanceolata					68						68	0.05
Oryzopsis hymenoides					4						4	0.13
Aristida sp.						16			97		113	0.85
Forestiera neomexicana										300	300	—
Sporobolus sp.										25	25	0.03

Total cover cm. = 2,876
Total cover % = 19.17%
Shannon-Weaver Index of diversity H'_{10} = .7806

Table 20

VEGETATIVE ANALYSIS AT AREA N

Species	Line 1	Line 2	Line 3	Σ x	D/M²
Bouteloua eriopoda	473	400	1,145	2,018	1.80
Dysodia acerosa	195	228	62	485	0.34
Aristida sp.	50			50	0.48
Larrea tridentata	199	182	64	445	0.33
Sporobolus cryptandrus	22	10	32	64	0.84
Krameria lanceolata	96		161	257	0.13
Gutierrezia sarothrae	45		45	90	0.18
Bouteloua curtipendula	79	35		114	0.54
Sporobolus sp.	35	25		60	0.53
Chrysothamnus sp.	26	43		69	0.09
Opuntia sp.	125			125	0.01
Muhlenbergia sp.	80	19	121	220	0.34
Opuntia imbricata			100	100	0.01
Unknown grass	23	210	21	254	2.12

Total cover cm. = 4,351
Total cover % = 48.34%
Shannon-Weaver Index of diversity H'_{10} = .8376

the highest encountered during this study, and H'_{10} = .8376. This area has a great deal of diversity throughout, perhaps because it is too inaccessible for grazing, or perhaps the limestone derived soil is more productive. *Bouteloua eriopoda* is the dominant vegetation. *Dysodia acerosa* and *Larrea tridentata* follow in importance. Other species seen but not encountered in the line intercept were *Quercus turbinella*, *Rhus trilobata*, and *Eurotia lanata*.

Area O has a southern exposure and lies north of the Rio Salado where it intergrades with D. Area O is generally above the valley bottom and the greater evapotranspiration rate of this zone results in greater water stress than in area P, which is otherwise similar. Area O lies mostly below the Pinon-Juniper woodland of the Sierra Ladrones. The dominant vegetation types are *Prosopis glandulosa*, *Hilaria jamesii*, and *Sporobolus airoides* — a more halophytic group of dominants than found at any other site at the Rio Salado study area. The study plot for area O is in the SE¼, SE¼, NW¼ of Section 29, T2N, R4W, Socorro County, New Mexico. Vegetation data are presented in Table 21. Cover averaged 32% and H'_{10} = .8304. In addition to the plants in Table 21 there was some prickly pear cactus and cholla. Some common annuals were *Baileya multiradiata*, *Eriogonum* sp., *Croton texensis*, and *Mentzelia pumila*.

Stratification P corresponds closely with stratification O except that the exposure is north, resulting in less water stress. Due to the reduced evapotranspiration, the soils are less salty, there are more junipers, and the vegetation is not dominated by such salt tolerant species. Vegetation data for area P are presented in Table 22. Cover averaged 20% and H'_{10} = .9381. The lowered cover is probably a result of grazing on the palatable grasses found here. The Shannon-Weaver Index at the study plot was very high, and would probably not have such a high value at other areas. The study plot for area P is directly south of Padilla Spring in the SW¼, NW¼, NE¼, Section 32, T2N, R4W, Socorro County, New Mexico.

Area P is ecologically diverse, consisting of one habitat type (Juniper woodland) on the slope, another (desert grassland) on the ridgetops and yet another (desert riparian) at lower elevation along the Rio Salado where it adjoins stratification D.

Table 21

VEGETATIVE ANALYSIS AT STRATIFICATION O

Species	Line 1	Line 2	Line 3	Σ x	D/M²
Opuntia sp.	106			106	0.12
Atriplex canescens	54	81		135	0.06
Tridens pulchellus	81	15		96	2.70
Gutierrezia sarothrae	35			35	0.08
Sporobolus airoides	357	69	22	448	2.07
Prosopis glandulosa	98	532	226	856	0.09
Hilaria jamesii	125	300	240	665	10.0
Bouteloua curtipendula		61	161	222	2.65
Sporobolus cryptandrus		15	7	22	0.19
Larrea tridentata		40	109	149	0.02
Bouteloua barbata		58		58	0.93
Muhlenbergia sp.			9	9	0.12

Total cover cm. = 2,859
Total cover % = 31.77%
Shannon-Weaver Index of diversity H'_{10} = .8304

Table 22

VEGETATIVE ANALYSIS AT STRATIFICATION P

Species	Line 1	Line 2	Line 3	Σx	D/M²
Dysodia acerosa and *Gutierrezia sarothrae*	159	73	52	284	1.17
Aster sp.	141			141	0.35
Tridens pulchellus	155	90	207	452	6.92
Hilaria jamesii	34			34	0.20
Sporobolus airoides	53		20	73	0.18
Sporobolus flexuosis	13	45	11	69	1.03
Krameria lanceolata	12			12	0.03
Aristida sp.	5	6		11	0.22
Bouteloua curtipendula	15	18	137	170	0.70
Bouteloua gracilis		59	6	65	1.31
Forestiers neomexicana		320	37	357	0.01
Ephedra trifurca			4	4	0.04
Atriplex canescens			82	82	0.01
Muhlenbergia sp.			68	68	0.05

Total cover cm. = 1,822
Total cover % = 20.24%
Shannon-Weaver Index of diversity H'_{10} = .9381

DISCUSSION

The Rio Salado study area is composed of two distinct ecological areas which correspond very closely to the two areas treated in this study, i.e. the rough broken land of the Grey and Ligon Ranch and the Sierra Ladrones, and the Sevilleta Wildlife Refuge.

The western component is characterized by rather high vegetative cover with a good deal of diversity. That this land is well managed rangeland is demonstrated by the high percentages of palatable grass species which would be considerably reduced under heavy grazing pressure. Mr. Ligon has stated that he is running one-half of his BLM allotment of cattle (Wimberly, personal communication) and the results of this conservative management are readily apparent.

In most areas that I visited there were abundant seed heads on the grasses. This indicates that reproduction is occurring and that the range is probably stable or in an improving state. Twenty-five percent cover in areas where rainfall averages 12 inches or less and the soils are gravelly with steep slopes, is probably all that can be expected.

The rangeland on the Sevilleta Wildlife Refuge appears to be in a rapid state of change. This is the most interesting area of the present study, ecologically, because of these changes. The soils and the landform within the Sevilleta are similar to those in the lower Rio Puerco valley. In 1971, the New Mexico Environmental Institute (Hernandez, et al. 1971) prepared a socioecological evaluation of the Sevilleta Grant and found rangeland cover similar to that of the Rio Puerco today. They reported extensive and heavy overgrazing. Average cover percentages in the various zones are listed in Table 23 and compared with the results of this study.

This table should not be taken too literally since the locations of the study plots are not the same. One must be very cautious about comparing the percentages of any one of these areas because of the variability present within each of the vegetative communities. The overall trend however, is clear; cover percentages of grasses have increased throughout the Rio Salado watershed within the Sevilleta Wildlife Refuge since 1971. This increase is most likely due to the elimination of grazing from the Refuge.

Table 23

$\bar{x}$ Cover in 1971* and Today

Area	$\bar{x}$ Grass Cover 1971	1979	Change in $\bar{x}$
H	5-6%	21.6%	16%
I	3%	8.9%	5.9%
J	low	15.1%	
M	15%	16.2%	1.2%
D-M	0%	7.6%	7.6%

*(Hernandez, et al. 1971)

As late as 1975, Manthey (1977) didn't record *Oryzopsis hymenoides* as an important component of any vegetative community in the Refuge and, indeed, he didn't record *Sporobolus giganteus* at all. Both species are important components of the vegetation of sandy soils in the Refuge today. Both are very successful invaders in disturbed sandy conditions. The abundant spring moisture of the past three years has no doubt enhanced the spread of both species. Hernandez, et al. (1971) do not list either of these species as being present at the time of their study. They had both probably been reduced or eliminated by grazing when they did their work. The name of the valley *Cañada Popotosa*, 5 km west of the study plots for H and J, probably refers to *S. giganteus*. Hernandez, et al. (1971) reported that large areas in Cañada Popotosa were vegetated only with *Salsola kali*. During past times these grasses were probably an important component of the vegetation as they are now.

Future ecological studies in the Rio Salado and Rio Puerco watersheds should concentrate on developing a vegetation map of the area. For this I recommend the use of color aerial photographs and/or flying, rather than Landsat, which is too large a scale for vegetation mapping. The vegetative boundaries should delineate Bare ground, Grassland, Shrub grassland, Riparian woodland and

shrub, and Juniper or Pinon-juniper woodland. The main purpose of the map would be to develop a sampling program to identify community species composition within each biome. Each biome should be analyzed for mean and variance in cover and diversity.

Whether or not the Rio Salado is included in future plans, the Sevilleta Wildlife Refuge can be used as a baseline for comparison with the Rio Puerco. In order to record the vegetative changes that have occurred at the Sevilleta, the data records of the NMEI should be compared in detail with a similar sample program to be carried out in the next stage of ecological study. The changes over a ten year period without grazing at the Sevilleta Wildlife Refuge will be very useful in attempting reconstruction of the prehistoric vegetation patterns.

The *Larrea tridentata* community should be examined for age structure by quantifying the numbers of large, medium and small plants, and the number of dead plants to see whether the community is stable, expanding, or dying back. This information should be helpful in the interpretation of the presence or absence of *Larrea* archaeologically. This community should provide an important source of firewood, where present.

The U.S. Fish and Wildlife Service is conducting a faunal survey of the Rio Salado and Rio Puerco watersheds, and their information should be utilized in interpreting the presence of archaeological wildlife remains.

COMMON PLANTS OF THE RIO SALADO AREA

Species	Common Name	Species	Common Name
Atriplex canescens	Four-wing saltbush	*Bouteloua gracilis*	Blue grama
Berberis haematocarpus	Barberry	*Distichilis stricta*	Salt grass
Cercocarpus breviflorus	Mountain Mahogany	*Hilaria jamesii*	Galleta
Chrysothamnus nauseosis	Rubber rabbitbush	*Muhlenbergia torreyi*	Ring muhley
Dysodia acerosa		*Oryzopsis hymenoides*	Indian rice grass
Ephedra trifurca	Mormon tea	*Scleropogon brevifolius*	Burro grass
Eurotia lanata	Winterfat	*Sporobolus cryptandrus*	Spike dropseed
Falugia paradoxa	Apache plume	*Sporobolus flexuosus*	Sand dropseed
Forestiera neomexicana	New Mexico olive	*Sporobolus giganteus*	Giant dropseed
Gutierrezia sarothrae	Broom snakeweed	*Tridens pulchellus*	Fluff grass
Juniperus monosperma	One-seed Juniper	*Allionia incarnata*	Trailing four o'clock
Krameria lanceolata	Chacate	*Aster* sp.	Aster
Larrea tridentata	Creosotebush	*Bailea multiradiata*	Desert marigold
Lycium pallida	Pale wolfberry	*Croton texensis*	Dove weed
Opuntia sp.	Prickly pear or cholla	*Cryptantha jamesii*	Nievitas
Pinus edulis	Pinon pine	*Eriogonum* sp.	Wild buckwheat
Prosopis glandulosa	Mesquite	*Franceria acanthacarpa*	Bursage
Quercus sp.	Oak	*Lesquerella* sp.	Bladderpod
Rhus microphylla	Sumac	*Menzilia pumila*	Stickleaf
Tamarix pentandra	Tamarix	*Mirabilis multiflora*	Four o'clock
Yucca baccata	Spanish Dagger yucca	*Penstemon* sp.	Penstemon
Yucca elata	Narrow-leaf yucca	*Phacelia* sp.	Scorpionweed
Aristida sp.	Threeawn	*Perezia nana*	Desert holly
Bouteloua curtipendula	Sideoats grama	*Solanum eleagnifolium*	Desert nightshade
Bouteloua eriopoda	Hairy grama	*Spheralcea* sp.	Globe mallow

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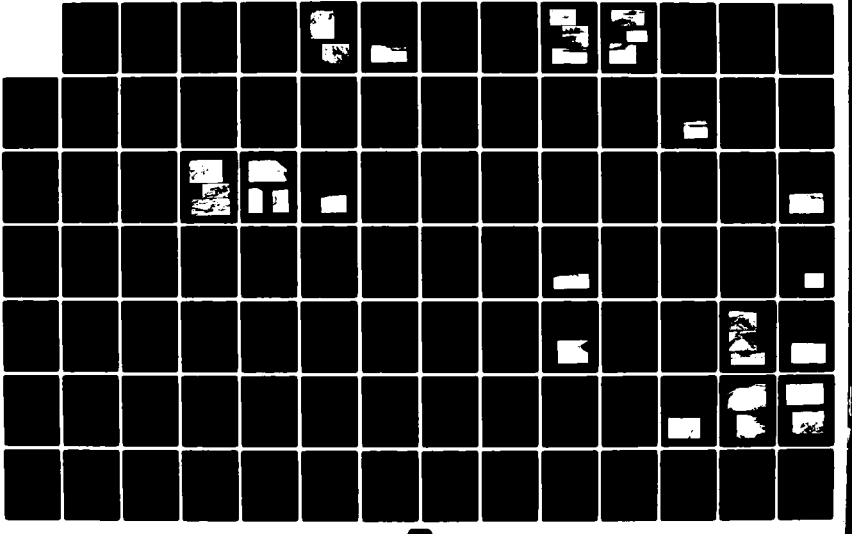
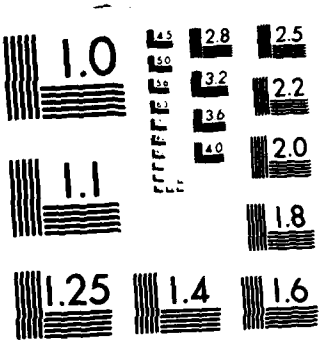




BIRDS OF THE RIO SALADO AND ENVIRONS

Species	Observer*
Mallard	s
Lesser Scaup	s
Turkey Vulture	s
Sharp Shinned Hawk	
Cooper's Hawk	
Red Tailed Hawk	
Rough Legged Hawk	s
Golden Eagle	
Prairie Falcon	
Sparrow Hawk	
Scaled Quail	
Gambels Quail	s
Sandhill Crane	s
Killdeer	
Long Billed Dowitcher	
Spotted Sandpiper	s
Least Sandpiper	s
Common Snipe	s
Greater Yellowlegs	s
Band-tailed Pigeon	s
Mourning Dove	
Roadrunner	s
Long-eared Owl	s
Spotted Owl	s
Great Horned Owl	
Common Nighthawk	
Poor-will	s
White-throated Swift	s
Broad-tailed Hummingbird	s
Black Chinned Hummingbird	s
Red Shafted Flicker	
Yellow-bellied Sapsucker	
Ladder-backed Woodpecker	s
Downy Woodpecker	s
Cassin's Kingbird	s
Ash-throated Flycatcher	s
Black Phoebe	s
Say's Phoebe	
Empidonax Flycatcher	s
Western Wood Peewee	s
Horned Lark	
Cliff Swallow	
Violet Green Swallow	s
Scrub Jay	
Pinon Jay	
Common Raven	
Mountain Chickadee	
Plain Titmouse	
Bushtit	
White Breasted Nuthatch	
Bewick's Wren	
Rock Wren	
Canyon Wren	
House Wren	
Mockingbird	
Sage Thrasher	
Bendire's Thrasher	s
Crissal Thrasher	s
Curve-billed Thrasher	s
Robin	
Townsend's Solitaire	
Swainsons Thrush	s
Western Bluebird	
Mountain Bluebird	s
Black-tailed Gnatcatcher	s
Ruby-crowned Kinglet	
Water Pipit	s
Cedar Waxwing	
Phainopepla	
Loggerhead Shrike	
Starling	
Grey Vireo	s
Solitary Vireo	s
Viriginia's Warbler	s
MacGillivray's Warbler	
Yellow Warbler	s
Wilson's Warbler	
Audubon's Warbler	
Brown-headed Cowbird	s
Red-winged Blackbird	s
Western Meadowlark	
Scott's Oriole	s
Western Tanager	s
Black-headed Grosbeak	s
Rose-breasted Grosbeak	s
Blue Grosbeak	s
Cassin's Finch	s
House Finch	
Pine Siskin	
Lesser Goldfinch	
Rufous-sided Towhee	
Brown Towhee	
Green-tailed Towhee	
Lark Bunting	
Vesper Sparrow	
Black-throated Sparrow	s
Sage Sparrow	
Black Chinned Sparrow	s
Oregon Junco	
Rufous Crowned Sparrow	s
Brewer's Sparrow	
Chipping Sparrow	
White-crowned Sparrow	

* No notation means that I saw the species during my fieldwork.
s = Scott (1978) for species that I did not observe.

MAMMALS OF THE RIO SALADO

Species	Observer*	Stratification
Lasionycterus noctivagans Silver-haired Bat	s	D
Pipistrellus hesperus Western pipistrelle	s	D
Antrozous pallida Pallid Bat	s	D
Sylvilagus auduboni Desert cottontail	s x	D, M, P
Lepus californicus Black-tailed jackrabbit	s x	D, H′, M
Eutamius dorsalis Cliff chipmunk	s x	D, M
Ammospermophilus leucurus White-tailed antelope ground squirrel	s x	D
Spermophilus variegatus Rock squirrel	s	N
Perognathus intermedius Rock pocket mouse	s x	M
Dipodomys merriami Merriam's Kangaroo rat	s x	M, D
Dipodomys spectabilis Banner-tail Kangaroo rat	s x	D, M
Neotoma albigula White-throated woodrat	s x	D, M
Peromyscus eremicus Cactus mouse	s	M
Peromyscus truei Pinon mouse	s x	M
Peromyscus boylei-leucopus	s	M-I
Peromyscus maniculatus Deer mouse	s x	M, D
Canis latrans Coyote	s x	H′, I, M, O, P, D
Urocyon cinereoargenteus Grey Fox	s	M
Lynx rufus Bobcat	x (Wimberly)	D
Mephitis mephitis Striped skunk	s	D
Odocoileus hemionus Mule deer	s x	M

*s = Scott (1978)
x = personal observation

CHAPTER IV

RESULTS OF THE TEN PERCENT SURVEY OF THE LOWER RIO PUERCO–RIO SALADO DRAINAGES, N.M.

SITE DESCRIPTIONS

PRELIMINARY ANALYSIS OF CERAMIC MATERIALS
By Michael Marshall

LITHIC ASSEMBLAGES FROM THE LOWER RIO PUERCO–RIO SALADO DRAINAGES, N.M.
By Cye Gossett

PREDICTION OF CULTURAL RESOURCES

There is no automatic, axiomatic assurance that the forms, types, and classes established today by the archaeologist are coextensive with any separable entities that existed in the minds or life ways of a bygone people. At best, the declaration of any such correspondence is a matter for explicit hypothesis and testing, not implicit assumption. It constitutes one of the archaeologist's greatest problems, not one of his self-evident truths. [Taylor 1948:121]

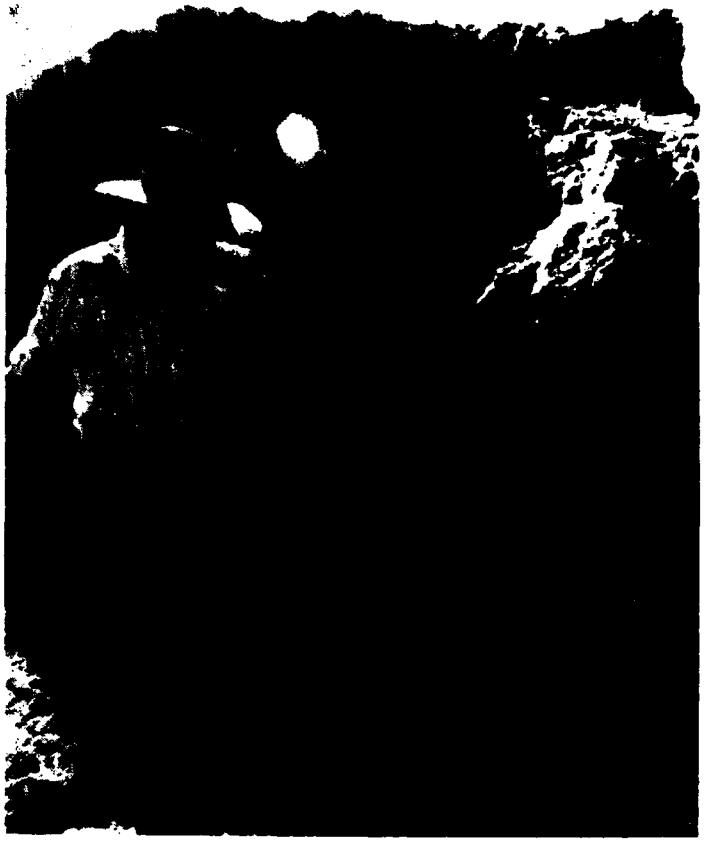


Photo 26

The survey conducted for this project was oriented to inventory archaeological materials exposed on the land surface. Although arroyo walls were examined in those cases where erosion had crosscut sample units, it should be recognized that the original sample stratification did not include recognition of an "erosion unit" in which exposed subsurface deposits were sampled in equal magnitude with surface units. On the Puerco especially, this factor should be considered in future survey. Hibben (personal communication) has noted numerous charcoal deposits at depths over 3 meters in the exposed banks near Pottery Mound. The HSR survey found two locations of buried charcoal in cut banks of tributary arroyos to the Puerco. Neither location yielded cultural materials.

However, by dating such locations in conjunction with studies of sedimentation, reconstruction of the history of the drainage should be possible. Further, in this manner very early archaeological sites may be discovered.

Photo 27

RESULTS OF THE TEN PERCENT SURVEY OF THE LOWER RIO PUERCO–RIO SALADO DRAINAGES, N.M.

A formal 10% archaeological survey at project locations in the Puerco-Salado drainages located and recorded 57 archaeological sites. Forty-four of these were actually within the formal sample units; 19 on the Rio Puerco, 20 in the La Jencia, and 5 at Loma Blanca study area. Two additional sites (one in La Jencia and one in Loma Blanca) had been previously recorded, but detailed data was lacking. Both were considered important and were thus subjected to comparable analytical studies. Eleven other new sites were located within the study region and were fully recorded as well. These additional sites help to confirm the predictive results based on the sites within the formal sample and substantially expand the interpretive and comparative base.

The predictive values and discussion are to be found in a separate portion of the report. Here we will present the formal descriptive results for each site location.

The actual sample coverage by study area and zone is given first. A total of 9.7% of the project land area was actually covered. Slight variances in zone sample proportions are evident, but overall *mean* coverage of 12.1% exceeds the requirements of the sample design. The variances in particular strata of the sample result from a variety of factors, including size of the particular zone, previous inventory samples, and logistic exigencies.

An index of all sites is given, with brief data on temporal affinity, site type, etc. Site descriptions are presented in a formal manner and all basic site data required by the research design are presented. Additional detailed data on ceramics and lithics analyzed on each site are presented in separate reports along with comparative discussion. Sites with historic site numbers are noted and additional descriptive and historic detail can be found in the historian's report.

Those few sites without detail maps were so diffuse and indistinct that even a dotted line was considered to be misleading.

Photo 28: HSR field crew at work on HSR903/P19

Table 24

SUMMARY OF SAMPLE COVERAGE

Unit Size 40 Acres

Zone	Puerco		La Jencia		Loma Blanca		Σ		
	Total Units	# Units Sampled	Total Units	# Units Sampled	Total Units	# Units Sampled	Total Units	Σ/Units Sampled	% Sample
B	72	7					72	7	9.7
C	118	16					118	16	13.5
D	97	9	1	0	56	6	154	15	9.7
E	69	5					69	5	7.2
H	27	3	4	0	63	7	94	10	10.6
H′			27	3	3	0	30	3	10.0
I			1	0	204	16	205	16	7.8
J	148	15					148	15	10.1
K	4	2					4	2	50.0
M			277	12	26	0	303	12	9.2
				16*				16	
N			4	1			4	1	25.0
O				7	1			7	114.3
P			33	3			33	3	9.1
TOTAL	535	57	354	36	352	29	1,241	122	
		(10.7%)		(10.2%)		(8.2%)		(9.8%)	$\bar{x}$ = 14.3
B-C	75	6					75	6	8.0
C-D	105	9					105	9	8.6
C-E	21	3					21	3	14.3
D-E	30	3					30	3	10.0
D-H					11	1	11	1	9.1
D-I			2	0	98	10	100	10	10.0
D-J	58	6			7	1	65	7	10.8
D-K	10	3					10	3	30.0
D-M			102	10	6	0	108	10	9.3
D-P-O			16	2			16	2	12.5
H-I					13	1	13	1	7.7
H-J	44	3			3	1	47	4	8.5
H′-M			29	3	4	0	33	3	9.1
I-M			1	0	10	1	11	1	9.1
J-K	45	3					45	3	6.7
M-N			10	1			10	1	10.0
O-M-H			6	1			6	1	16.7
P-M			6	0			6	0	0.0
TOTAL	388	36	172	17	152	15	712	68	
		(9.3%)		(9.9%)		(9.9%)		(9.6%)	$\bar{x}$ = 10.5
Σ TOTALS	923	93	526	53	504	44	1,953	190	
		(10.1%)		(10.1%)		(8.7%)		(9.7%)	$\bar{x}$ = 12.1

* within BLM, Unit 115 (see map)

Table 25
INVENTORY OF SITES LOCATED

Site No.	Period	Lithic Pattern	Site Type	Elevation (feet)
		LOWER RIO PUERCO		
P-1	historic		homestead	5005
P-2	late P-II/early P-III	1	scatter?	4985
P-3	?	1	scatter	4920
P-4	late P-II/early P-III		pueblo	5020
P-5	BM-III		scatter	4870
P-6	P-II	1	scatter	4825
P-7	Archaic?		scatter	4820
P-8	P-I	2	scatter	4815
P-9	late P-II/early P-III		scatter	4950
P-10	historic/P-I	1	scatter	4945
P-11	?	4	scatter (quarry)	5040
P-12	P-I?	1	scatter	4925
P-13	P-I?	3	scatter	4850
P-14	?	2	scatter	4860
P-15	P-II	3	pueblito	4900
P-16	P-II	3	pueblito	4915
P-17	P-II	3	pueblito	4860
P-18	P-II	2	scatter	5020
P-19	late P-I	3	scatter	5060
P-20	P-IV — Glaze A	2	scatter	5000
		LA JENCIA		
S-1	historic		corral	5560
S-2	BM-III/early P-I	3	jacal?	5480
S-3	historic		ranch	5400
S-4	early P-I/late P-II		pueblito	5420
S-5	late P-II	3	pueblito	5410
S-6	late P-II	3	pueblito	5410
S-7	P-I/P-II		pueblito	5480
S-8	late P-II	3	pueblo	5410
S-9	early P-I/early P-II		jacal?	5405
S-10	historic		homestead	5410
S-11	late P-I		pueblito	5460
S-12	early P-I		pueblito	5450
S-13	late P-I		scatter	5380
S-14	late P-II		scatter	5360
S-15	?		jacal?	5380
S-16	early P-I/late P-II	3	pueblito	5360
S-17	early P-I		pueblito	5380
S-18	P-IV — Glaze D		pueblo	5440
S-19	early P-I		jacal?	5330
S-20	modern		corral	5160
S-21	late P-I/late P-II	1	pueblito	5210
S-22	BM-III	2	pithouse	5200
S-23	BM-III/historic	3	pueblito/house	5190
S-24	?		cave	5280
S-25	BM-III/P-I		tipi rings?	5290
S-26	BM-III	3	pithouse	5400
S-27	late P-II		pueblito	
		LOMA BLANCA		
L-1	late P-I	1	jacal	5015
L-2	P-I	3	pueblito	4970
L-3	Archaic?	2	scatter	4985
L-4	BM-III/early P-I		jacal?	4930
L-5	early P-II		scatter	5000
L-6	late P-II	2	scatter	5120
L-7	P-IV — Glaze C,D,E	3	pueblito	5080
L-8	BM-III	2	pithouse	5100
L-9	late P-I		pueblito	5120
L-10	P-IV — Glaze A	2	pueblo	

Photo 29: Site HSR903/P-9

Sites along the lower Puerco commonly appear as low density surface distributions of lithics or ceramics and lithics spread thinly across the surface of alluvial bottomland sediments. Only in a very limited number is any evidence of structure visible on the surface today. Whether this is an artifact of erosion, deposition of sediments covering the site, or characteristic of the sites is a problem which should be addressed by future research in the drainage. In some cases, site location suggests association with the present main drainage course; in others, proximity to older abandoned stream meanders indicates possible changes in drainage course through time.

(right) Photo 30: Site HSR903/P-20

(below) Photo 31: Site HSR903/P-6, Prov. 1

Photo 32: Site HSR903/P-14

In the Puerco valley, some sites appear to have been totally exposed by sheet erosion and tributary arroyo cutting, while other locations away from the valley bottom remain intact with indications of depth to the deposits. Approximate dates based on ceramics indicate that the 10% sample has not gathered sufficient site information to specify environmental clustering of sites by time period. Some preliminary indications suggest that structural sites of the earlier ceramic periods are located away from the main drainage bottom, while hearth sites (camps?) of all ceramic periods commonly occur immediately adjacent to the active channel.

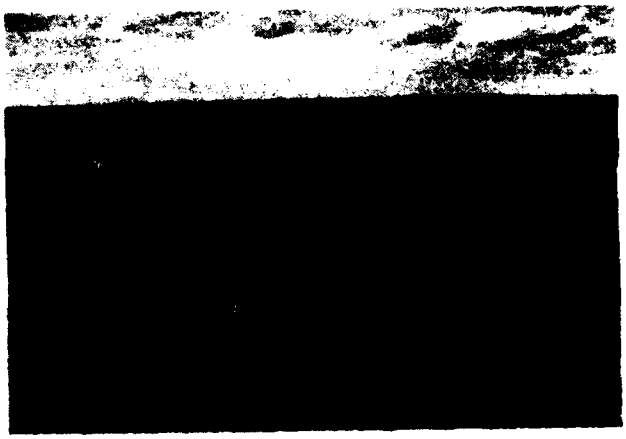


Photo 33: Site HSR903/P-6, Prov. 2

Photo 34: Site HSR903/P-16

HSR SITE NO: 903/P-1
LA NUMBER: 20901

Stratification Zone: D-E
Elevation: 5005 feet; 1526 meters
Slope: <1%
Aspect: 160°
Temporal Horizon: Historic
Cultural Litter Density: <1/m²
Lithic Pattern: —

Maximum Length (longest axis): 30 m
Orientation (longest axis): 90°
Maximum Width: 20 m
Estimated Maximum Area: 600 m²
Maximum Depth: 1.0 m
Number of Hearths: 0
Number of Structures: 3

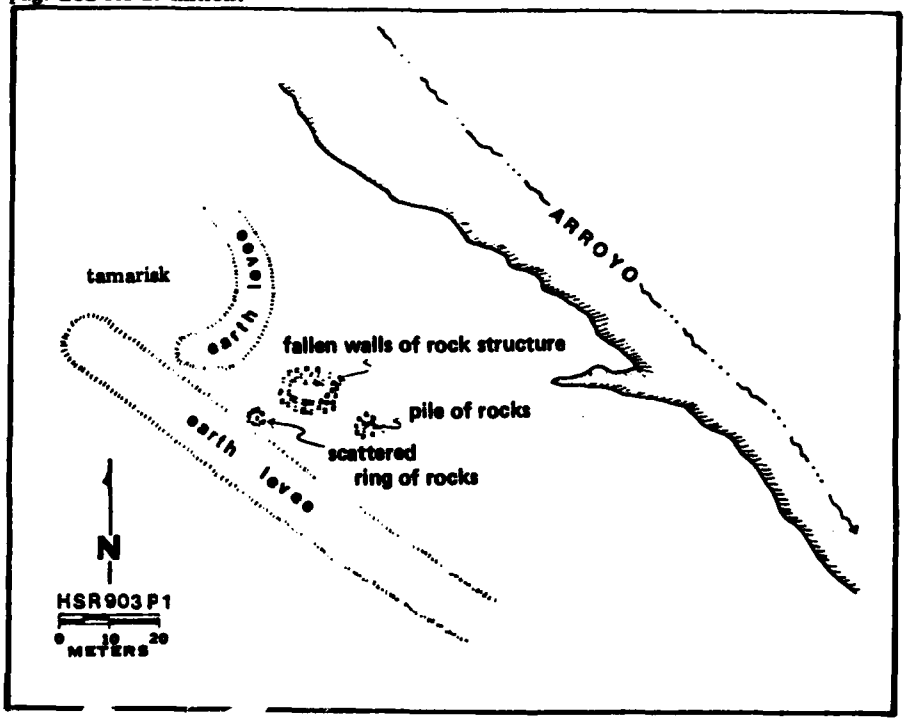
Description: This small homestead is located on flat bottomland at the edge of a series of small arroyos leading east into the Rio Puerco. Modern earth levees border the site on the immediate west.

Architecture: Historic masonry structures include a one room domicile and two isolated small outbuildings. The one large room is approximately 3 m wide x 6 m long. Shaped or prepared sandstone blocks, probably rubble representing the full height of the original walls, is scattered over an area of approximately 12 m x 12 m. The two outbuildings appear to have been constructed of similar elements and presently stand as more or less circular mounds of approximately 4 m x 4 m each.

Flora: Four-wing saltbush, Russian thistle, and tamarisk.

Score *	
0	Cultural Litter Density: <1/m²
2	Preservation: Three masonry structures in average condition.
2	Stratigraphy: Recent historic remains appear to be in situ.
1	Rarity: Probably a typical historic homestead.
0	Aesthetics: No unusual features.
2	Restoration Potential: Remains are fallen, but do not appear to have been vandalized.
1	Educational Potential: Relatively inaccessible; in active range land near modern water control features.
8	TOTAL

*See page 231 for definition.



HSR SITE NO: 903/P-2
LA NUMBER: 20902

Stratification Zone: E
Elevation: 4985 feet; 1519 meters
Slope: 1%
Aspect: 90^0
Temporal Horizon: Late P-II/Early P-III
Cultural Litter Density: $33/m^2$
Lithic Pattern: 1

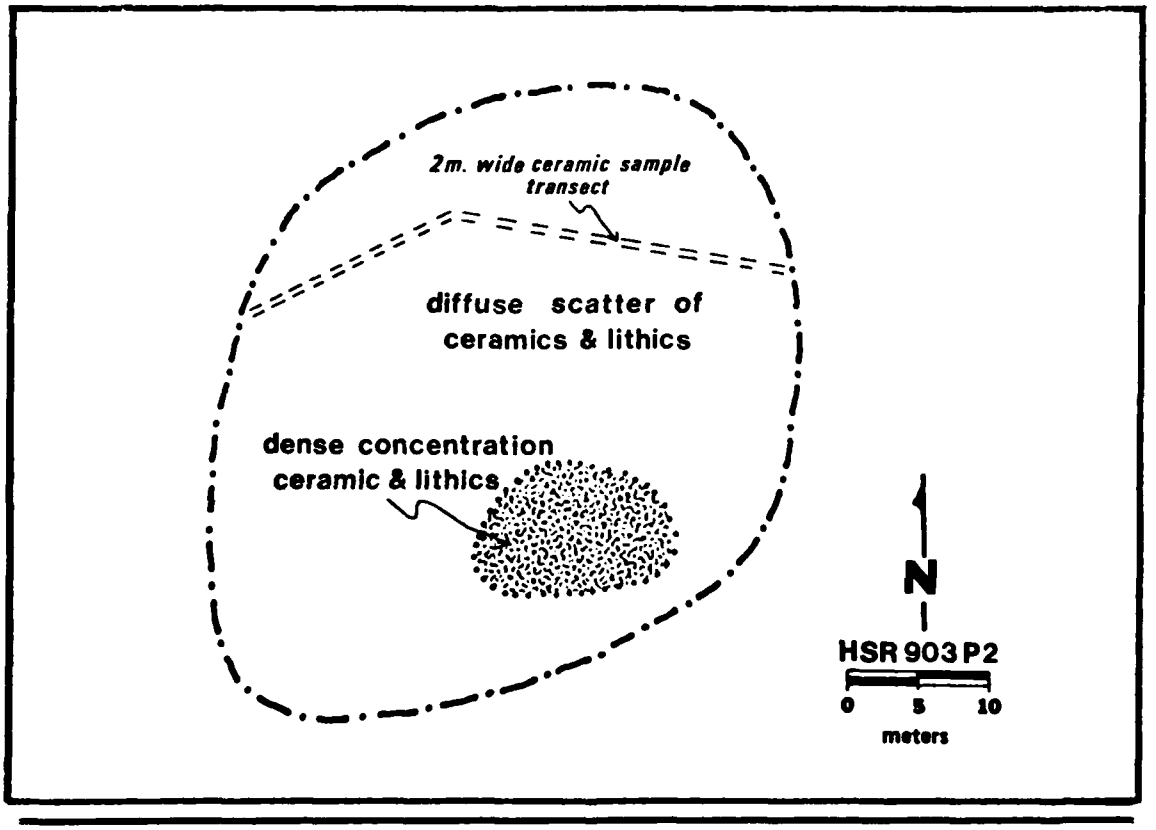
Maximum Length (longest axis): 50 m
Orientation (longest axis): 40^0
Maximum Width: 40 m
Estimated Maximum Area: 2000 m^2
Maximum Depth: 0.50 m
Number of Hearths: 0
Number of Structures: 0

Description: This scatter lies among low hummocks on a slight rise in the alluvial flats along the north side of the Target Reservoir drainage to the west of the Rio Puerco.

Architecture: There is no direct evidence of structures on this prehistoric site. One raised area within the site has the appearance of being a structural mound, but neither evidence of burned adobe nor rock elements of any kind were observed.

Flora: Galleta, Indian rice grass.

Score	
3	Cultural Litter Density: $33/m^2$
2	Preservation: Slight surface erosion, possibility of a buried structure.
1	Stratigraphy: At least partially intact.
2	Rarity: Typical of the period in this area.
0	Aesthetics: No unusual features.
0	Restoration Potential: No obvious potential suggested by surface remains.
0	Educational Potential: Relatively inaccessible; localized.
8	TOTAL



HSR SITE NO: 903/P-3
LA NUMBER: 20903

Stratification Zone: E
Elevation: 4920 feet; 1500 meters
Slope: 1%
Aspect: 110°
Temporal Horizon: Unknown
Cultural Litter Density: 18/m²
Lithic Pattern: 1

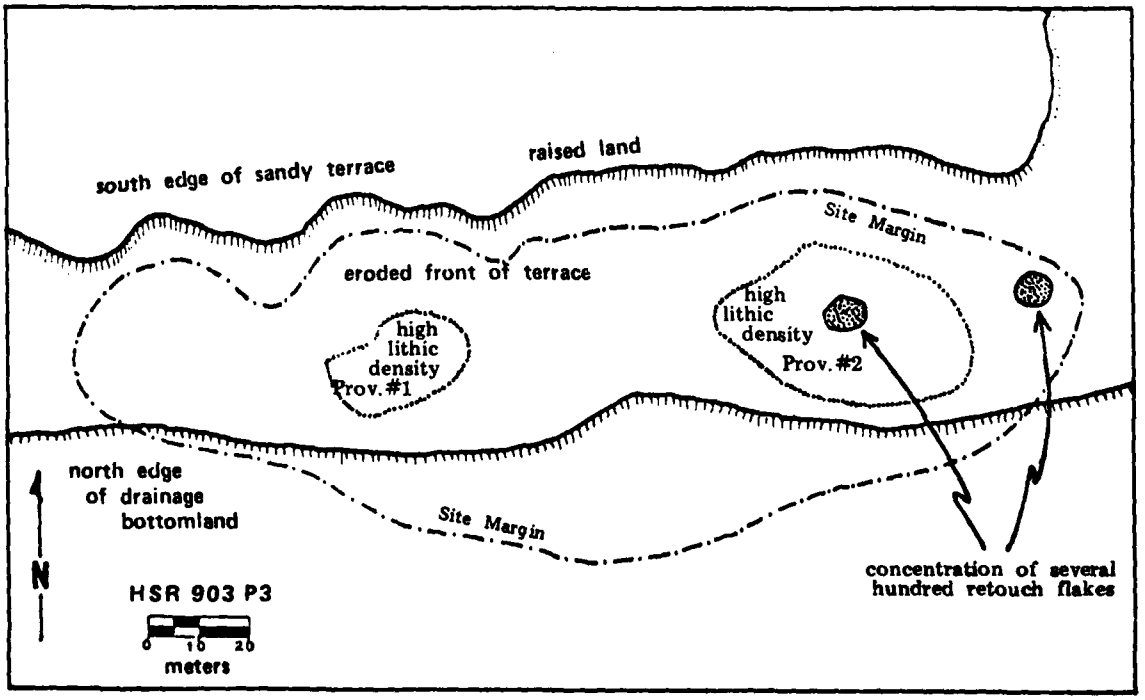
Maximum Length (longest axis): 200 m
Orientation (longest axis): 65°
Maximum Width: 60 m
Estimated Maximum Area: 10,000 m²
Maximum Depth: 0.25 m
Number of Hearths: 2
Number of Structures: 0

Description: This site is located at the southern edge of a slightly raised, hummocked, bottomland terrace. South of the site, slightly depressed land has the appearance of a playa, although it is actually a broad flat drainage bottom.

Architecture: Although there are two very limited areas of high density of cultural materials within this site, there is no direct evidence of structure on the surface.

Flora: Galleta, Indian rice grass, broom snakeweed, Russian thistle, four-wing saltbush, sacaton.

Score	
2	Cultural Litter Density: 18/m²
1	Preservation: Actively eroding from the bank of a minor drainage.
2	Stratigraphy: Estimated depth of deposits at least 25 cm; may contain hearths.
3	Rarity: Few similar sites encountered; may be Archaic period.
0	Aesthetics: No unusual features.
0	Restoration Potential: Probably an open site, partially destroyed by erosion.
2	Educational Potential: Large amount of cultural material may represent a significant study collection.
10	TOTAL



HSR SITE NO: 903/P-4
LA NUMBER: 20904

Stratification Zone: G
Elevation: 5020 feet; 1530 meters
Slope: 3-5%
Aspect: 30°
Temporal Horizon: Late P-II/Early P-III
Cultural Litter Density: 27/m²
Lithic Pattern: —

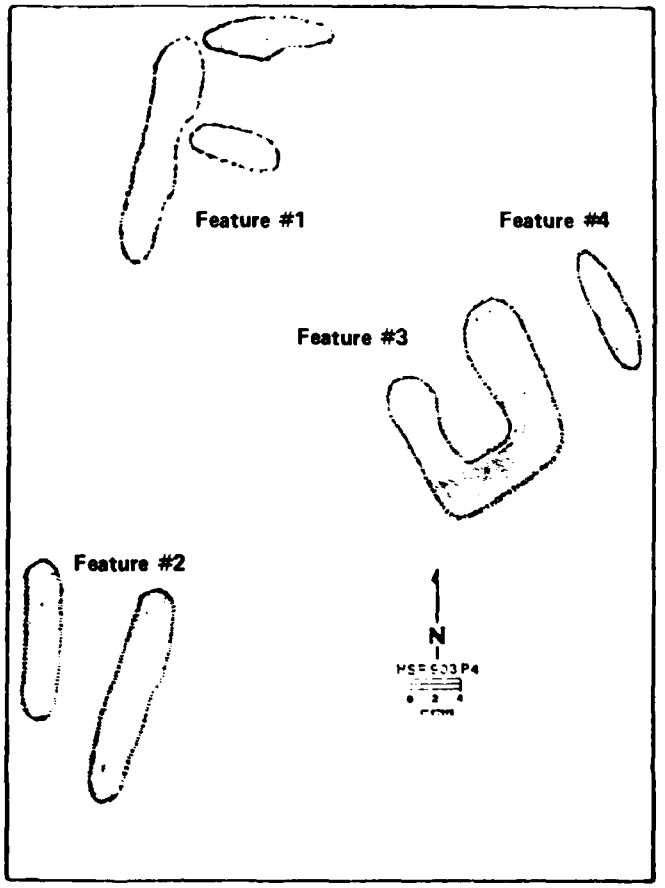
Maximum Length (longest axis): 70 m
Orientation (longest axis): 10°
Maximum Width: 45 m
Estimated Maximum Area: 5000 m²
Maximum Depth: 2.0 m
Number of Hearths: 0
Number of Structures: 4

Description: This pueblo village lies on the first sandy terrace above the valley bottom. This terrace has eroded along the edge into low rolling sand hills.

Architecture: At least three roomblocks of adobe, and in some cases mixed adobe and rock elements, surround what appears to be a sizeable plaza area (approximately 25 m x 35 m). In the east central area of the *plaza* a vandalized depression area approximately 4 m in diameter suggests the presence of a kiva. Approximately 10 m east of the kiva is an adobe and sparsely mixed masonry element mound 2 m wide and 10 m long (estimated five rooms). At the northwest corner of the plaza is another roomblock of similar materials which is 17 m long and 2 m wide (estimated eight rooms). Extending east from the center and north end of this roomblock are two slightly disconnected (approximately 1 m separates them from the long mound) additional small roomblocks. The northern one is approximately 10 m long and 2 m wide (five rooms). The central one is 7 m long and 2 m wide (estimated three rooms). A final roomblock actually appears, from surface indications, to be two parallel structures both oriented north to south, with a 4 m space between the two units. The eastern unit is approximately 3 m wide and 16 m long (estimated eight rooms). The western unit is 6 m long x 2 m wide (three rooms). Extensive evidence of vandalism to all observed structures was noted.

Flora: Broom snakeweed, indigo bush, galleta, Indian rice grass.

Score	
3	Cultural Litter Density
1	Preservation: Site has been heavily pothunted although some rooms are probably still intact.
1	Stratigraphy: Disturbed in many places; may be up to 1 m in depth.
2	Rarity: Apparently similar to small villages excavated during pipeline survey.
2	Aesthetics: In a commanding position with an excellent view of the Puerco valley.
1	Restoration Potential: Adobe masonry combined with heavy vandalism probably preclude significant restor.
2	Educational Potential: Potential study collections.
12	TOTAL



HSR SITE NO: 903/P-5
LA NUMBER: 20905

Stratification Zone: D-J
Elevation: 4900 feet; 1494 meters
Slope: 3%
Aspect: 110^0
Temporal Horizon: BM-III
Cultural Litter Density: $3/m^2$
Lithic Pattern: --

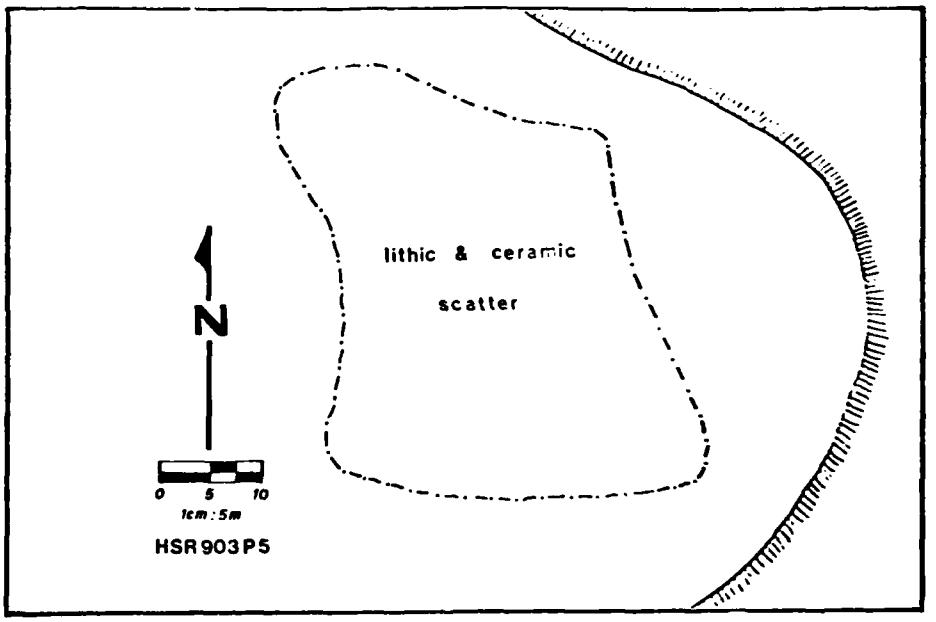
Maximum Length (longest axis): 56 m
Orientation (longest axis): 320^0
Maximum Width: 41 m
Estimated Maximum Area: 2000 m^2
Maximum Depth: 0.25 m
Number of Hearths: 0
Number of Structures: 0

Description: This site occupies the point of a low gravel ridge which descends from a higher east-west ridge. Large gravels are scattered on the surface of this main ridge, and smaller gravels are sorted down the side ridge toward the site.

Architecture: A dark stain in the soil of the ridgetop and slightly down the side suggests the presence of hearths or possibly a burned structure, but no direct evidence of either was observed.

Flora: Broom snakeweed, narrowleaf yucca, galleta, four-wing saltbush.

Score	
1	Cultural Litter Density: $3/m^2$
3	Preservation: Only slightly eroded; any pithouse structures or hearths would probably be well preserved.
2	Stratigraphy: Could not be determined, although site deposits appear to be intact.
3	Rarity: Relatively unusual in the study area.
1	Aesthetics: Position on a low ridge near a well and homestead could offer an enjoyable setting for interpretation.
0	Restoration Potential: Probably no restorable structures.
3	Educational Potential: Apparent intact condition; easy access and rarity of sites from this period make site ideal for future study.
13	TOTAL



HSR SITE NO: 903/P-6
LA NUMBER: 20906

Stratification Zone: D-K
Elevation: 4825 feet; 1471 meters
Slope: 1%
Aspect: 110^0
Temporal Horizon: P-III
Cultural Litter Density: $20/m^2$
Lithic Pattern: 1

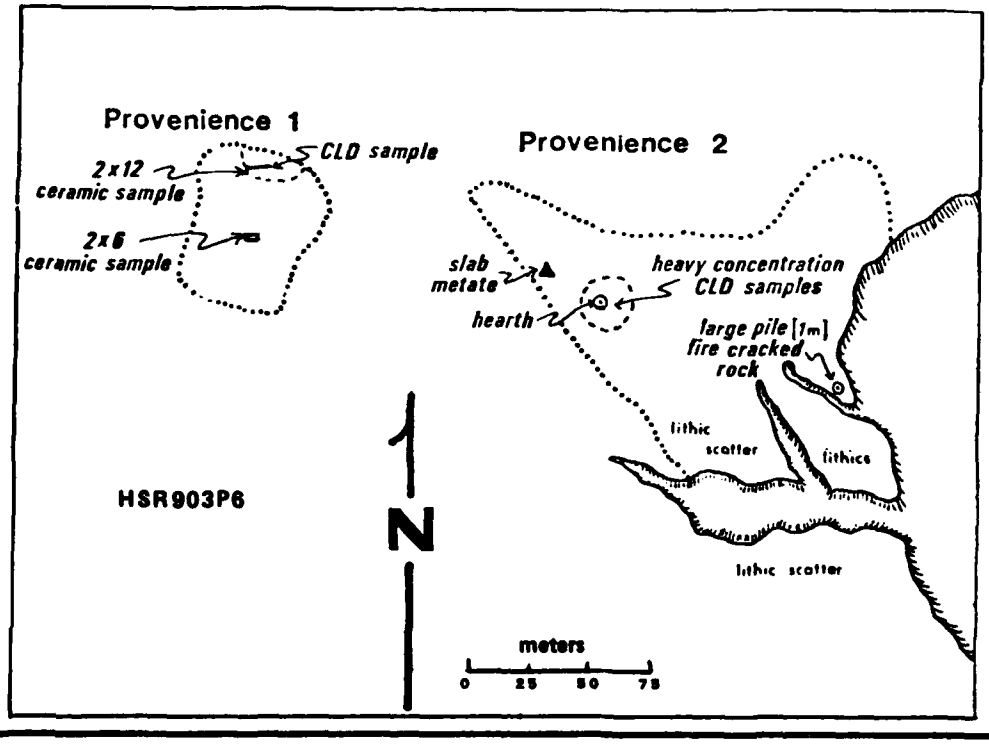
Maximum Length (longest axis): 330 m
Orientation (longest axis): 115^0
Maximum Width: 150 m
Estimated Maximum Area: 15,000 m^2
Maximum Depth: 0.50 m
Number of Hearths: 4
Number of Structures: 0

Description: This scatter is exposed at the upper (western) end, and along the southern and lower (eastern) end of a low sand ridge along the west side of the Rio Puerco. The immediate vicinity forms the point of valley bottomland which is cut one-half mile to the south by Alamito Arroyo near its confluence with the main channel.

Architecture: No direct evidence of domicile structure was observed on this site. The western provenience of the site is in sand hummock and blow area. High densities are recorded here, and although sand may well cover structural evidence, no support for such a contention was found. A total of 4 hearth areas were observed. Two of these were dispersed stains with a few fire-cracked rocks, but the other two were very marked concentrations of fire-cracked rock (estimated 40 fragments per m^2). Both hearths are contained in approximately 1.5 m^2 areas.

Flora: Four-wing saltbush, sacaton, broom snakeweed, Russian thistle.

Score	
2	Cultural Litter Density: $19/m^2$
2	Preservation: Eroded with some preserved areas.
1	Stratigraphy: Probably shallow.
2	Rarity: Typical of scatters in study area.
0	Aesthetics: No unusual features.
0	Restoration Potential: Probably no structures.
2	Educational Potential: Potential study collections.
9	TOTAL



HSR SITE NO: 903/P-7
LA NUMBER: 20907
ACE NO: 01

Stratification Zone: D-K
Elevation: 4820 feet; 1469 meters
Slope: <1%
Aspect: 90°
Temporal Horizon: Archaic?
Cultural Litter Density: 17/m²
Lithic Pattern: –

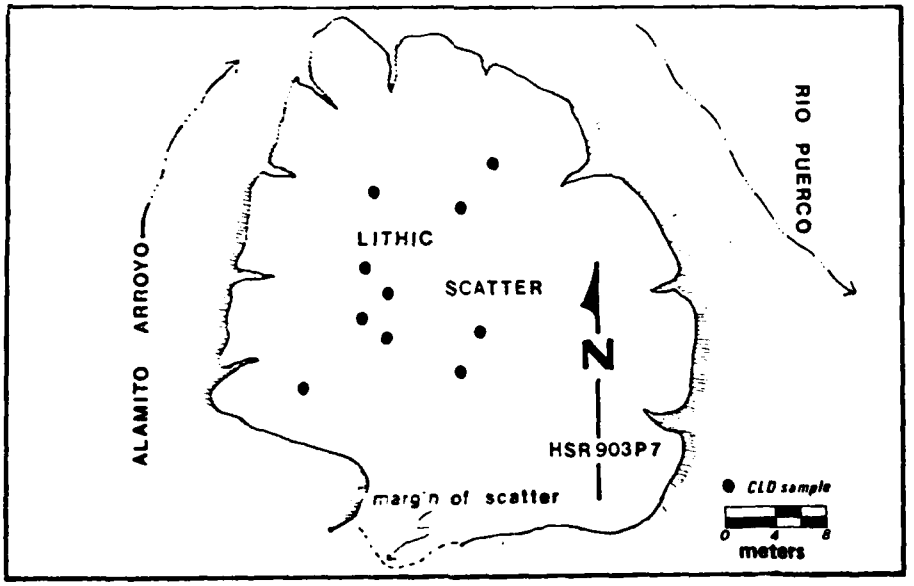
Maximum Length (longest axis): 46 m
Orientation (longest axis): 326°
Maximum Width: 36 m
Estimated Maximum Area: 800 m²
Maximum Depth: 0.50 m
Number of Hearths: 2
Number of Structures: 0

Description: This site is located on the south point at the confluence of Alamito Arroyo with the Rio Puerco. The arroyo bank is approximately 8 m high, and the top meter is a gray-green remnant left at the very point of the old valley fill.

Architecture: The entire site consists of a dark gray stained area directly overlying a light gray-green, sandy soil deposit. Heavily burned areas are observable in two locations and appear to be hearths. Fire-cracked rock is associated with these two locations and sparsely scattered across the site, suggesting that several other hearths may have been present on the site prior to erosion.

Flora: Four-wing saltbush.

Score	
2	Cultural Litter Density: 17/m²
2	Preservation: Although the surface is eroded, considerable subsurface remains are in situ; threatened by Puerco.
2	Stratigraphy: Remaining stratigraphy probably in situ.
3	Rarity: Suspected Archaic sites are not common in study area.
0	Aesthetics: No unusual features.
0	Restoration Potential: Site is actively threatened by the main channel of the Puerco.
2	*Educational Potential:* Potential study collections.
11	TOTAL



HSR SITE NO: 903/P-8
LA NUMBER: 20908
ACE NO: 01

Stratification Zone: D-K
Elevation: 4815 feet; 1468 meters
Slope: <1%
Aspect: 110°
Temporal Horizon: P-I
Cultural Litter Density: 48/m²
Lithic Pattern: 2

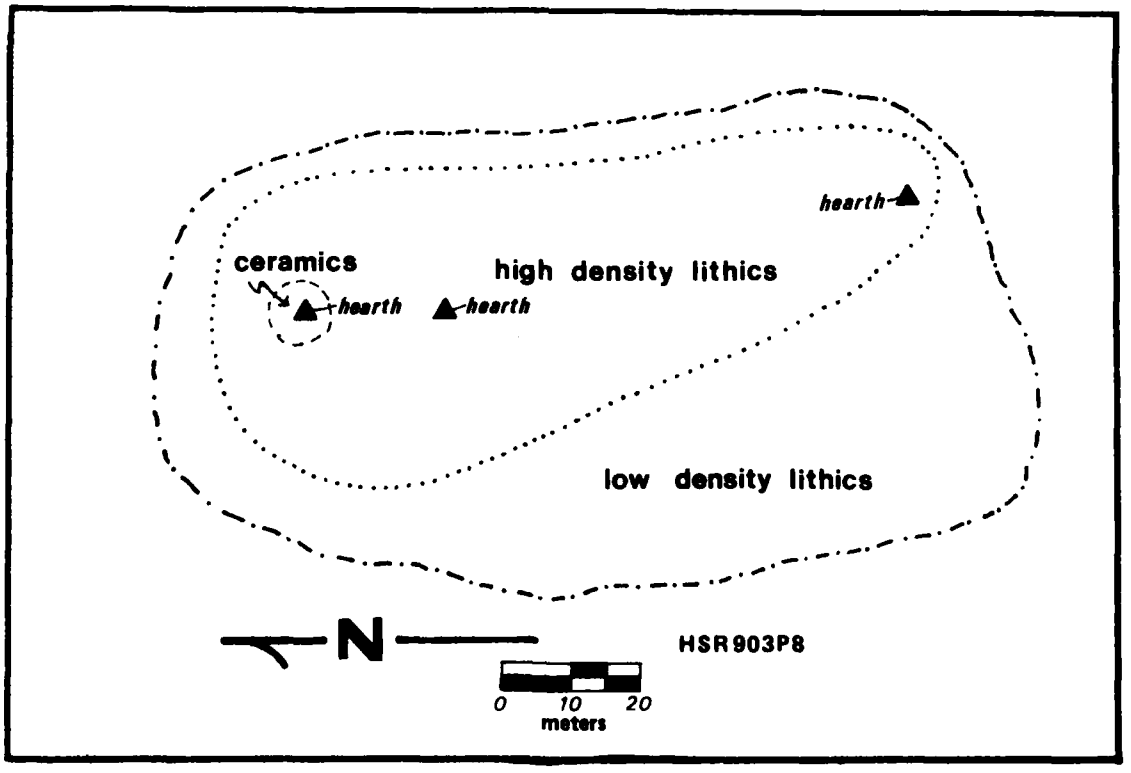
Maximum Length (longest axis): 130 m
Orientation (longest axis): 0°
Maximum Width: 70 m
Estimated Maximum Area: 9000 m²
Maximum Depth: 0.30 m
Number of Hearths: 3
Number of Structures: 0

Description: This site lies in a slight swale just west and above the Rio Puerco channel cut, below the confluence of Alamito Arroyo.

Architecture: Three distinct hearths approximately 1 m in area each were observed at this site. Fire-cracked rock at approximately 15/m² is present at each hearth. No other structural indications were observed.

Flora: Four-wing saltbush, broom snakeweed, Russian thistle.

Score	
4	Cultural Litter Density: 48/m²
2	Preservation: Partially eroded; otherwise in good condition.
2	Stratigraphy: Probably 25-30 cm of depth.
2	Rarity: Typical of scatters in study area.
0	Aesthetics: No unusual features.
0	Restoration Potential: No structures apparent.
2	Educational Potential: Potential study collections.
12	TOTAL



HSR SITE NO: 903/P-9
LA NUMBER: 20909

Stratification Zone: C-D
Elevation: 4950 feet; 1509 meters
Slope: 2%
Aspect: 250°
Temporal Horizon: Late P-II/Early P-III
Cultural Litter Density: $<1/m^2$
Lithic Pattern: —

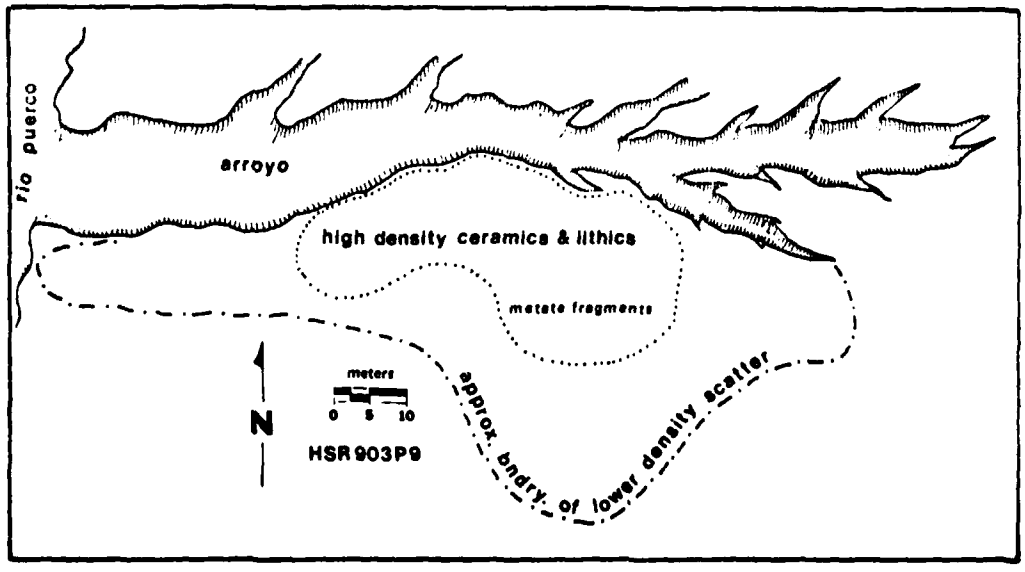
Maximum Length (longest axis): 110 m
Orientation (longest axis): 90°
Maximum Width: 50 m
Estimated Maximum Area: 2200 m^2
Maximum Depth: 0.50 m
Number of Hearths: 0
Number of Structures: 0

Description: This site is located along the lower edge of sandy bottomland at the east edge of the Rio Puerco channel.

Architecture: Fire-cracked rock is sparsely scattered across the site but there is no distinct hearth area or any other structural evidence.

Flora: Broom snakeweed, Russian thistle, four-wing saltbush.

Score	
0	Cultural Litter Density: $<1/m^2$
1	Preservation: Generally eroded, although some deposits may be intact.
0	Stratigraphy: Probably minimal.
2	Rarity: Typical of scatters in study area.
0	Aesthetics: No unusual features.
0	Restoration Potential: No restorable features.
2	Educational Potential: Potential study collections.
5	TOTAL



HSR SITE NO: 903/P-10
LA NUMBER: 20910

Stratification Zone: C-D
Elevation: 4945 feet; 1507 meters
Slope: 1%
Aspect: 200°
Temporal Horizon: P-I/Historic
Cultural Litter Density: <1/m²
Lithic Pattern: 1

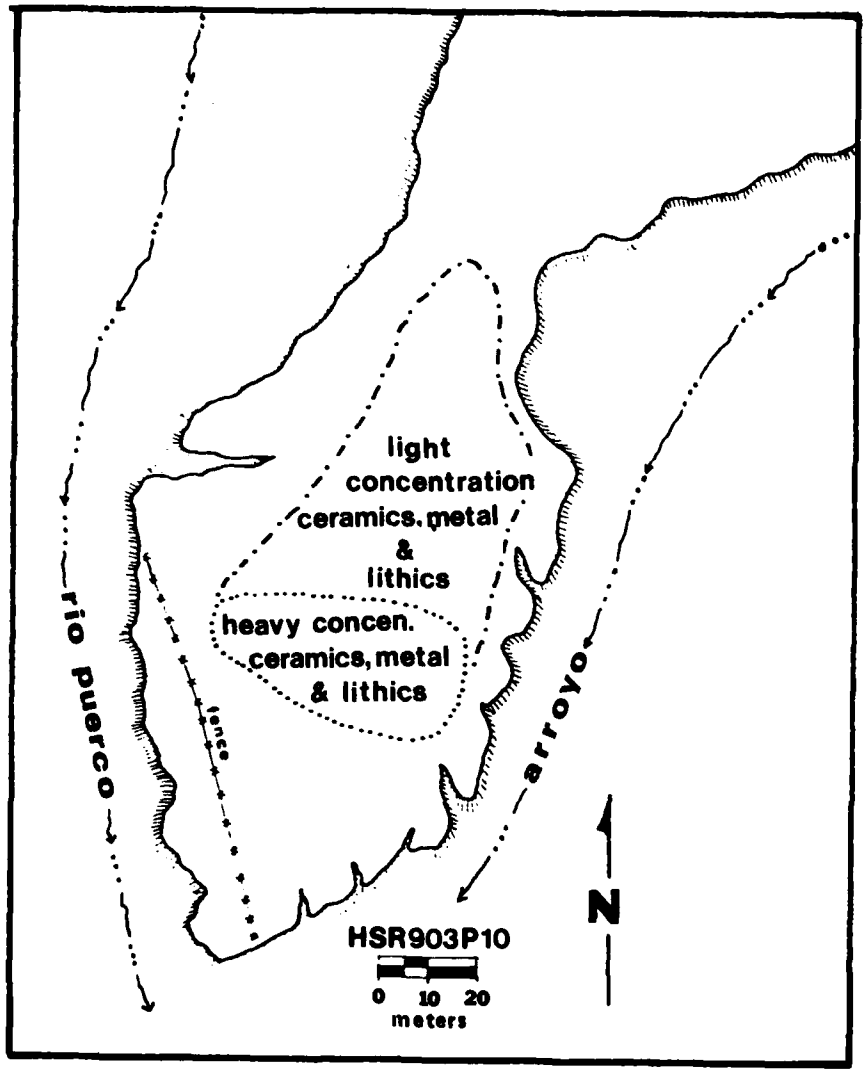
Maximum Length (longest axis): 100 m
Orientation (longest axis): 30°
Maximum Width: 50 m
Estimated Maximum Area: 2500 m²
Maximum Depth: 0.10 m
Number of Hearths: 0
Number of Structures: 0

Description: This scatter of lithics, ceramics and historic materials lies on a sizeable, bare island left between two deep arroyos flowing into the Rio Puerco from the east.

Architecture: This site has no indications of structures.

Flora: Four-wing saltbush, Russian thistle.

Score	
0	Cultural Litter Density: <1/m²
0	Preservation: Heavily eroded, most deposits are gone.
0	Stratigraphy: Probably none.
2	Rarity: Typical of scatters in study area.
0	Aesthetics: No unusual features
0	Restoration Potential: None.
2	Educational Potential: Historic materials may be of study interest.
4	TOTAL



HSR SITE NO: 903/P-11
LA NUMBER: 20911

Stratification Zone: C
Elevation: 5040 feet; 1536 meters
Slope: 15%
Aspect: 250°
Temporal Horizon: Unknown
Cultural Litter Density: <1/m²
Lithic Pattern: 4

Maximum Length (longest axis): 130 m
Orientation (longest axis): 250°
Maximum Width: 45 m
Estimated Maximum Area: 4500 m²
Maximum Depth: 0.0 m
Number of Hearths: 0
Number of Structures: 0

Description: This site lies along two low ridges composed of Santa Fe gravels and sand. The location appears to have a higher than average amount of chert, jasper, and chalcedony in large gravel cobbles. A number of cores of chalcedony, jasper, and chert are scattered along the surface of these low ridges which rise about 10 m above the surrounding alluvium.

Architecture: This is a quarry site; there is no indication of structure.

Flora: Four-wing saltbush, snakeweed, grasses.

Score	
0	Cultural Litter Density: <1/m²
0	Preservation: Materials exposed on surface.
0	Stratigraphy: None.
4	Rarity: Apparently a quarry area, unique in this sample.
0	Aesthetics: No unusual features.
0	Restoration Potential: None.
4	Educational Potential: Unique and significant study collection.
8	TOTAL

HSR SITE NO: 903/P-12
LA NUMBER: 20912

Stratification Zone: C-D
Elevation: 4925 feet; 1501 meters
Slope: <1%
Aspect: 270°
Temporal Horizon: P-I?
Cultural Litter Density: 2/m²
Lithic Pattern: 1

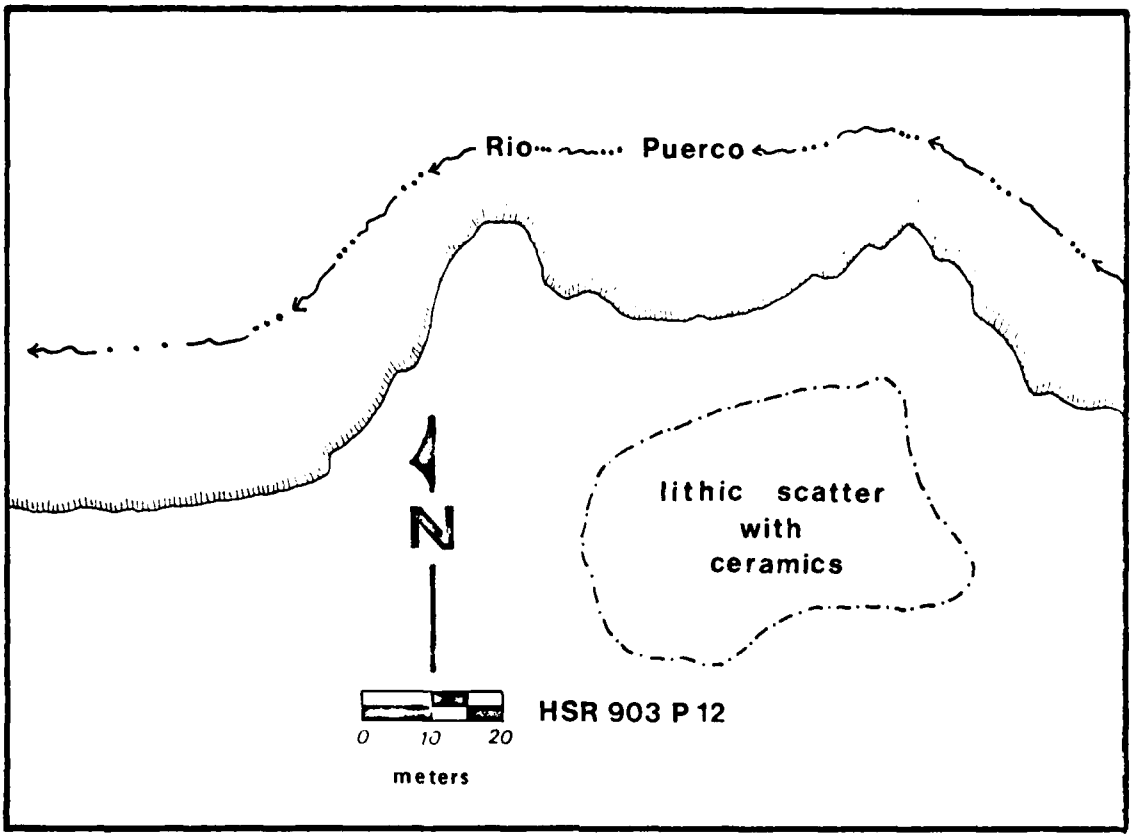
Maximum Length (longest axis): 55 m
Orientation (longest axis): 75°
Maximum Width: 32 m
Estimated Maximum Area: 1700 m²
Maximum Depth: 0.10 m
Number of Hearths: 0
Number of Structures: 0

Description: This scatter is located at a major meander along a south-facing portion of the east bank of the Rio Puerco. These soils are heavily sheet eroded floodlands.

Architecture: This ceramic and lithic scatter has no indication of hearths or other structures.

Flora: Tamarisk, broom snakeweed, Russian thistle, four-wing saltbush.

Score	
1	Cultural Litter Density: 2/m²
0	Preservation: Heavily eroded.
1	Stratigraphy: Probably less than 10 cm of remaining deposits.
2	Rarity: Typical of scatters in study area.
0	Aesthetics: No unusual features.
0	Restoration Potential: None.
2	Educational Potential: Potential study collections.
6	TOTAL



HSR SITE NO: 903/P-13
LA NUMBER: 20913

Stratification Zone: C-D
Elevation: 4850 feet; 1478 meters
Slope: 2%
Aspect: 250°
Temporal Horizon: P-I?
Cultural Litter Density: <1/m²
Lithic Pattern: 3

Maximum Length (longest axis): 23 m
Orientation (longest axis): 20°
Maximum Width: 18 m
Estimated Maximum Area: 40 m²
Maximum Depth: 0.20 m
Number of Hearths: 0
Number of Structures: 0

Description: Lithic materials are concentrated in a small area of exposed soils just west of and below the edge of the main arroyo on a small, low island in a large deposit of modern alluvium. This location is set in the mouth of a modern arroyo which cuts the main Rio Puerco arroyo bank at an old meander along the western margin of the main channel.

Architecture: There are no structural indications at this site.

Flora: Russian thistle, four-wing saltbush, tamarisk.

Score	
0	Cultural Litter Density: <1/m²
2	Preservation: Partially eroded.
1	Stratigraphy: Although materials appear to be in place, deposits are thin; probably 10-20 cm in depth.
2	Rarity: Typical of scatters in study area.
0	Aesthetics: No unusual features.
0	Restoration Potential: None.
2	Educational Potential: Potential study collections.
7	TOTAL

HSR SITE NO: 903/P-14
LA NUMBER: 20914

Stratification Zone: C-D
Elevation: 4860 feet; 1481 meters
Slope: <1%
Aspect: 180^0
Temporal Horizon: Unknown
Cultural Litter Density: $14/m^2$
Lithic Pattern: 2

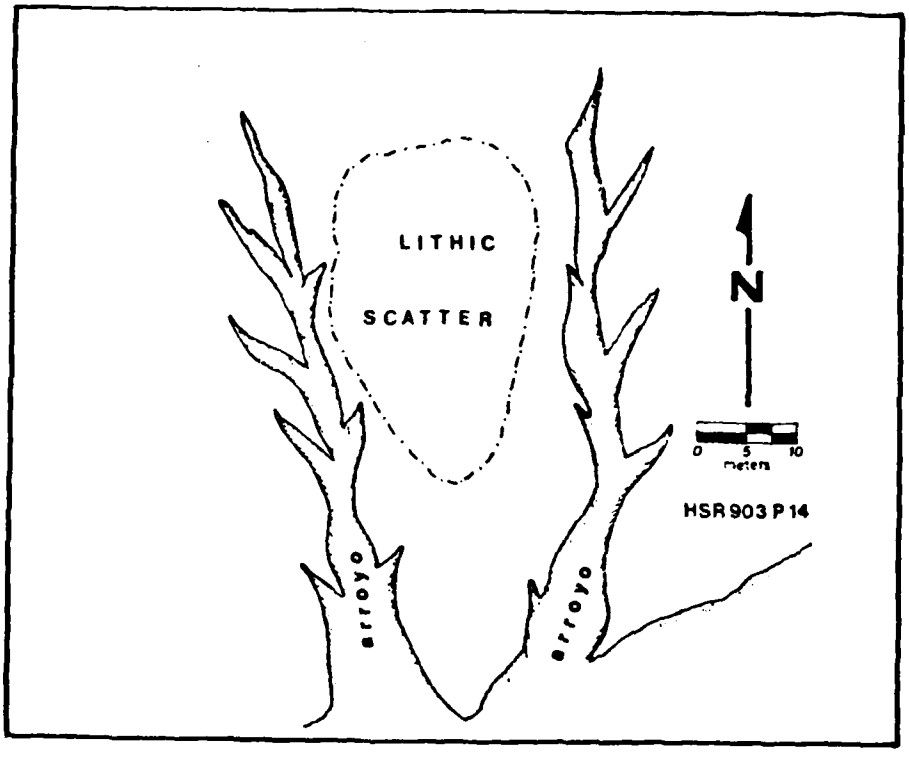
Maximum Length (longest axis): 33 m
Orientation (longest axis): 358^0
Maximum Width: 19 m
Estimated Maximum Area: $600\ m^2$
Maximum Depth: 0.50 m
Number of Hearths: 0
Number of Structures: 0

Description: This site is located near the edge of the east side of the Rio Puerco channel, about 75 m northeast of a major meander along the lower floodplain. Arroyo cuts surrounding the site suggest a possible pond situation immediately west of the site during the past.

Architecture: There are no structural indications at this site.

Flora: Russian thistle, four-wing saltbush, broom snakeweed.

Score	
2	Cultural Litter Denisty: $14/m^2$
2	Preservation: Generally eroded.
1	Stratigraphy: Minimal deposits.
2	Rarity: Typical of scatters in study area.
0	Aesthetics: No unusual features.
0	Restoration Potential: None.
2	Educational Potential: Potential study collections.
9	TOTAL



HSR SITE NO: 903/P-15
LA NUMBER: 20915

Stratification Zone: C
Elevation: 4900 feet; 1493 meters
Slope: 2%
Aspect: 25°
Temporal Horizon: P-II
Cultural Litter Density: 15/m^2
Lithic Pattern: 3

Maximum Length (longest axis): 80 m
Orientation (longest axis): 250°
Maximum Width: 40 m
Estimated Maximum Area: 2800 m^2
Maximum Depth: 0.30 m
Number of Hearths: 0
Number of Structures: 1

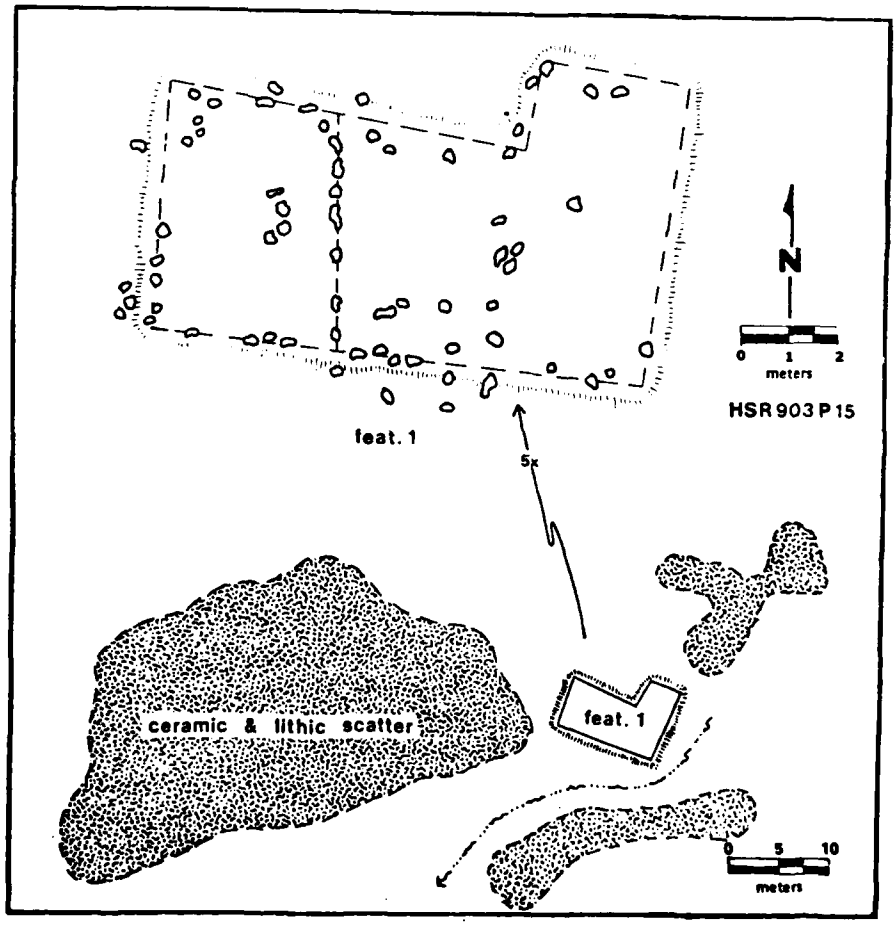
Description: This site lies near the top of a sandy hill which has formed as alluvium deposited on a structural ridge which extends from the east side of the valley into the valley floor, effectively narrowing the valley width at this point on the east side of the Puerco.

Architecture: An estimated three room pueblito is present on this site. The roomblock is outlined by a single course of sandstone, basalt, and conglomerate clasts suggesting the possibility that the major construction technique was jacal. The three rooms are estimated at 3 x 4, 3 x 3, and 3 x 5 meters, and are constructed in an L-shape with two rooms on one arm and one room extending to the north of the east-west alignment of the other two.

Flora: Broom snakeweed, four-wing saltbush, indigo bush, narrowleaf yucca, juniper.

Score

2	Cultural Litter Density: 15/m^2
3	Preservation: Well preserved, recommended mitigation.
2	Stratigraphy: Deposits generally in situ; estimated 30 cm deep.
3	Rarity: Such a well preserved structural site is uncommon in the study area.
0	Aesthetics: No unusual feat's.
1	Restoration Potential: Visible structures are probably not restorable.
3	Educational Potential: Excellent opportunity for study of small P-II residence units in the study area.
14	TOTAL



HSR SITE NO: 903/P-16
LA NUMBER: 20916

Stratification Zone: C
Elevation: 4915 feet; 1498 meters
Slope: 1-10%
Aspect: 250°
Temporal Horizon: P-II
Cultural Litter Density: 8/m²
Lithic Pattern: 3

Maximum Length (longest axis): 90 m
Orientation (longest axis): 0°
Maximum Width: 50 m
Estimated Maximum Area: 3000 m²
Maximum Depth: 0.50 m
Number of Hearths: 1
Number of Structures: 4

Description: This site occupies the flat top of the lowest gravel terrace just above the sandy alluvium on the east side of the Puerco. The location overlooks the alluvium and floodplain lowlands just north of the confluence of Alamito Arroyo.

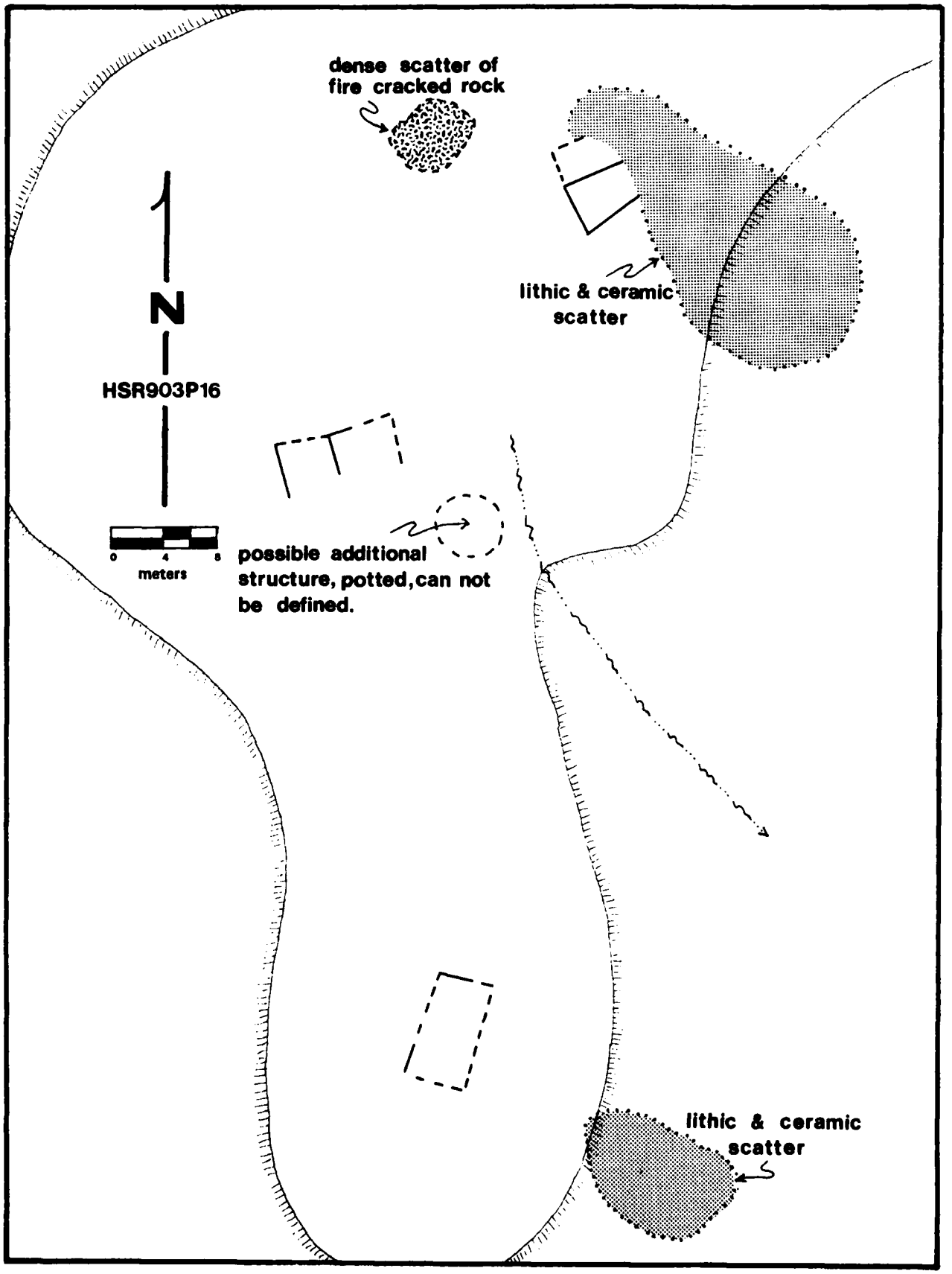
Architecture: At least three small roomblocks are present in this site. Walls are defined by single course alignments of sandstone, conglomerate and basalt. All three of the roomblocks appear to have two rooms each. There appears to be no organized plan of placement of roomblocks other than the availability of reasonably level places on the ridgetop. In addition to the three locations evidenced by masonry elements, another feature exposed by the head of a small drainage course might possibly represent a small jacal room. Likewise, the single-course wall alignments of the masonry roomblocks would suggest that the majority of the actual wall structures were originally of jacal. At least seven rooms are represented in this site.

Flora: Broom snakeweed, Indian rice grass, juniper.

Score	
1	Cultural Litter Density: 8/m²
2	Preservation: Although several potholes are evident, site is in good condition, with walls in place.
2	Stratigraphy: In generally good condition.
3	Rarity: P-II residence sites of this size are uncommon in this sample.
1	Aesthetics: Elevated location.
2	Restoration Potential: Structures may be restorable.
3	Educational Potential: Worthwhile for mitigation and future study.
14	TOTAL

Photo 35: Northwest structure at Site HSR903/P-16

At least two rooms, possibly three, are present in this structure with walls indicated by vertical slabs in double lines exposed in two places. Construction may have been of plastered vertical posts, or jacal, with the rock elements acting as foundation for plastering.


dense scatter of fire cracked rock
lithic & ceramic scatter
N
HSR903P16
0 4 8
meters
possible additional structure, potted, can not be defined.
lithic & ceramic scatter

HSR SITE NO: 903/P-17
LA NUMBER: 20917

Stratification Zone: C
Elevation: 4860 feet; 1481 meters
Slope: 2%
Aspect: 250°
Temporal Horizon: P-II
Cultural Litter Density: 9/m²
Lithic Pattern: 3

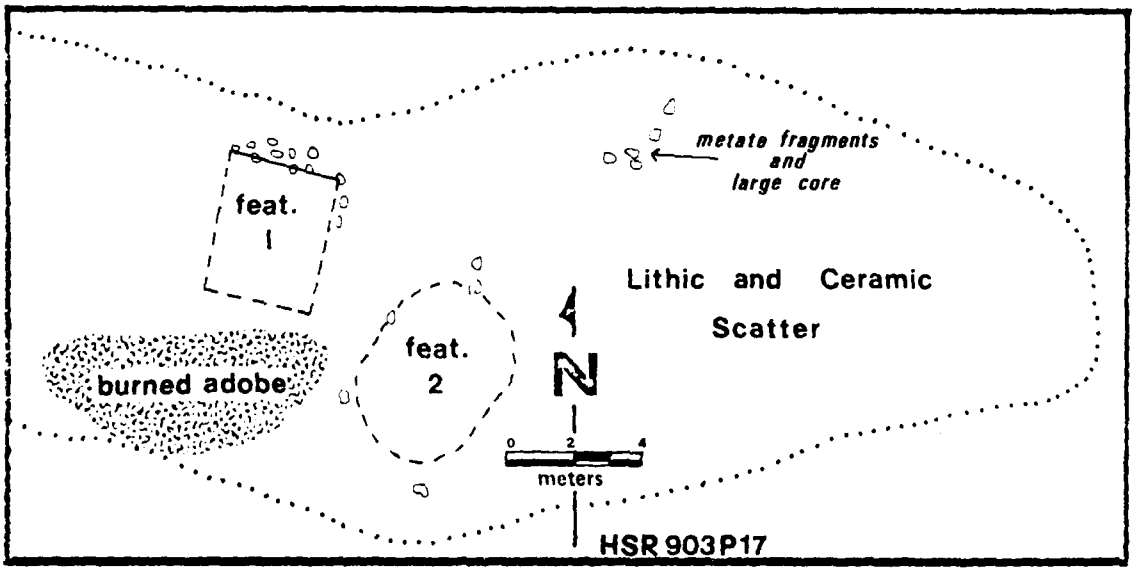
Maximum Length (longest axis): 60 m
Orientation (longest axis): 90°
Maximum Width: 15 m
Estimated Maximum Area: 800 m²
Maximum Depth: 0.50 m
Number of Hearths: 0
Number of Structures: 2

Description: This site occupies a low sandy rise at the eastern edge of the east side Rio Puerco floodplain. It is located just north and opposite the confluence of Alamito Arroyo.

Architecture: Possibly as many as four jacal rooms are evidenced in two slightly mounded structural features on this site. At least one of these rooms is evidenced by partial alignments of single courses of masonry elements. Further evidence of the nature of construction are a number of sizeable fragments of burned adobe showing latilla casts. Outside measurements of the two features are 3 x 4 and 4 x 5 meters (approximate).

Flora: Mixed grasses, broom snakeweed, four-wing saltbush.

Score	
1	Cultural Litter Density: 9/m²
3	Preservation: Slight surface erosion, otherwise site is well preserved.
2	Stratigraphy: In good condition.
3	Rarity: P-II residence sites in good condition are uncommon in this sample.
0	Aesthetics: No unusual features.
1	Restoration Potential: Structures are probably jacal and not restorable.
3	Educational Potential: Worthwhile for mitigation and future study.
13	TOTAL



HSR SITE NO: 903/P-18
LA NUMBER: 20918

Stratification Zone: C-E
Elevation: 5020 feet; 1530 meters
Slope: 5%
Aspect: 240^0
Temporal Horizon: P-II
Cultural Litter Density: $<1/m^2$
Lithic Pattern: 2

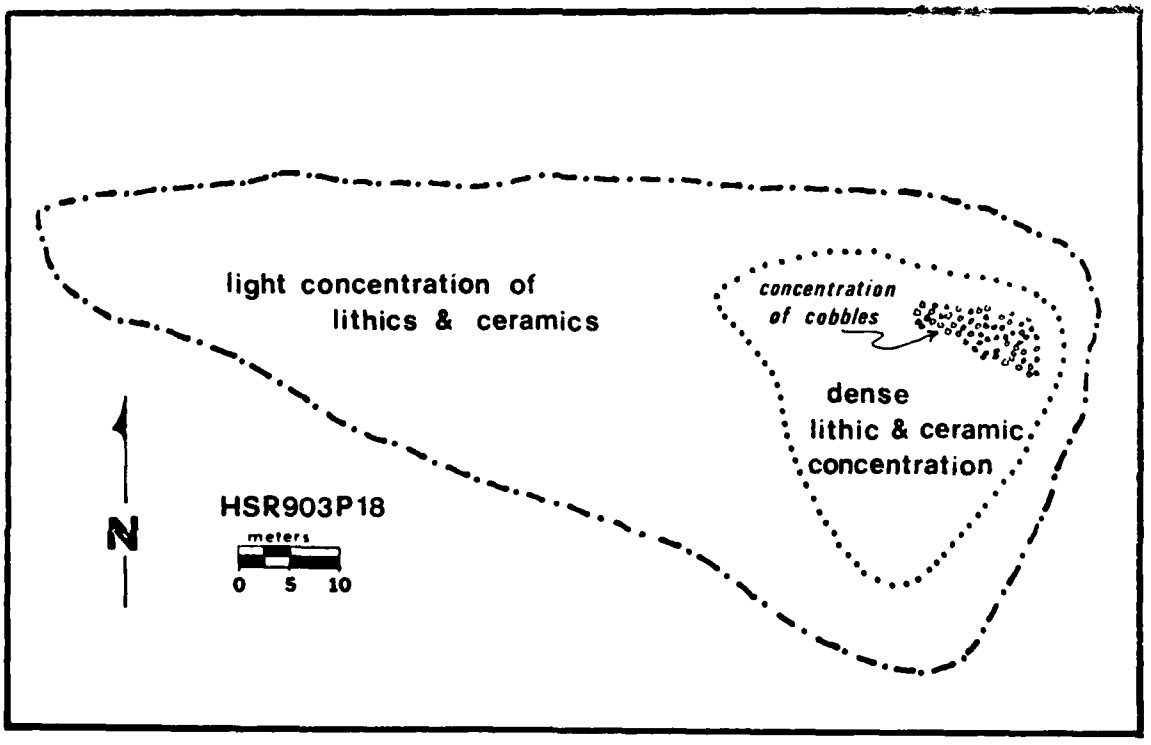
Maximum Length (longest axis): 105 m
Orientation (longest axis): 100^0
Maximum Width: 45 m
Estimated Maximum Area: 2400 m^2
Maximum Depth: 0.50 m
Number of Hearths: 1?
Number of Structures: ?

Description: Ceramics and lithics are distributed at the base and on the slope of a sandy hill, or terrace, facing the Rio Puerco to the west. Sand from alluvial deposits in the valley below has blown up the face of a structural ridge creating a sandy hill front.

Architecture: A concentration of stream cobble rock elements ranging from approximately 15-20 cm in maximum dimension are densely concentrated on the top of a sand covered ridge. Although the basic appearance is one of a single large hearth with approximately 400 cobble elements, less than .1% appear to evidence burning. The rocks do not clearly define a structure but the presence of a masonry room below the sand deposits appears to be the best explanation of these rocks. No other evidence of structure is present on the surface.

Flora: Indigo bush, broom snakeweed, mixed grasses.

Score	
0	Cultural Litter Density: $<1/m^2$
3	Preservation: Erosion in the past seems minimal; site surface is actively aggrading.
2	Stratigraphy: Apparently in good condition.
3	Rarity: Sites which may have preserved structural remains are uncommon in this sample.
0	Aesthetics: No unusual features.
2	Restoration Potential: A restorable structure may exist.
3	*Educational Potential: Worthwhile for excavation and study.*
13	TOTAL



HSR SITE NO: 903/P-19
LA NUMBER: 20919

Stratification Zone: C
Elevation: 5060 feet; 1542 meters
Slope: 2%
Aspect: 230°
Temporal Horizon: Late P-I
Cultural Litter Density: 19/m^2
Lithic Pattern: 3

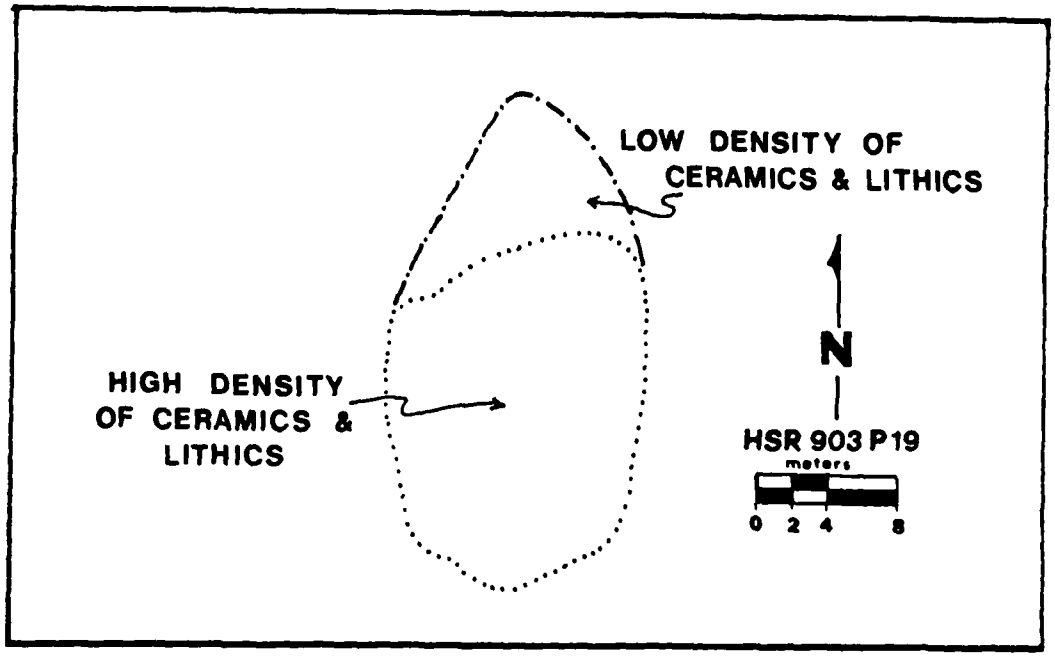
Maximum Length (longest axis): 28 m
Orientation (longest axis): 2°
Maximum Width: 14 m
Estimated Maximum Area: 350 m^2
Maximum Depth: 0.50 m
Number of Hearths: 0
Number of Structures: 0

Description: This site is located in a small blow about half-way up the slope of a low sandy hill at the top of steep sandy alluvial deposits on the east side of the Rio Puerco.

Architecture: Two dark stained areas probably representing hearths in the hardpan of a blow area are the only evidence of structure at this site.

Flora: Indigo bush, broom snakeweed, mixed grasses.

Score	
2	Cultural Litter Density: 19/m^2
3	Preservation: Only a small portion of the site seems to be exposed; substantial deposits are suspected below the sand.
3	Stratigraphy: Probably in excellent condition.
2	Rarity: Buried condition of site makes this judgement difficult.
0	Aesthetics: No unusual features.
0	Restoration Potential: Unknown.
4	Educational Potential: Potential for an intact site are excellent.
14	TOTAL



HSR SITE NO: 903/P-20
LA NUMBER: 20920

Stratification Zone: D
Elevation: 5000 feet; 1524 meters
Slope: 1%
Aspect: 190°
Temporal Horizon: P-IV, Glaze A
Cultural Litter Density: 11/m^2
Lithic Pattern: 2

Maximum Length (longest axis): 60 m
Orientation (longest axis): 140°
Maximum Width: 25 m
Estimated Maximum Area: 1200 m^2
Maximum Depth: 0.10 m
Number of Hearths: 0
Number of Structures: 0

Description: This site is located on the floodplain at the north side of the Rio Puerco (the easterly bank) just off the edge of the present channel, and south of an older filled channel.

Architecture: There is no indication of structure on this site.

Flora: Russian thistle, four-wing saltbush.

Score	
1	Cultural Litter Density: 11/m^2
0	Preservation: Substantial erosion has resulted in poor condition.
1	Stratigraphy: Examination of arroyo bank failed to show evidence of stratigraphy.
3	Rarity: Early glaze sites, especially open sites, seem to be unusual.
0	Aesthetics: No unusual features.
0	Restoration Potential: None.
2	Educational Potential: Potential study collections.
7	TOTAL

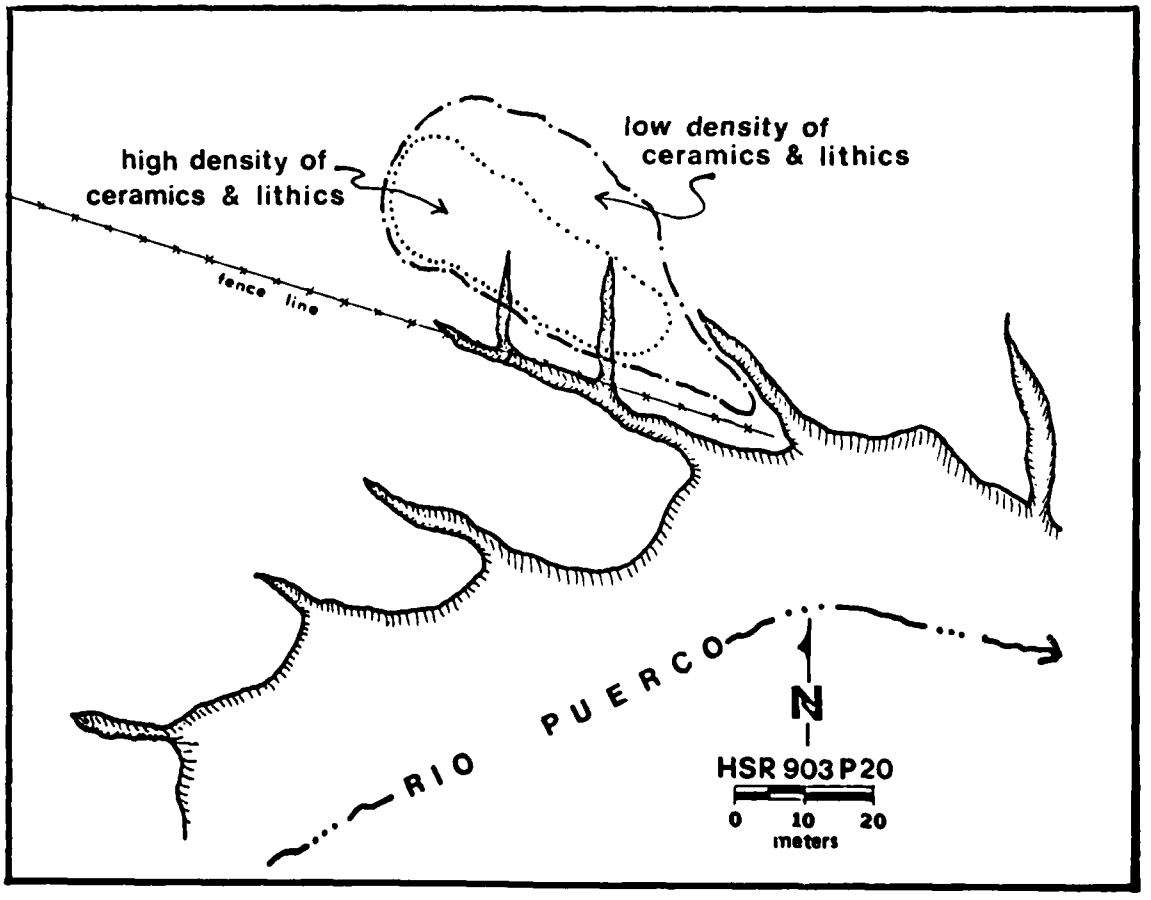
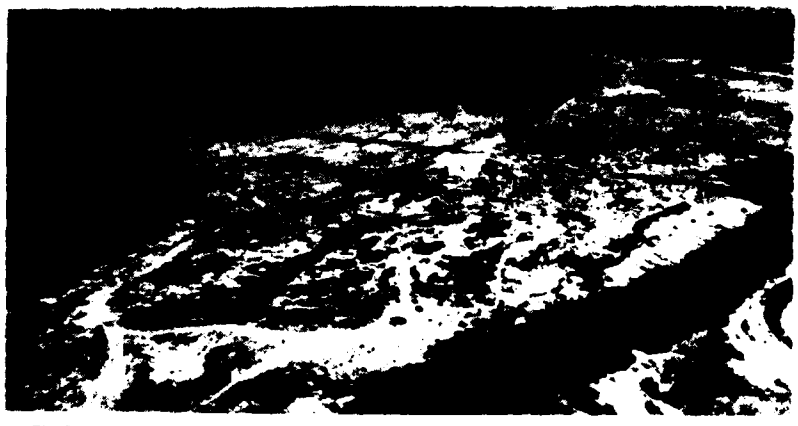
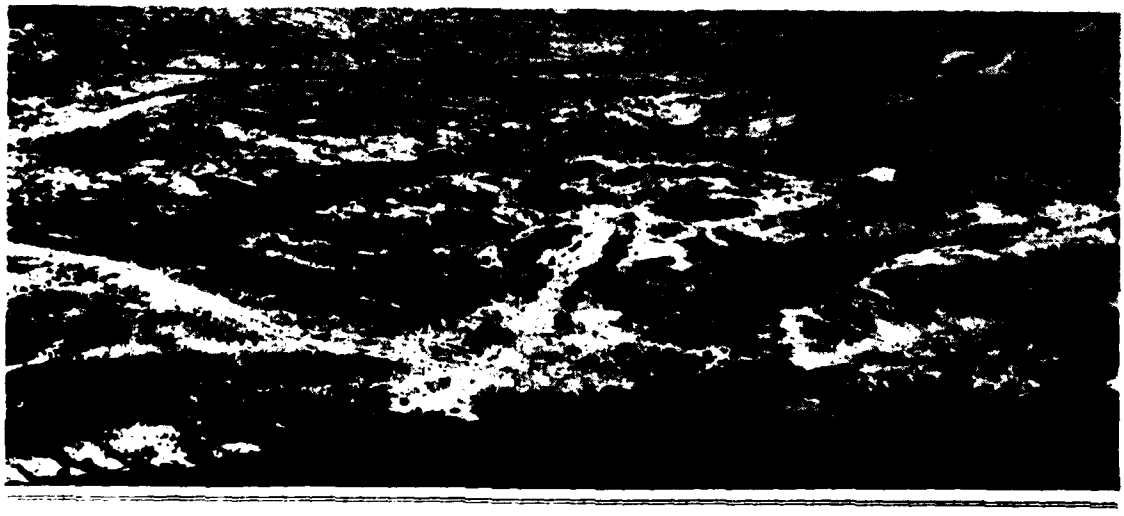


Photo 36: Pottery Mound

Pottery Mound a Pueblo IV or late Glaze period adobe pueblo, is located immediately adjacent to the present active channel of the Rio Puerco. Results of recent test excavation by University of New Mexico (Cordell, personal communication) indicate at least 13 feet of cultural deposits at the site. Previous excavations by Hibben (1955, 1960, 1967) revealed extensive and remarkable frescos in multiple layers of plaster within kiva structures on the site. The Army Corps is currently assisting UNM in development of a program to protect the site from further erosion damage (Site LA 416).



(right) Photo 37 and (below) Photo 38: Pottery Mound



Glaze A (early P-IV) structures were built on the top of basalt mesa near Pottery Mound. One group of structures forms a plaza square, while other structures are located along the rim of the mesa. Rock art (petroglyphs pecked into basalt patina) is found along the rim of the mesa and on boulders down the talus slopes. Little cultural material is in evidence, and occupation of the site appears from surface evidence to have been of very short duration. Box in the plaza of the main portion of the site (above) is believed to relate to present use by the Army as a heliocopter landing location during exercises based at Albuquerque.

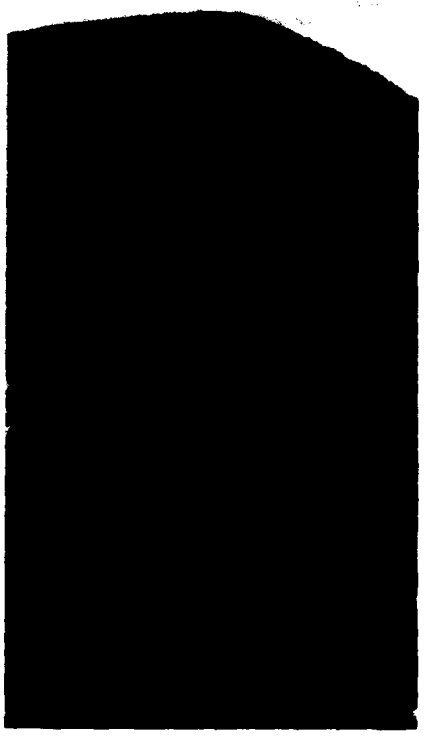


Photo 39 (above), Photo 40 (left), and Photo 41 (right): Early P-IV structures on top of basalt mesa near Pottery Mound.

HSR SITE NO: 903/S-1, Shepherd's Camp
LA NUMBER: 20921

Stratification Zone: M
Elevation: 5560 feet; 1695 meters
Slope: 1%
Aspect: 200°
Temporal Horizon: Historic
Cultural Litter Density: <1/m²
Lithic Pattern: —

Maximum Length (longest axis): 40 m
Orientation (longest axis): 45°
Maximum Width: 20 m
Estimated Maximum Area: 140 m²
Maximum Depth: 0.50 m
Number of Hearths: 0
Number of Structures: 1

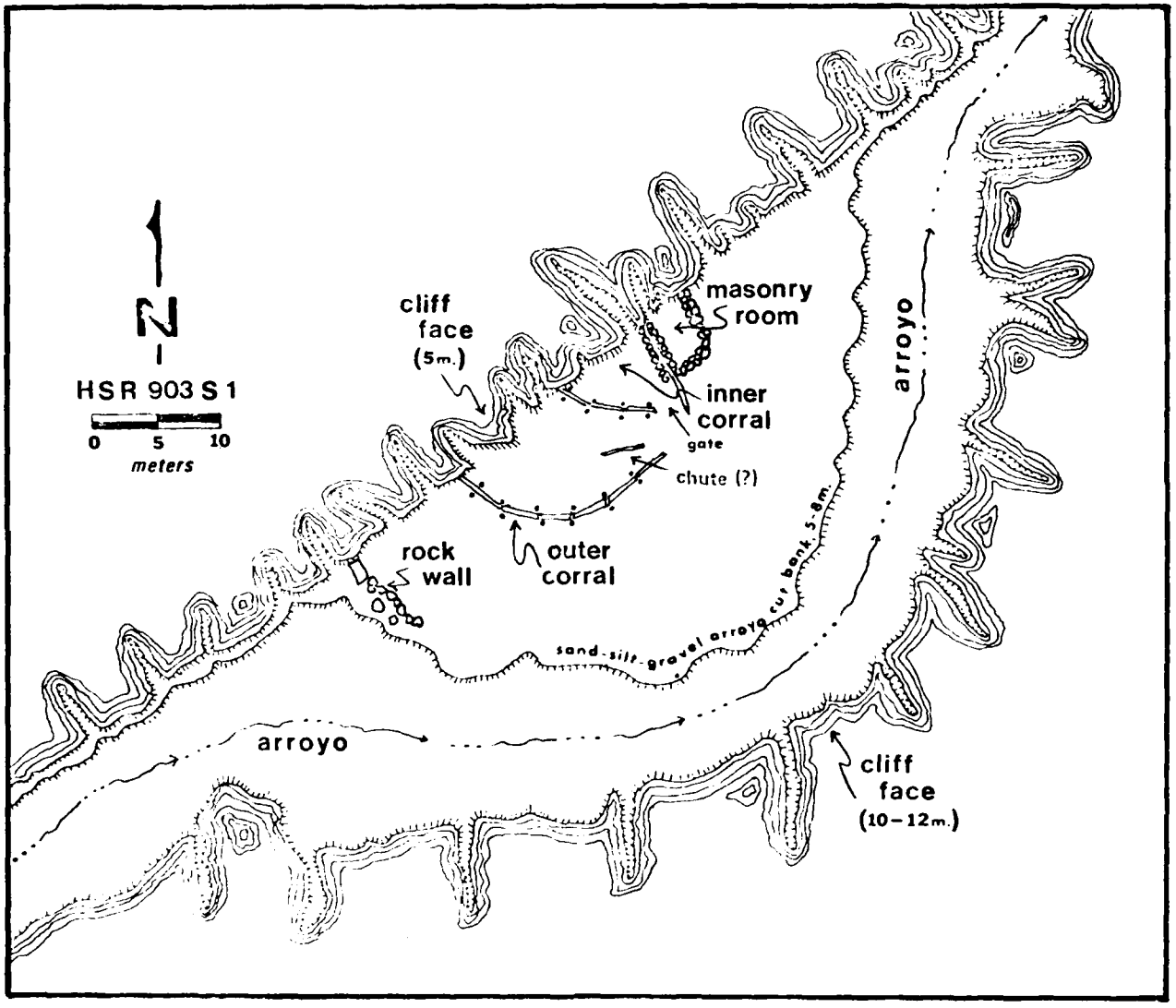
Description: This site is a post-1930s brush corral and shepherd's camp. The site is situated on a narrow alluvial bench along the north side of a narrow rock canyon. A 5 m cliff forms the north margin, and a 3 m arroyo faces the south margin. Food cans, wire and barrel hoops constituted the meager artifactual material.

Architecture: This historic site consists of a one room, oval, masonry structure measuring approximately 3 x 5 m. Also present is a *two-celled*, circular brush and juniper rail corral.

Flora: Hackberry, sumac, juniper, rabbitbush, sagebrush, four-wing saltbush, cholla and prickly pear.

Score	
0	Cultural Litter Density: <1/m²
2	Preservation: Undisturbed.
0	Stratigraphy: None.
1	Rarity: Relatively recent, and probably not unusual.
0	Aesthetics: No unusual features.
0	Restoration Potential: Minimal.
1	Educational Potential: Recent; of minimal educational value.
4	TOTAL

Photo 42: Masonry room and corrals in protection of cliff, HSR903/S-1.


N
HSR 903 S 1
0 5 10
meters
cliff face (5m.)
masonry room
inner corral
gate
chute (?)
outer corral
rock wall
arroyo
sand-silt-gravel arroyo cut bank 5-8m.
arroyo
cliff face (10-12m.)

HSR SITE NO: 903/S-2
LA NUMBER: 20922

Stratification Zone: P
Elevation: 5480 feet; 1670 meters
Slope: 3-5%
Aspect: 200°
Temporal Horizon: BM-III/Early P-I
Cultural Litter Density: 31/m²
Lithic Pattern: 3

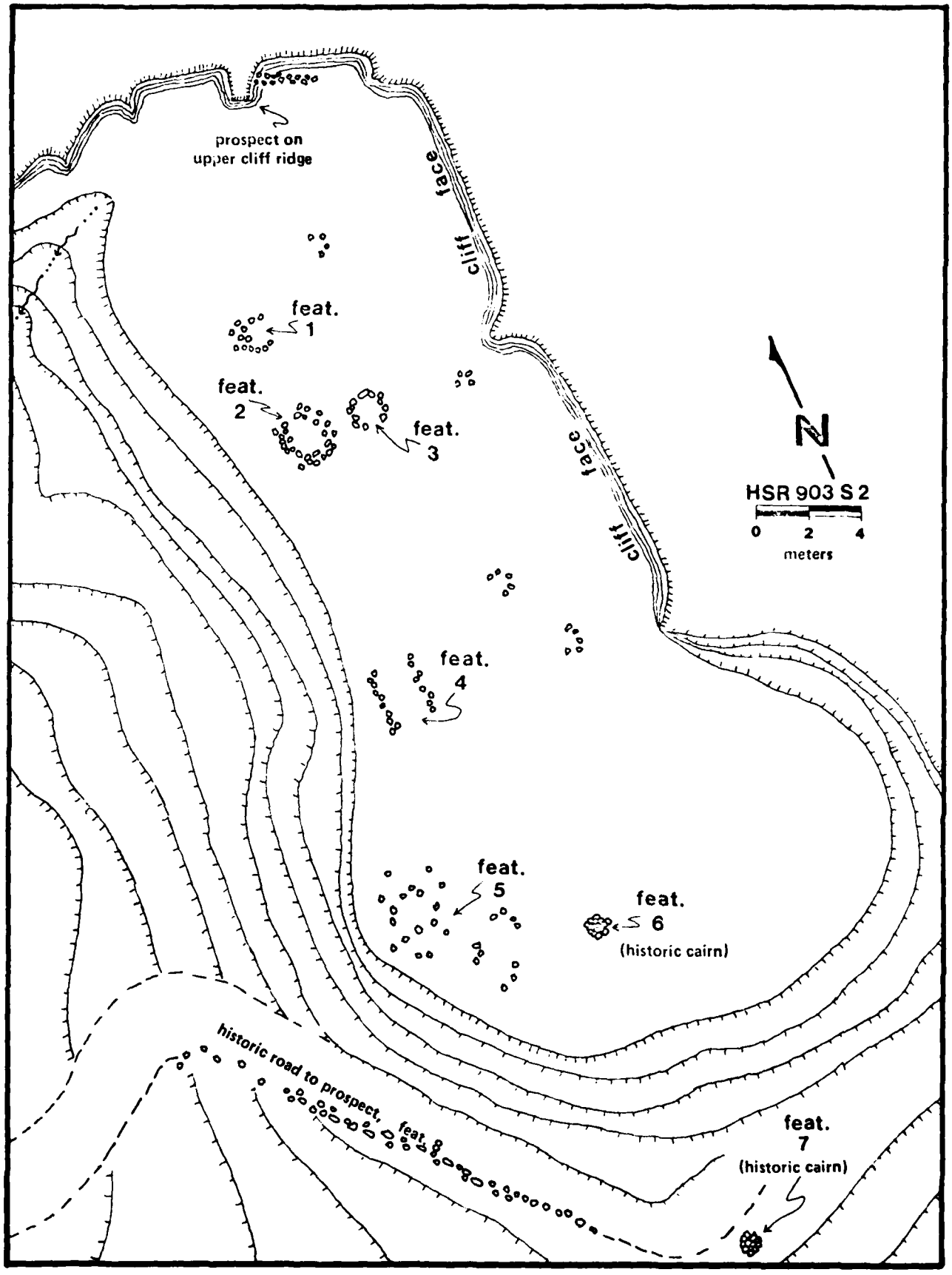
Maximum Length (longest axis): 150 m
Orientation (longest axis): 358°
Maximum Width: 50 m
Estimated Maximum Area: 7500 m²
Maximum Depth: 0.25 m
Number of Hearths: 0
Number of Structures: 8

Description: A series of circular structures and cairns lie on a hill overlooking the Rio Salado on its south side.

Architecture: Eight to ten circular structures measuring 1.5 to 2 meters in greatest diameter are constructed of locally available metamorphic rocks. It is possible that other similar structures are present on the site but alignments are unclear. In no case are more than three rock elements stacked on the wall and the majority consist of only one course of rocks set in a ring. In addition to the circular structures, two stacked rock cairns are present on the site but these are probably associated with an historic road constructed to the top of the mesa and a mine excavated into the outcropping north side of the mesa.

Flora: Four-wing saltbush, broom snakeweed, juniper, bymnoxis, sideoats grama and other grasses.

Score	
4	Cultural Litter Density: 31/m²
2	Preservation: Structural remains are at surface height; remainder of the site is undisturbed and uneroded.
2	Stratigraphy: Estimated depth 25 cm stratigraphy intact.
3	Rarity: Circular, rock outlined structures are uncommon.
3	Aesthetics: Offers an excellent view of the Salado and Padilla Spring
1	Restoration Potential: Structural remains are minimal.
2	Educational Potential: Potential study collections.
17	TOTAL


prospect on
upper cliff ridge
cliff face
feat.
1
feat.
2
feat.
3
cliff face
N
HSR 903 S 2
0 2 4
meters
feat.
4
feat.
5
feat.
6
(historic cairn)
historic road to prospect, feat. 8
feat.
7
(historic cairn)

HSR SITE NO: 903/S-3, Padilla Spring
LA NUMBER: 20923

Stratification Zone: P
Elevation: 5400 feet; 1646 meters
Slope: 2%
Aspect: 102°
Temporal Horizon: Historic
Cultural Litter Density: $<1/m^2$
Lithic Pattern: —

Maximum Length (longest axis): 190 m
Orientation (longest axis): 120°
Maximum Width: 50 m
Estimated Maximum Area: 10,000 m^2
Maximum Depth: 0.10 m
Number of Hearths: 0
Number of Structures: 4

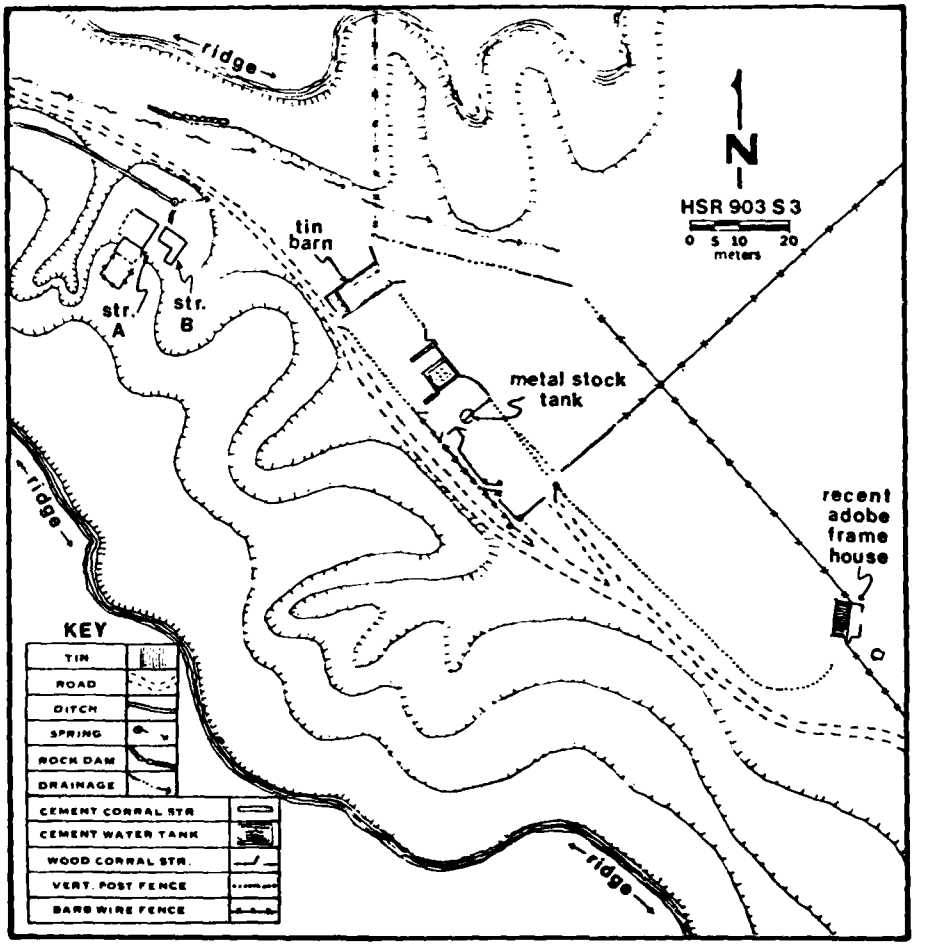
Description: This historic homestead lies at the mouth of a narrow draw just south of the Rio Salado floodplain. A variety of metal cans, nails, screw top jars and fragments of two glass batteries were among the principal artifacts.

Architecture: The site consists of an historic homestead containing two structures: a large dugout (B) with apparently no supporting masonry or log walls; and a two, possibly three-room rock and masonry structure (A). Also present on the site are a more recent tin barn, corrals, and an adobe/frame house.

Flora: Four-wing saltbush, juniper, tamarisk, mesquite, cholla, grama grass and sacaton.

Score

0	Cultural Litter Density: $<1/m^2$
2	Preservation: Generally good, except for oldest house.
1	Stratigraphy: Little stratigraphic deposition.
2	Rarity: One of the larger & obviously older homesteads.
2	Aesthetics: An interesting & scenic location.
3	Restoration Potential: Excellent potential for restoration of a period homestead.
3	Educational Potential: Complex and well preserved; worthy of State Register status.
13	TOTAL



HSR SITE NO: 903/S-4
LA NUMBER: 20924

Stratification Zone: P
Elevation: 5420 feet; 1652 meters
Slope: <1%
Aspect: 180^0
Temporal Horizon: Early P-I/Late P-II
Cultural Litter Density: $<1/m^2$
Lithic Pattern: —

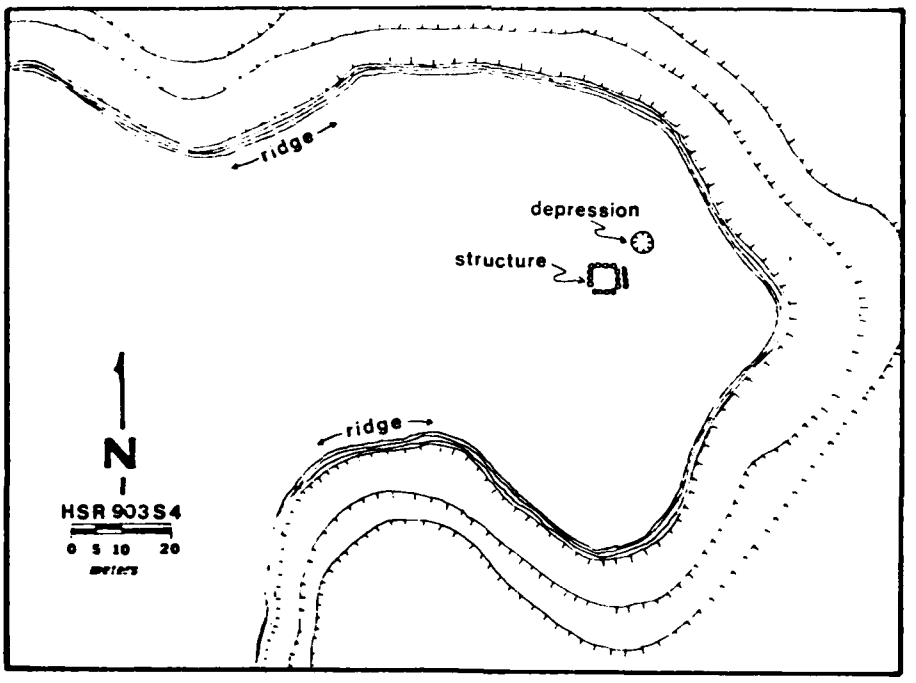
Maximum Length (longest axis): 40 m
Orientation (longest axis): 180^0
Maximum Width: 40 m
Estimated Maximum Area: 160 m^2
Maximum Depth: 0.20 m
Number of Hearths: 0
Number of Structures: 1

Description: This site lies on a flat-topped hill terrace south and overlooking the Rio Salado.

Architecture: A single large (approximately 3 x 3 m inside) masonry surface room is the most obvious structure on the site. A slight depression to the north and east of the surface structure approximately 10 m suggests the possibility that a pithouse is present on the site.

Flora: Four-wing saltbush, broom snakeweed, juniper, hymenoxis, prickly pear, sideoats grama and other grasses.

Score	
0	Cultural Litter Density: $<1/m^2$
2	Preservation: Uneroded, undisturbed.
1	Stratigraphy: Estimated 20 cm of deposits.
2	Rarity: Relatively typical of unit structure sites in study area.
2	Aesthetics: Excellent view of Salado and Padilla Spring
2	Restoration Potential: Probably average.
2	Educational Potential: Potential study collections.
11	TOTAL



HSR SITE NO: 903/S-5
LA NUMBER: 20925

Stratification Zone: P
Elevation: 5410 feet; 1649 meters
Slope: 2%
Aspect: 134°
Temporal Horizon: Late P-II
Cultural Litter Density: <1/m²
Lithic Pattern: 3

Maximum Length (longest axis): 80 m
Orientation (longest axis): 134°
Maximum Width: 35 m
Estimated Maximum Area: 1600 m²
Maximum Depth: 1.0 m
Number of Hearths: 1 possible
Number of Structures: 2

Description: This site is located on a sandy gravel ridge or bench along the west side of an unnamed tributary which enters the Rio Salado from the south.

Architecture: Three indications of structure are present on the site. The first consists of a single large room (A) of approximately 4 x 4 m, constructed of 20-30 cm basalt rocks. This structure presently stands almost a meter in height. The second structure (B) consists of approximately four rooms in a single roomblock of an L-shape with three rooms on one side and one on the lower end of the L. Wall alignments are only partially visible and surface distribution of rubble confuse the observer as to the actual number of rooms present. A third structural indication is a low mound or raised area in the center of the site. This raised area is approximattely 12 x 6 m. No rock alignments are visible, and it is impossible to determine if the mound is a roomblock of masonry rooms, a line of jacal structures, or simply a sizeable midden area. (It should be noted, however, that cultural material is not particularly dense on the mound, which would seem to rule out a midden.)

Flora: Grama, broom snakeweed, juniper, mesquite, four-wing saltbush.

Score

0 Cultural Litter Density: <1/m²

2 Preservation: Good condition.

3 Stratigraphy: Cultural deposits appear to be undisturbed, up to 1 m in depth.

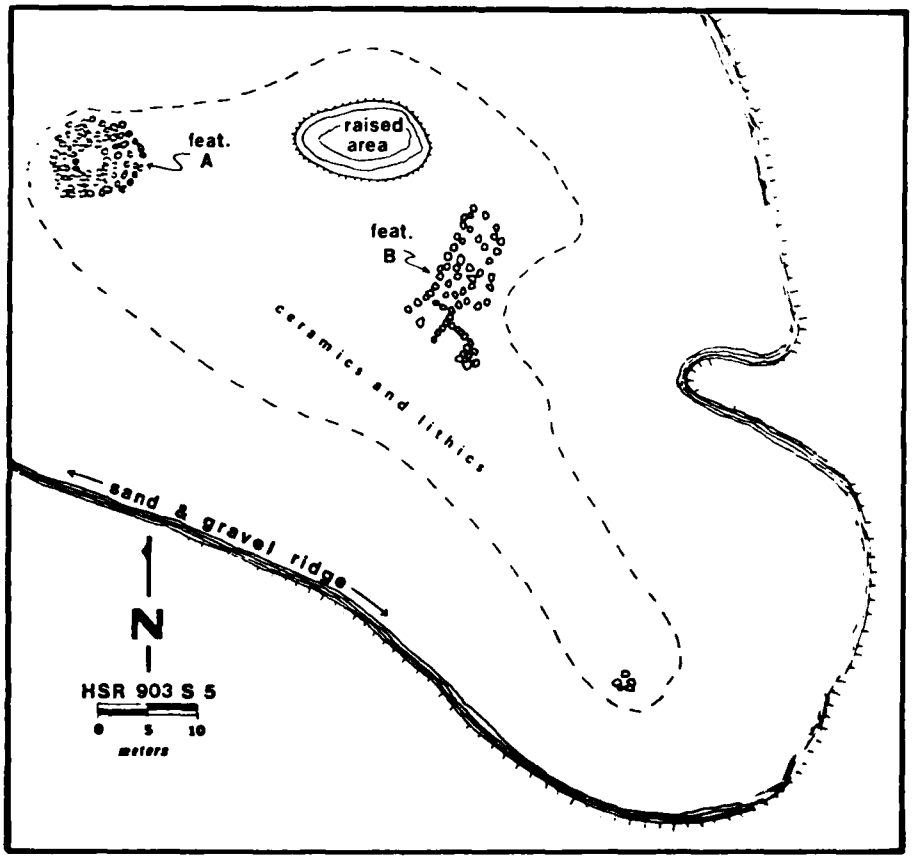
2 Rarity: Generally typical of unit residence sites in study area.

0 Aesthetics: No unusual features.

2 Restoration Potential: Structures in good condition.

3 Educational Potential: Good; worthy of nomination to the State Register as contributing.

12 TOTAL



HSR SITE NO: 903/S-6
LA NUMBER: 20926

Stratification Zone: P
Elevation: 5410 feet; 1649 meters
Slope: 1%
Aspect: 80^0
Temporal Horizon: Late P-II
Cultural Litter Density: $19/m^2$
Lithic Pattern: 3

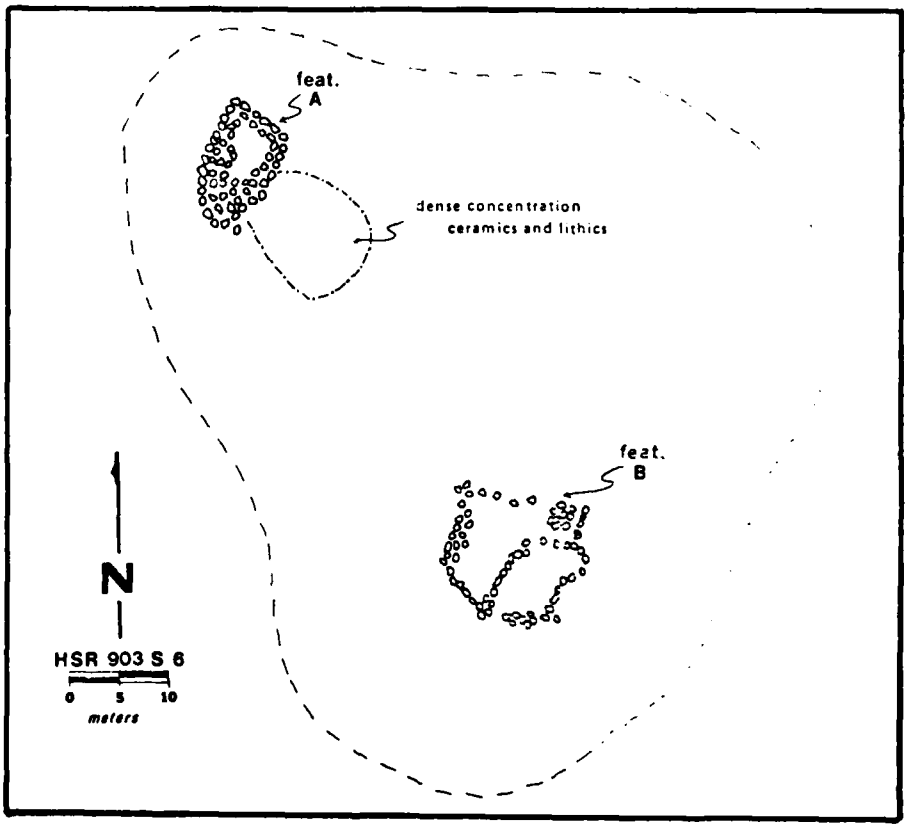
Maximum Length (longest axis): 90 m
Orientation (longest axis): 160^0
Maximum Width: 60 m
Estimated Maximum Area: $5000\ m^2$
Maximum Depth: 0.50 m
Number of Hearths: 0
Number of Structures: 2

Description: This site lies on top of a low flat ridge or terrace which extends east into the floor of the bottomlands associated with an unnamed tributary entering the Rio Salado from the south.

Architecture: Two structures are present on this site. The first (A) consists of an estimated two large masonry rooms. These rooms are approximately 2 x 3 m. The rooms are unusually large if surface indications can be relied upon; the height of the structure, approximately 0.50 m, made surface alignments clearly visible. The second structural indication on the site is somewhat an enigma, consisting of what is apparently a sizeable depression (B), approximately 10 m in diameter. This depression, while appearing to be circular, when mapped comes out more rectangular. Rock alignments surround the depression and one alignment of rocks crosses the depression just east of center. This cross wall meets the surrounding alignment and to the west forms and approximate 45^0 angle. The exact nature of this structure could not be determined from surface indications.

Flora: Juniper, dropseed, cholla, four-wing saltbush, broom snakeweed, grama, sacaton.

Score	
3	Cultural Litter Density: $19/m^2$
2	Preservation: Good condition.
2	Stratigraphy: Probably 50 cm in depth; undisturbed.
2	Rarity: Typical of residence units in this area.
0	Aesthetics: No unusual feat's.
2	Restoration Potential: Structures are in good condition.
3	Educational Potential: Good, worthy of inclusion in a District nomination.
14	TOTAL



HSR SITE NO: 903/S-7
LA NUMBER: 20927

Stratification Zone: O-M-H
Elevation: 5480 feet; 1670 meters
Slope: 1%
Aspect: 90^0
Temporal Horizon: P-I/P-II
Culturai Litter Density: $<10/m^2$
Lithic Pattern: —

Maximum Length (longest axis): 60 m
Orientation (longest axis): 110^0
Maximum Width: 25 m
Estimated Maximum Area: 1000 m^2
Maximum Depth: 0.30 m
Number of Hearths: 0
Number of Structures: 1

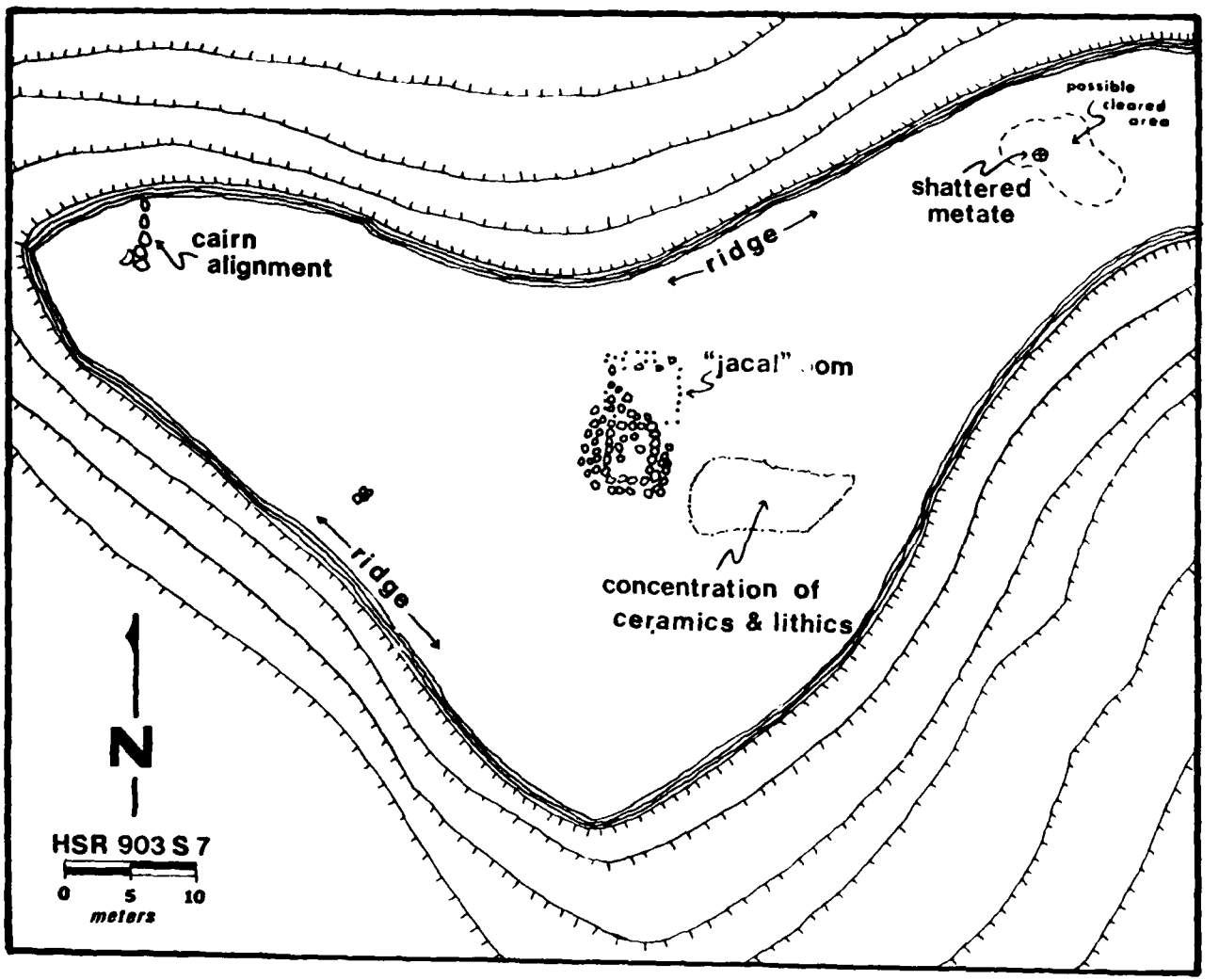
Description: This site lies on the point of a high ridge overlooking the Rio Salado along its north side. Sandstone and metamorphic rock outcrop along this and neighboring ridges. A sandy flat is located below the ridge along the border of the main channel.

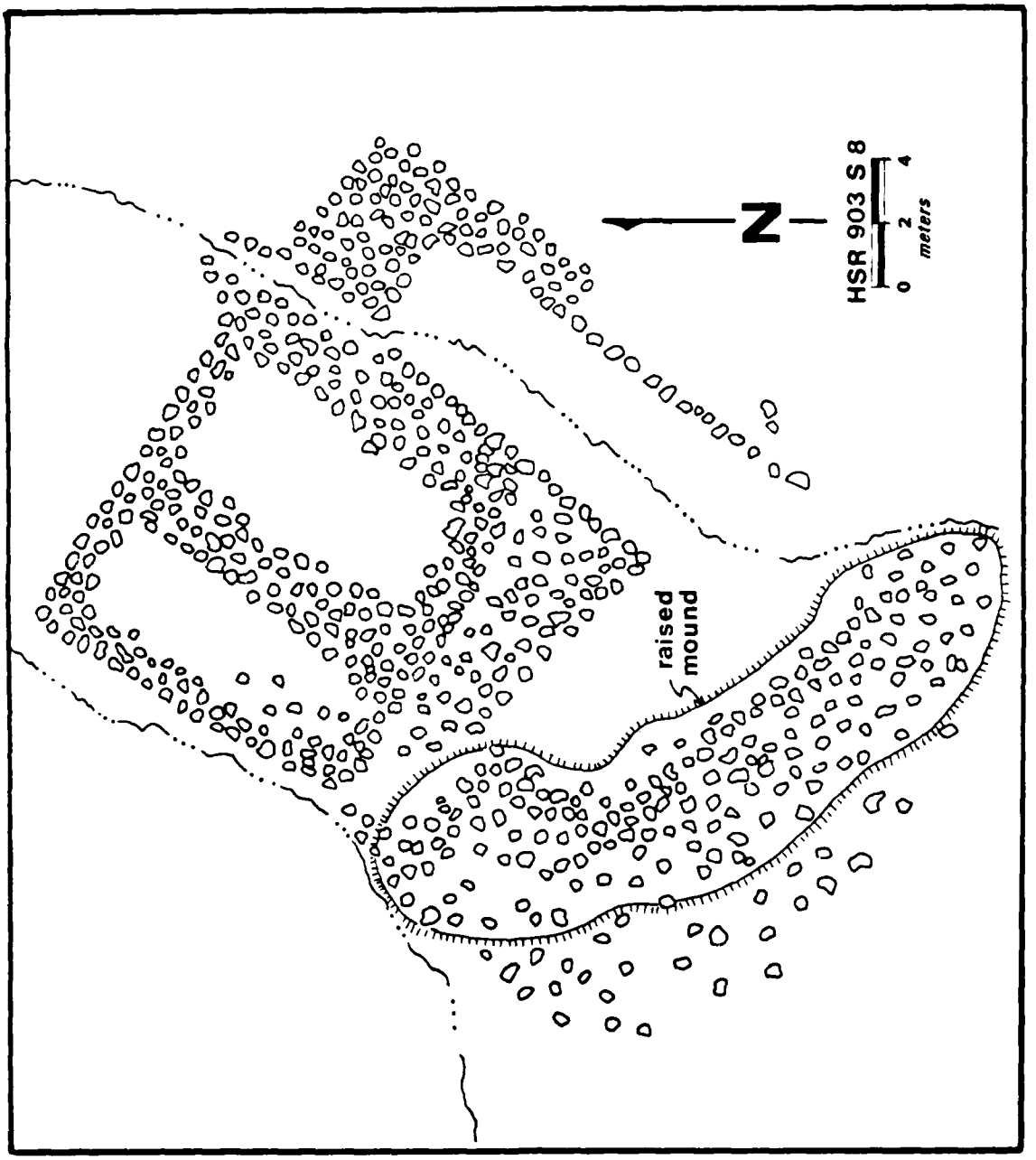
Architecture: A single masonry structure consisting of one masonry room constructed of river cobbles in a double wall alignment forms a sizeable mound (ca. 30 cm high) and an attached room of upright slabs was present. The masonry room measures approximately 2 x 2 m inside and the attached room, which appears to represent a jacal construction, is approximately 2 x 3 m inside. Two other possible indications are present on the site. Approximately 30 m northeast of the masonry structure a flattened cleared area and concentration of cultural materials including a metate, suggests the possibility of a ramada. Approximately the same distance northwest a small stacked rock cairn and approximately 5 m of aligned rocks were observed.

Flora: Juniper, creosote, dropseed, broom snakeweed.

Score	
2	Cultural Litter Density: $<10/m^2$
2	Preservation: Undisturbed, good condition.
2	Stratigraphy: Undisturbed; deposits probably 30 cm in depth.
2	Rarity: Typical of unit residence sites in this area.
1	Aesthetics: No unusual features; ridgetop position above site S-8.
2	Restoration Potential: Structures in good condition.
3	Educational Potential: Potentially contributing to District nomination.
14	TOTAL

Photo 43: HSR903/S-7 masonry structure, overlooking Rio Salado


possible cleared area
shattered metate
cairn alignment
ridge
"jacal" room
ridge
concentration of ceramics & lithics
N
HSR 903 S 7
0 5 10
meters


N
HSR 903 S 8
0
2
4
meters
raised
mound

HSR SITE NO: 903/S-8
LA NUMBER: 20928

Stratification Zone: O-M-H
Elevation: 5410 feet; 1649 meters
Slope: 5%
Aspect: 150°
Temporal Horizon: Late P-II
Cultural Litter Density: —
Lithic Pattern: 3

Maximum Length (longest axis): 26 m
Orientation (longest axis): 40°
Maximum Width: 18 m
Estimated Maximum Area: 500 m^2
Maximum Depth: 2 m
Number of Hearths: 0
Number of Structures: 1

Description: This masonry site lies at the foot of a steep ridge, just below the talus, and above the first alluvial terrace along the north side of the Rio Salado.

Architecture: This site consists of a sizeable area of masonry rubble distributed on the lower edge of an alluvial slope. Rubble is densely distributed over an area of approximately 18 x 24 m. Approximately six clear wall alignments were visible, but because of the erosion channels cross-cutting the structure, no clear number of rooms could be determined, nor could any estimate of the actual distribution of rooms or form of the structure be determined from the surface.

Flora: Sacaton, creosote, mesquite, juniper.

Score	
0	Cultural Litter Density.
2	Preservation: Well preserved except for small runoff channels.
3	Stratigraphy: Cultural deposits may exceed 1 m in places generally undisturbed.
4	Rarity: Probably largest site from this and earlier periods.
0	Aesthetics: No unusual features.
2	Restoration Potential: Masonry roomblocks are in good condition.
3	Educational Potential: A large site, worthy of excavation and nomination to a District.
14	TOTAL

HSR SITE NO: 903/S-9
LA NUMBER: 20929

Stratification Zone: O-M-H
Elevation: 5405 feet; 1647 meters
Slope: 2%
Aspect: 220°
Temporal Horizon: Early P-I/Early P-II
Cultural Litter Density: 10/m^2
Lithic Pattern: —

Maximum Length (longest axis): 75 m
Orientation (longest axis): 155°
Maximum Width: 40 m
Estimated Maximum Area: 3000 m^2
Maximum Depth: 0.25 m
Number of Hearths: 1
Number of Structures: 1

Description: Ceramics and lithics are scattered along the lower edge of the first alluvial terrace on a sizeable flat area along the north side of the Rio Salado.

Architecture: Two proveniences in this site appear to have some indication of structures. On the east, a small slab-lined hearth (approximately 30 x 50 cm) was observed; on the west, a small possible jacal room is eroding from the face of a sloped bank. A burned floor and fragments of burned adobe as well as a few rocks were observed. The room is less than 2 m^2, but no exact dimensions could be determined. From the size of the site, it is possible that several other similar structures could be present, but no direct evidence was observed.

Flora: Tamarisk, cholla, creosote, grama, juniper, mesquite, dropseed.

Score	
2	Cultural Litter Density: 10/m^2
1	Preservation: Heavily eroded and exposed.
0	Stratigraphy: Little of the original deposit appears to survive.
1	Rarity: Unusual only for its eroded condition.
0	Aesthetics: No unusual features.
0	Restoration Potential: None.
2	Educational Potential: Potential study collection.
6	TOTAL

HSR SITE NO: 903/S-10
LA NUMBER: 20930

Stratification Zone: D-P-O
Elevation: 5410 feet; 1649 meters
Slope: 3%
Aspect: 25°
Temporal Horizon: Historic
Cultural Litter Density: <1/m²
Lithic Pattern: —

Maximum Length (longest axis): 48 m
Orientation (longest axis): 160°
Maximum Width: 20 m
Estimated Maximum Area: 800 m²
Maximum Depth: 0.50 m
Number of Hearths: 0
Number of Structures: 2

Description: This historic site lies at the base of a ridge or terrace along the south side of the Rio Salado.

Architecture: This is an historic *homestead* location consisting of two structures. The first is a single masonry room 2.5 x 3 m inside, partially dug into the hill slope. Thirty meters north of structure 1 is a second structure consisting of a few rock elements and numerous juniper posts suggesting that construction was jacal. The structure is approximately 13 x 3 m inside.

Flora: Juniper, four-wing saltbush, broom snakeweed, cholla, grasses.

Score	
0	Cultural Litter Density: <1/m²
2	Preservation: Good condition.
2	Stratigraphy: <50 cm in depth, undisturbed.
3	Rarity: A smaller homestead; jacal structure is unusual.
0	Aesthetics: No unusual features.
2	Restoration Potential: Masonry in good condition.
1	Educational Potential: Relatively recent.
10	TOTAL

HSR SITE NO: 903/S-11
LA NUMBER: 20931

Stratification Zone: D-P-O
Elevation: 5460 feet; 1664 meters
Slope: 2%
Aspect: 300°
Temporal Horizon: Late P-I
Cultural Litter Density: <1/m²
Lithic Pattern: —

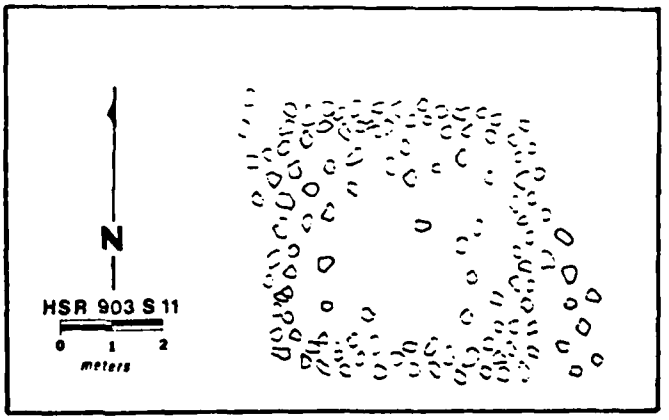
Maximum Length (longest axis): 10 m
Orientation (longest axis): —
Maximum Width: 10 m
Estimated Maximum Area: 100 m²
Maximum Depth: 0.50 cm
Number of Hearths: 0
Number of Structures: 1

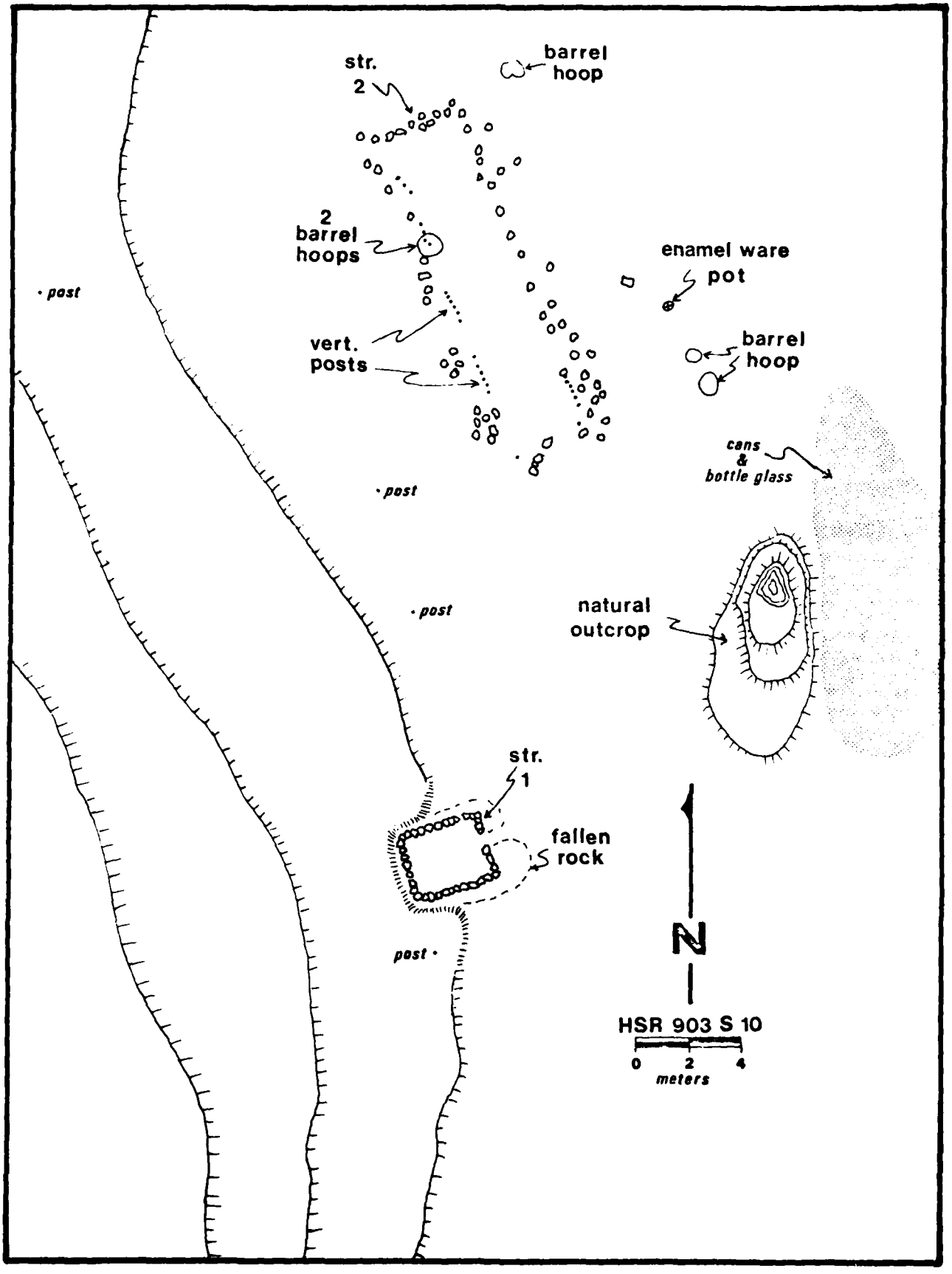
Description: This single room lies on the flat surface of an elevated terrace ridge point, along the west margin of Baca Canyon just south of its confluence with the Rio Salado.

Architecture: The structure consists of a single cobble masonry room approximately 4 x 3 m inside. The substantial amount of cobbles (mount 8 x 8 m) suggests full height masonry walls.

Flora: Juniper, broom snakeweed, mixed grasses, four-wing saltbush, mesquite.

Score	
0	Cultural Litter Density: <1/m²
2	Preservation: Good condition.
2	Stratigraphy: Undisturbed.
2	Rarity: Typical of small residence units in this area.
0	Aesthetics: No unusual features.
2	Restoration Potential: Structure fallen, but in good condition.
2	Educational Potential: Potential study collection.
10	TOTAL




str. 2
barrel hoop
2 barrel hoops
enamel ware pot
post
vert. posts
barrel hoop
cans & bottle glass
post
post
natural outcrop
str. 1
fallen rock
post
N
HSR 903 S 10
0 2 4
meters

HSR SITE NO: 903/S-12
LA NUMBER: 20932

Stratification Zone: O
Elevation: 5450 feet; 1661 meters
Slope: 3%
Aspect: 160°
Temporal Horizon: Early P-I
Cultural Litter Density: <10/m²
Lithic Pattern: —

Maximum length (longest axis): 30 m
Orientation (longest axis): 140°
Maximum Width: 20 m
Estimated Maximum Area: 600 m²
Maximum Depth: 0.50 m
Number of Hearths: 0
Number of Structures: 2

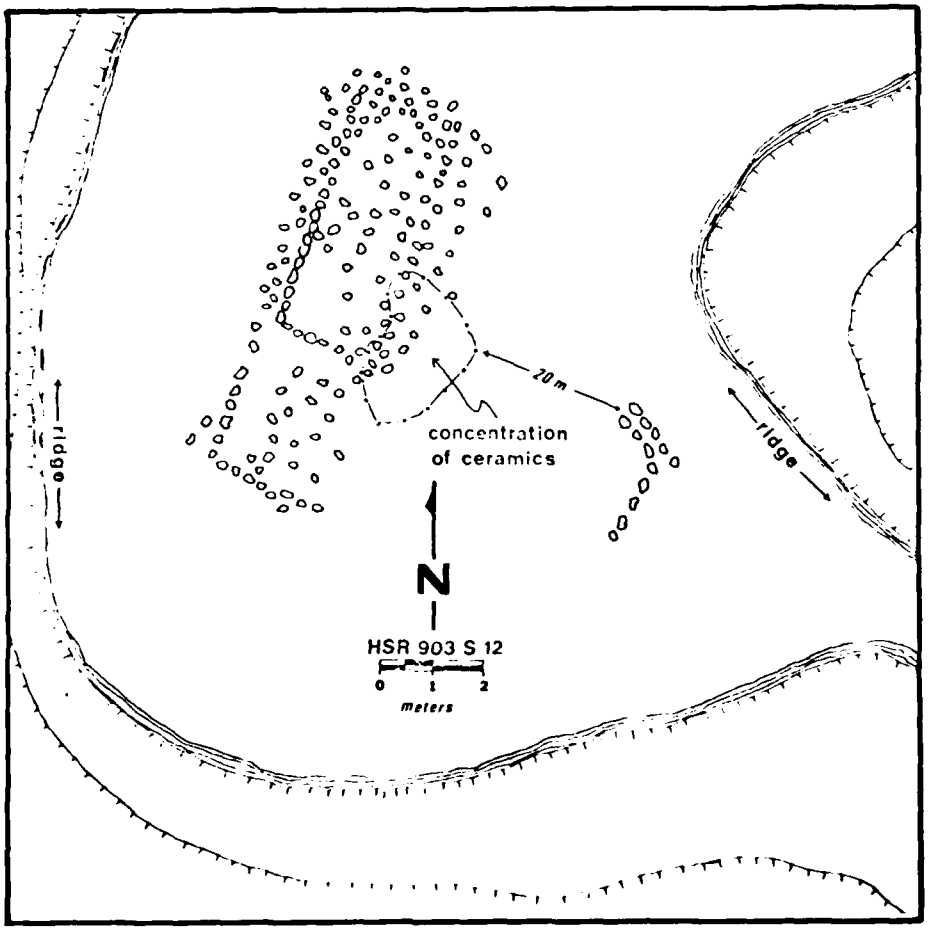
Description: This site occupies the point of a low ridge which runs along the eastern margin of an unnamed tributary which enters the Rio Salado from the north.

Architecture: Two cobble masonry structures are present on this site. The largest contains either two or three rooms; inside dimensions are approximately 8 x 2 m. Only one dividing wall was observed on the surface but the size of the structure indicates that three rooms are possible. The second structure lies approximately 20 m east of the larger structure, and consists of a single corner alignment suggesting the presence of a one room masonry structure which is substantially buried.

Flora: Juniper, four-wing saltbush, broom snakeweed, grama, dropseed, mesquite.

Score

2	Cultural Litter Density: <10/m²
2	Preservation: Slightly eroded, majority of deposits probably intact.
2	Stratigraphy: Up to 50 cm of deposition, undisturbed except for surface erosion.
2	Rarity: Typical of small residence units in study area.
0	*Aesthetics:* No unusual features.
2	Restoration Potential: Structures generally in good condition.
2	Educational Potential: Potential study collection.
12	TOTAL



HSR SITE NO: 903/S-13
LA NUMBER: 20933

Stratification Zone: D-M
Elevation: 5380 feet; 1640 meters
Slope: 1%
Aspect: 180°
Temporal Horizon: Late P-I
Cultural Litter Density: <1/m²
Lithic Pattern: --

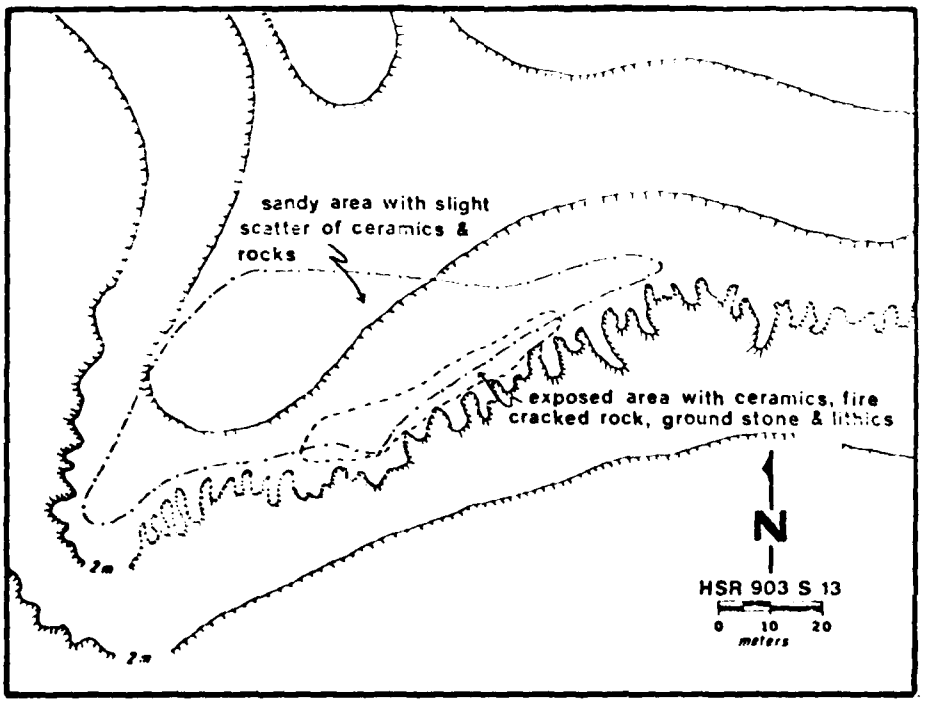
Maximum Length (longest axis): 100 m
Orientation (longest axis): 215°
Maximum Width: 40 m
Estimated Maximum Area: 2000 m²
Maximum Depth: 0.50 m
Number of Hearths: 0
Number of Structures: 0

Description: Scattered ceramics and lithics are eroding along the top of the lower bank of the second terrace above the north bank of the Rio Salado, and west of an unnamed tributary.

Architecture: No structural indications were observed on this site. Fire-cracked rock was dispersed throughout the site area, but no distinct hearth areas were observed. The site is located at the lower edge of the first major river terrace, and it is possible that other structural sites exist on the higher bench to the north. The upper edge of the site is deeply buried so some structural features may be present in this area of the site.

Flora: Russian thistle, broom snakeweed, juniper, tamarisk.

Score	
0	Cultural Litter Density: <1/m²
1	Preservation: Actively eroding along embankment.
0	Stratigraphy: Probably minimal.
2	Rarity: Scatter typical of eroded situations.
0	Aesthetics: No unusual features.
0	Restoration Potential: None.
2	Educational Potential: Possibility of buried features.
5	TOTAL



HSR SITE NO: 903/S-14
LA NUMBER: 20934

Stratification Zone: D-M
Elevation: 5360 feet; 1634 meters
Slope: 2%
Aspect: 140°
Temporal Horizon: Late P-II
Cultural Litter Density: <1/m²
Lithic Pattern: —

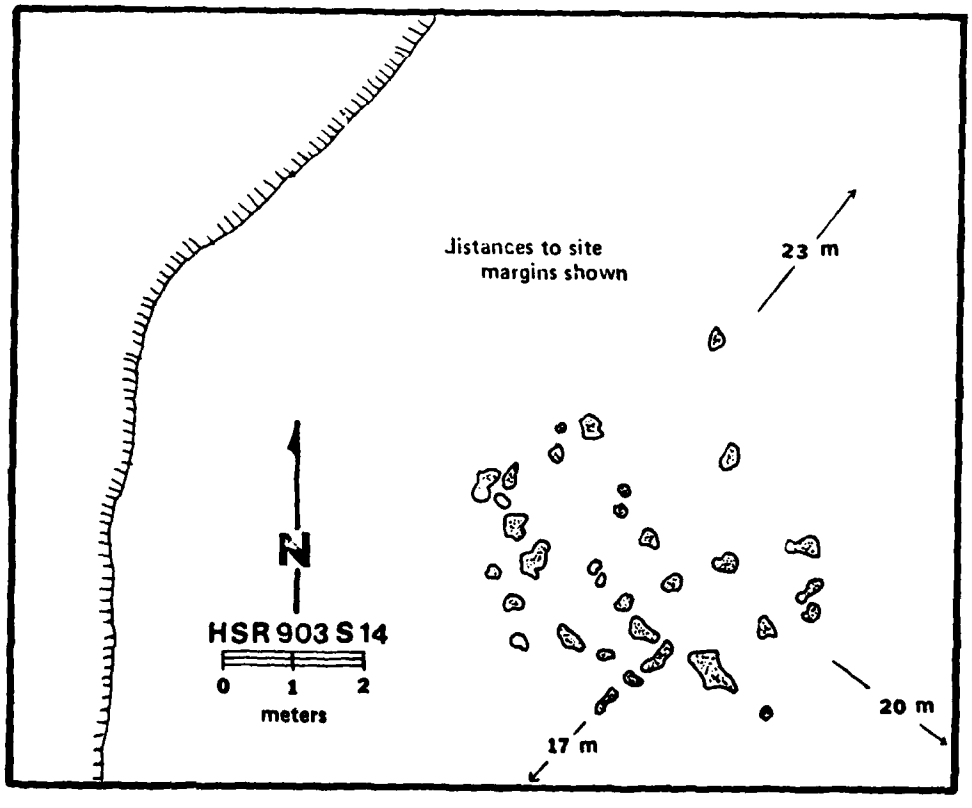
Maximum Length (longest axis): 40 m
Orientation (longest axis): 25°
Maximum Width: 30 m
Estimated Maximum Area: 1000 m²
Maximum Depth: 0.10 m
Number of Hearths: 1
Number of Structures: 0

Description: This eroded hearth lies on the alluvial flats of the first terrace along the south side of the Rio Salado, east of an unnamed tributary.

Architecture: This large fire-cracked rock hearth area is approximately 3 m in diameter. No other structural indications were present.

Flora: Four-wing saltbush.

Score	
0	Cultural Litter Density: <1/m²
0	Preservation: An exposed hearth, scattered.
0	Stratigraphy: None.
2	Rarity: Typical.
0	*Aesthetics:* No unusual features.
0	Restoration Potential: None.
0	Educational Potential: None, completely inventoried.
2	TOTAL



HSR SITE NO: 903/S-15
LA NUMBER: 20935

Stratification Zone: D-M
Elevation: 5380 feet; 1640 meters
Slope: 3%
Aspect: 34^0
Temporal Horizon: Unknown
Cultural Litter Density: $0/m^2$
Lithic Pattern: —

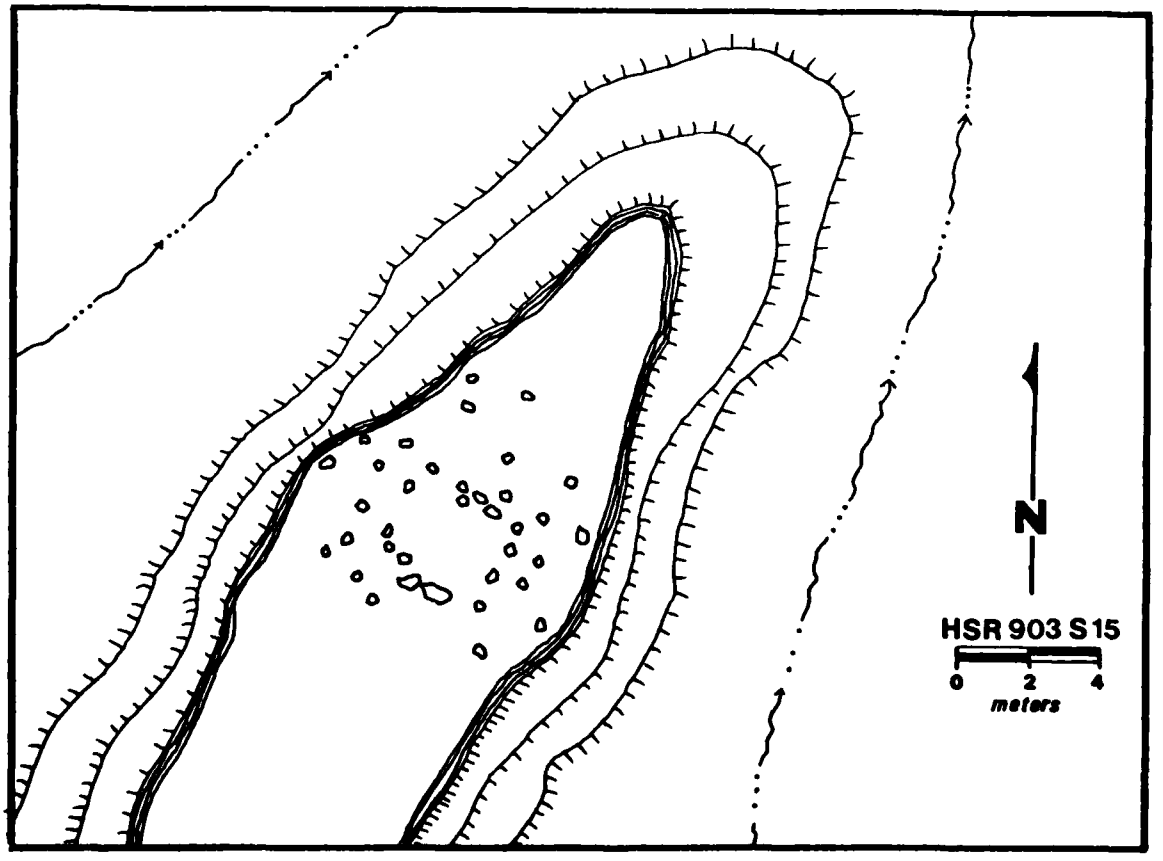
Maximum Length (longest axis): 6 m
Orientation (longest axis): 45^0
Maximum Width: 6 m
Estimated Maximum Area: 36 m^2
Maximum Depth: 10 cm
Number of Hearths: 0
Number of Structures: 1

Description: This single room is situated on the crest of a low gravel ridge south of the Rio Salado.

Architecture: This masonry room is approximately 2 x 3 m inside. Rubble is scattered over an area of ca. 6 x 6 m and the mound is approximately 25 cm in height. No cultural materials were associated.

Flora: Juniper, broom snakeweed, four-wing saltbush, wolfberry, cholla, tamarisk nearby.

Score	
0	Cultural Litter Density: None.
1	Preservation: Structural elements scattered.
1	Stratigraphy: Minimal due to scattered condition and exposed situation.
2	Rarity: Appears to be a typical masonry room in poor condition.
0	Aesthetics: No unusual features.
0	Restoration Potential: None.
0	Educational Potential: None.
4	TOTAL



HSR SITE NO: 903/S-16
LA NUMBER: 20936

Stratification Zone: D-M
Elevation: 5360 feet; 1634 meters
Slope: 2%
Aspect: 20^0
Temporal Horizon: Early P-I/Late P-II
Cultural Litter Density: $7/m^2$
Lithic Pattern: 3

Maximum Length (longest axis): 80 m
Orientation (longest axis): 140^0
Maximum Width: 50 m
Estimated Maximum Area: 3000 m^2
Maximum Depth: 0.50 m
Number of Hearths: 1
Number of Structures: 2

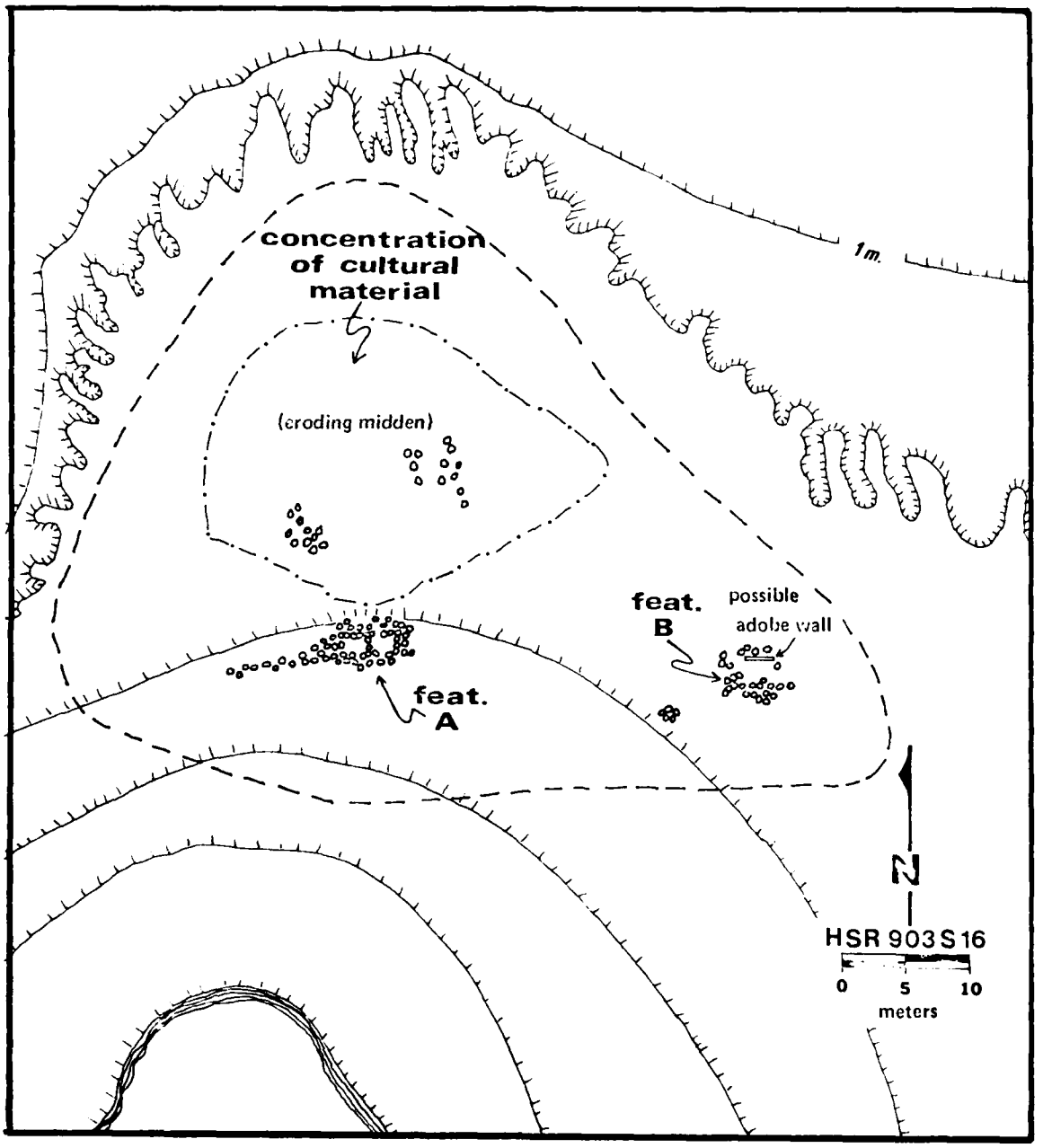
Description: This site lies on the point of a structural ridge protruding into a meander of Rio Salado, along its south bank. The present channel is cutting the side and point of this ridge.

Architecture: Structures on this site are in two units, separated by approximately 25 meters. The most prominant appears to be a two-room unit house of cobble masonry construction. The remnant of a wall extends to the west of the two rooms, suggesting the possibility that another room was at one time present but has been eroded away, or that the original inhabitants of the existing two rooms constructed a wing wall for runoff protection of the structure. The structure to the east is somewhat indeterminant in size and shape. Masonry cobble construction is indicated by the presence of some limited wall alignments, but in one clear instance, the remains of an adobe wall are visible, and the presence of a slight adobe mounding suggests that the construction was at least partially adobe. At least one room and possibly two are represented.

Flora: Four-wing saltbush, juniper, tamarisk, cholla, broom snakeweed, mixed grasses.

Score	
2	Cultural Litter Density: $7/m^2$
3	Preservation: Site condition good to excellent, although threatened by the Salado.
3	Stratigraphy: Deposits appear to be quite deep, up to 50 cm.
3	Rarity: Multicomponent sites are uncommon in the study area.
0	Aesthetics: No unusual features.
2	Restoration Potential: Masonry units are in good condition.
3	Educational Potential: Excellent potential for study collections.
16	TOTAL

Photo 44: HSR903/S-16 from midden area looking SW.


concentration
of cultural
material
(eroding midden)
1m.
feat.
B
possible
adobe wall
feat.
A
N
HSR 903 S 16
0 5 10
meters

HSR SITE NO: 903/S-17
LA NUMBER: 20937

Stratification Zone: D-M
Elevation: 5380 feet; 1640 meters
Slope: 5%
Aspect: 15^0
Temporal Horizon: Early P-I
Cultural Litter Density: $16/m^2$
Lithic Pattern: —

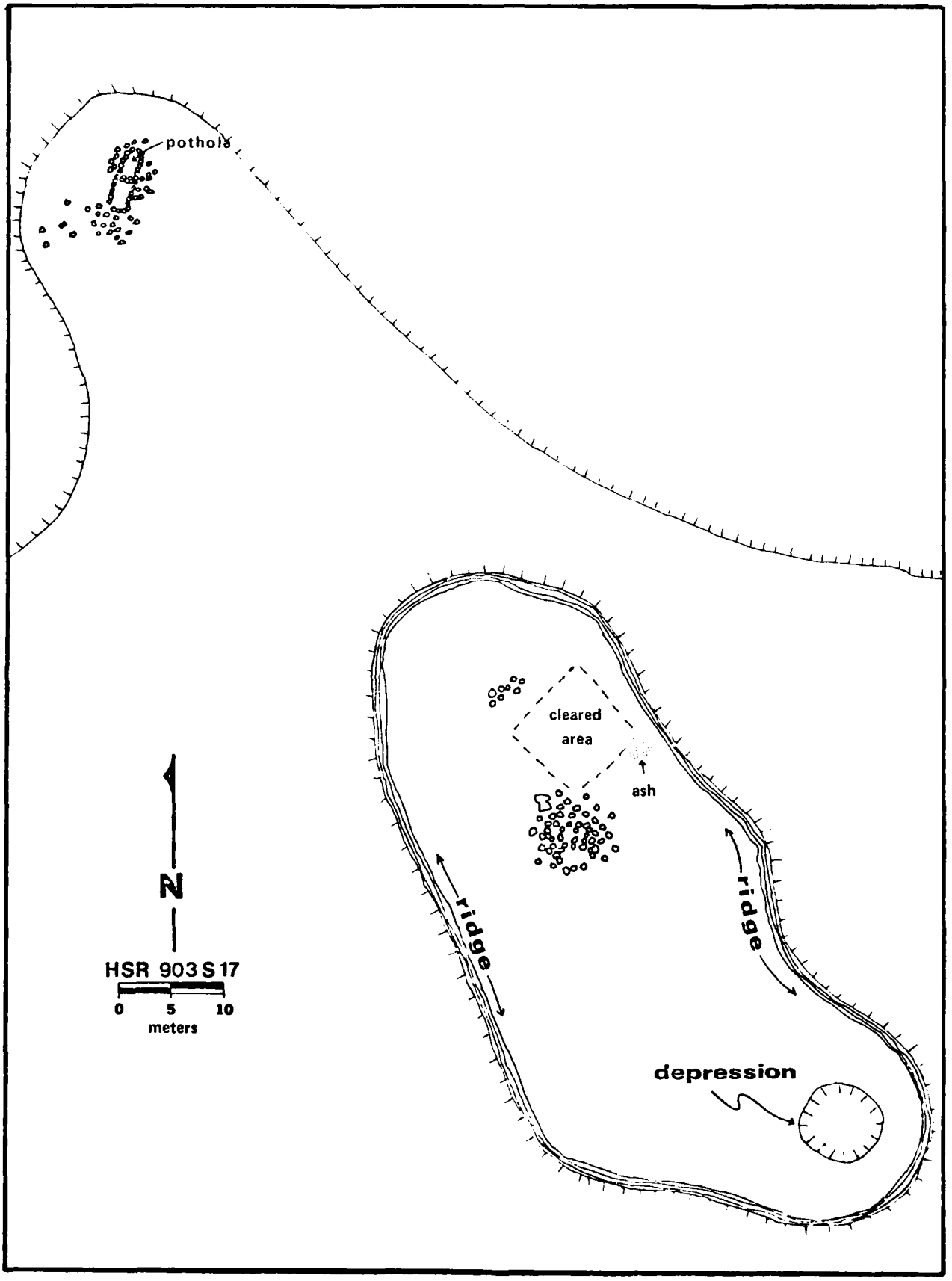
Maximum Length (longest axis): 125 m
Orientation (longest axis): 150^0
Maximum Width: 50 m
Estimated Maximum Area: 5000 m^2
Maximum Depth: 0.50 m
Number of Hearths: 1
Number of Structures: 2

Description: These structures lie on a low gravel ridge above the first alluvial terrace along the south side of the Rio Salado. The site is opposite the confluence of a large unnamed arroyo flowing south into the Rio Salado.

Architecture: Two isolated cobble masonry rooms are present on this site. In addition, one circular depression approximately 20 m south of the rooms on the ridge point indicates that a pit room may also be present. Further, a rectangular cleared area between the two masonry structures may be an indication of another pit room or possibly a work area or ramada structure. The most prominant masonry structure is approximately 5 x 5 m in outside dimensions. The other structure is indistinct, with only one wall showing clearly and slight indications in the ridge point mound of other wall alignments.

Flora: Mixed grasses, broom snakeweed, four-wing saltbush.

Score	
3	Cultural Litter Density: $16/m^2$
2	Preservation: Generally in good condition, although one room has been potted.
3	Stratigraphy: Deep deposits in situ, up to 50 cm.
2	Rarity: Typical of unit residence sites in study area.
0	Aesthetics: No unusual features.
2	Restoration Potential: Structures are in generally good condition.
2	Educational Potential: Potential study collections.
14	TOTAL


potholes
cleared
area
ash
ridge
ridge
depression
N
HSR 903 S 17
0 5 10
meters

HSR SITE NO: 903/S-18
LA NUMBER: 20938
ACE NO: 02

Stratification Zone: D-M
Elevation: 5440 feet; 1658 meters
Slope: 2%
Aspect: 90^0 to 270^0
Temporal Horizon: P-IV, Glaze D
Cultural Litter Density: $2/m^2$
Lithic Pattern: —

Maximum Length (longest axis): 90 m
Orientation (longest axis): 30^0
Maximum Width: 70 m
Estimated Maximum Area: 5000 m^2
Maximum Depth: 1 m
Number of Hearths: 0
Number of Structures: 2

Description: This large pueblo is located on top of a high ridge which protrudes into the Rio Salado valley from the north. The site occupies the point of the ridge and has clear command of both up and down river. The ridge offers an elevated route away from the valley towards the Ladron Mountains.

Architecture: This site consists of a large L-shaped pueblo with two roomblocks separated by an approximately 7 m wide passage, and two kiva depressions. The northern and largest roomblock is, in one place, four rooms wide, with the majority of the block being three rooms wide. It is approximately 65 m long and 18 m at its widest point. It contains at least 32 rooms and has some indications that jacal or ramada construction was attached to the inside or plaze-facing wall for a major portion of the length of the building. The smaller roomblock is approximately 32 m long and about 8 m at the widest point. The building is five rooms long and in two locations has additional rooms attached to the inside or plaza wall, making the structure two rooms wide at these points. It is possible that ramada or jacal rooms were constructed between the two protruding rooms. Seven masonry rooms are in evidence in this roomblock. The largest of the two kiva depressions is approximately 9 m in maximum extent of the depression (suspect 6 to 7 m diameter inside structure). The depression is approximately 1.5 m deep. The second depression is approximately 7 m in maximum diameter, with a slight indication of an interior depression which is approximately 4.5 m in diameter. The depression is approximately 0.5 m deep.

Flora: Juniper, mesquite, broom snakeweed, grasses.

Score	
1	Cultural Litter Density: $2/m^2$
2	Preservation: Generally undisturbed.
3	Stratigraphy: Deposits up to 1 m, in situ.
4	Rarity: Sites dating to this period, and of this size, are rare in the study area.
3	Aesthetics: A commanding view of the Salado.
4	Restoration Potential: Structure is generally undisturbed; excellent potential for major restoration.
4	Educational Potential: Worthy of individual nomination.
21	TOTAL

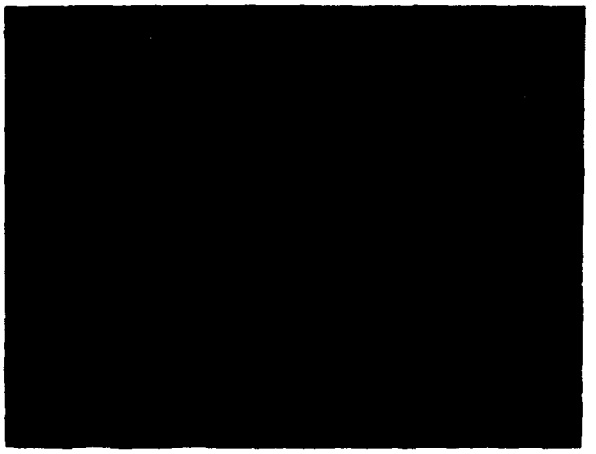
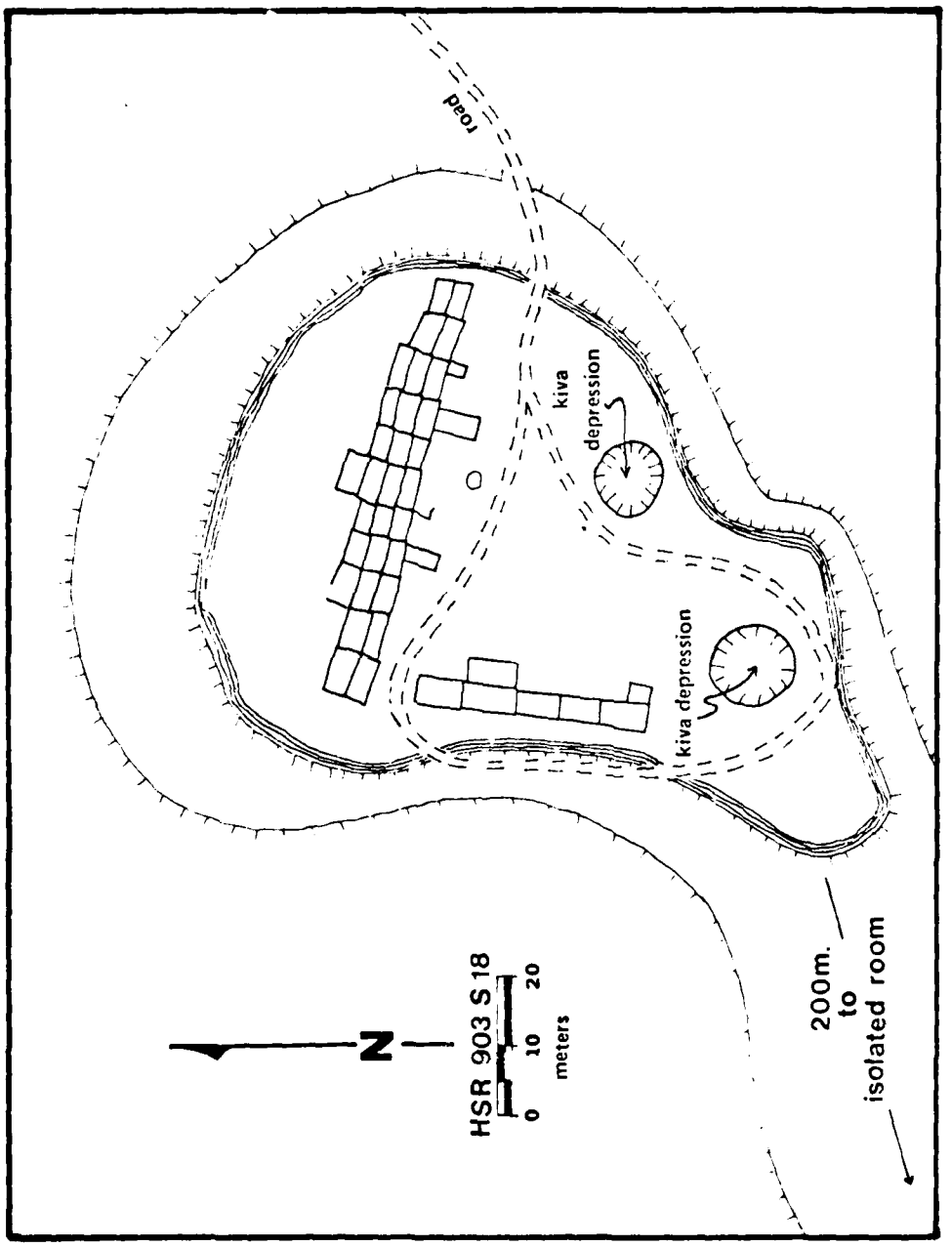
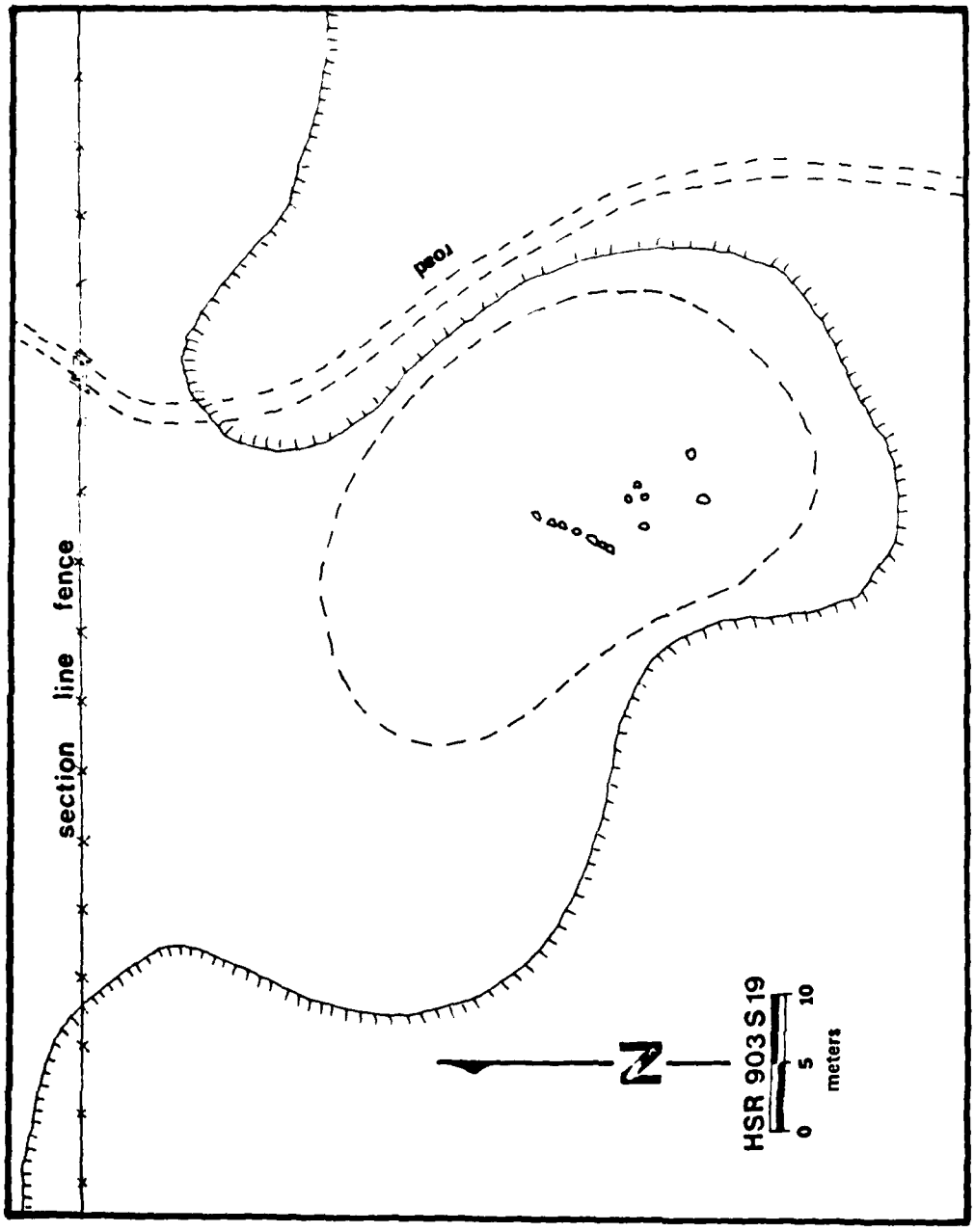


Photo 45: HSR903/S-18, view from northeast. A ca. 40-room Glaze D period pueblo above the Rio Salado Box.


road
kiva
depression
kiva depression
N
HSR 903 S18
0
10
20
meters
200m.
to
isolated room


road
section line fence
N
HSR 903 S19
0 5 10
meters

HSR SITE NO: 903/S-19
LA NUMBER: 20939

Stratification Zone: D-M
Elevation: 5330 feet; 1625 meters
Slope: 1%
Aspect: 190°
Temporal Horizon: Early P-I
Cultural Litter Density: <1/m²
Lithic Pattern: —

Maximum Length (longest axis): 40 m
Orientation (longest axis): 160°
Maximum Width: 20 m
Estimated Maximum Area: 500 m²
Maximum Depth: 0.25 m
Number of Hearths: 0
Number of Structures: 1

Description: This small site occupies the top of a low ridge which extends south into the confluence of a small arroyo flowing into the north side of the Rio Salado.

Architecture: Structural indication on this site is limited to a single alignment of upright slabs approximately 5 m long. No corners were observed, but the presence of a small amount of masonry rubble to the southeast of the alignment suggests that the remainder of the structure is buried.

Flora: Juniper, broom snakeweed, cholla, tamarisk, mixed grasses.

Score	
0	Cultural Litter Density: <1/m²
2	Preservation: In good condition.
2	Stratigraphy: Typical of smaller residence sites.
2	Rarity: Typical of units residence sites in sample.
0	Aesthetics: No unusual features.
1	Restoration Potential: Remains of structures are minimal.
2	Educational Potential: Potential study collections.
9	TOTAL

HSR SITE NO: 903/S-20
LA NUMBER: 20940

Stratification Zone: D-M
Elevation: 5160 feet; 1573 meters
Slope: 5%
Aspect: 90°
Temporal Horizon: Modern
Cultural Litter Density: <1/m²
Lithic Pattern: —

Maximum Length (longest axis): 18 m
Orientation (longest axis): 100°
Maximum Width: 10 m
Estimated Maximum Area: 180 m²
Maximum Depth: 0.10 m
Number of Hearths: 0
Number of Structures: 1

Description: This modern brush and post corral is situated on an eastern ridge slope directly above the first terrace along the north bank of the Rio Salado. Tin cans, wire, scrap tin, etc., indicate a date of approximately 1940.

Architecture: This double post and brush corral is approximately 6 x 10 m inside.

Flora: Mesquite, creosote, cholla, broom snakeweed, dropseed, Russian thistle.

Score	
0	Cultural Litter Density: <1/m²
2	Preservation: Good condition, although abandoned and beginning to fall down.
0	Stratigraphy: None.
1	Rarity: Typical homestead corral structure.
0	Aesthetics: No unusual features.
0	Restoration Potential: None.
1	Educational Potential: Recent, with minimal cultural materials.
4	TOTAL

HSR SITE NO: 903/S-21, Abajo de Caja Pueblo
LA NUMBER: 20941

Stratification Zone: D-M
Elevation: 5210 feet; 1588 meters
Slope: 2%
Aspect: 145°
Temporal Horizon: Late P-I/Late P-II
Cultural Litter Density: <10/m²
Lithic Pattern: 1

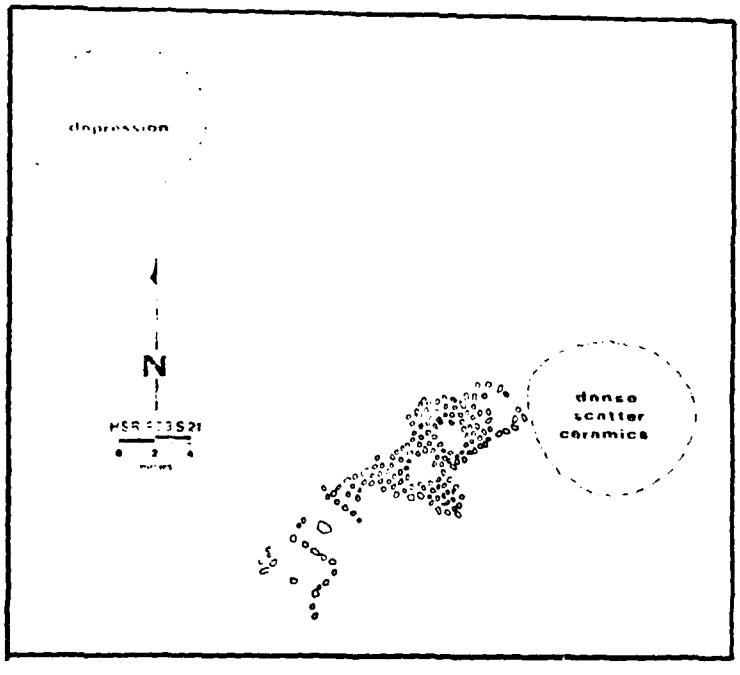
Maximum Length (longest axis): 60 m
Orientation (longest axis): 300°
Maximum Width: 60 m
Estimated Maximum Area: 3000 m²
Maximum Depth: 2.0 m
Number of Hearths: 0
Number of Structures: 2

Description: This site lies on the top of a flat bench point of the second terrace above the north bank of the Rio Salado. La Jencia Creek enters the Salado directly across from this location.

Architecture: Structural indications on this site consist of a linear surface house of six rooms and a large pit room. The linear surface house consists of two masonry rooms defined by substantial rubble and four rooms of probable jacal construction with masonry subwalls indicated by rock alignments but little rubble. The pit room is indicated by a large circular depression approximately 9 m in diameter (maximum).

Flora: Creosote, broom snakeweed, mesquite, cholla.

Score	
2	Cultural Litter Density: <10/m²
2	Preservation: Good condition, undisutrbed.
3	Stratigraphy: Deep deposits, up to 1 m in pit room.
2	Rarity: Typical of unit residence sites in study area.
0	Aesthetics: No unusual features.
2	Restoration Potential: Masonry in good condition.
2	Educational Potential: Potential study collections.
13	TOTAL



HSR SITE NO: 903/S-22
LA NUMBER: 20942

Stratification Zone: D-M
Elevation: 5200 feet; 1585 meters
Slope: 3%
Aspect: 140^0
Temporal Horizon: BM-III
Cultural Litter Density: $<1/m^2$
Lithic Pattern: 2

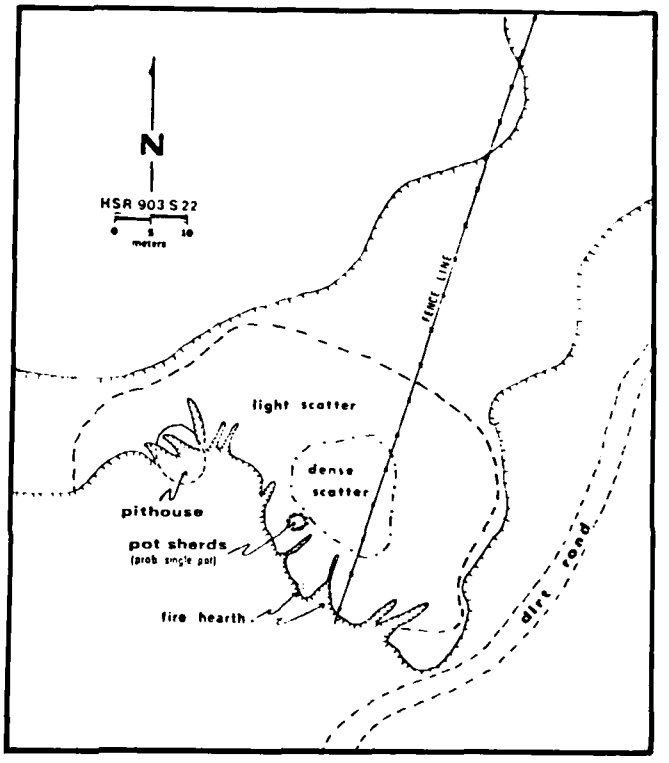
Maximum Length (longest axis): 50 m
Orientation (longest axis): 130^0
Maximum Width: 30 m
Estimated Maximum Area: 1000 m^2
Maximum Depth: 1.0 m
Number of Hearths: 3
Number of Structures: 1

Description: This diffuse lithic and ceramic scatter is actively eroding into an arroyo, exposing the floor of a buried pithouse in the cut bank. The site is located on a broken alluvial bench within the gravel hills which extend beyond and above the first alluvial terrace along the south side of the Rio Salado.

Architecture: A single pit room evidenced in the eroding arroyo bank and two hearths also observed in the bank (' are the structural indications on this site. The pit room is more than half eroded away, but it was possible to determine that the structure was originally ca. 4.5 m in diameter and approximately 0.75 m in depth.

Flora: Sacaton, creosote, mesquite, cholla, narrowleaf yucca, Russian thistle.

Score	
0	Cultural Litter Density: $<1/m^2$
1	Preservation: Actively eroding, threatened by arroyo cut.
3	Stratigraphy: Deep deposits, up to 1 m.
3	Rarity: BM-III pithouse sites are uncommon in study area.
0	Aesthetics: No unusual features.
0	Restoration Potential: None.
2	Educational Potential: Potential study collections.
9	TOTAL



HSR SITE NO: 903/S-23 (903/RS-1, see Historic report)
LA NUMBER: 20943
ACE NO: 04

Stratification Zone: D-M
Elevation: 5190 feet; 1582 meters
Slope: 2%
Aspect: 10^0
Temporal Horizon: BM-III/Historic
Cultural Litter Density: $6/m^2$
Lithic Pattern: 3

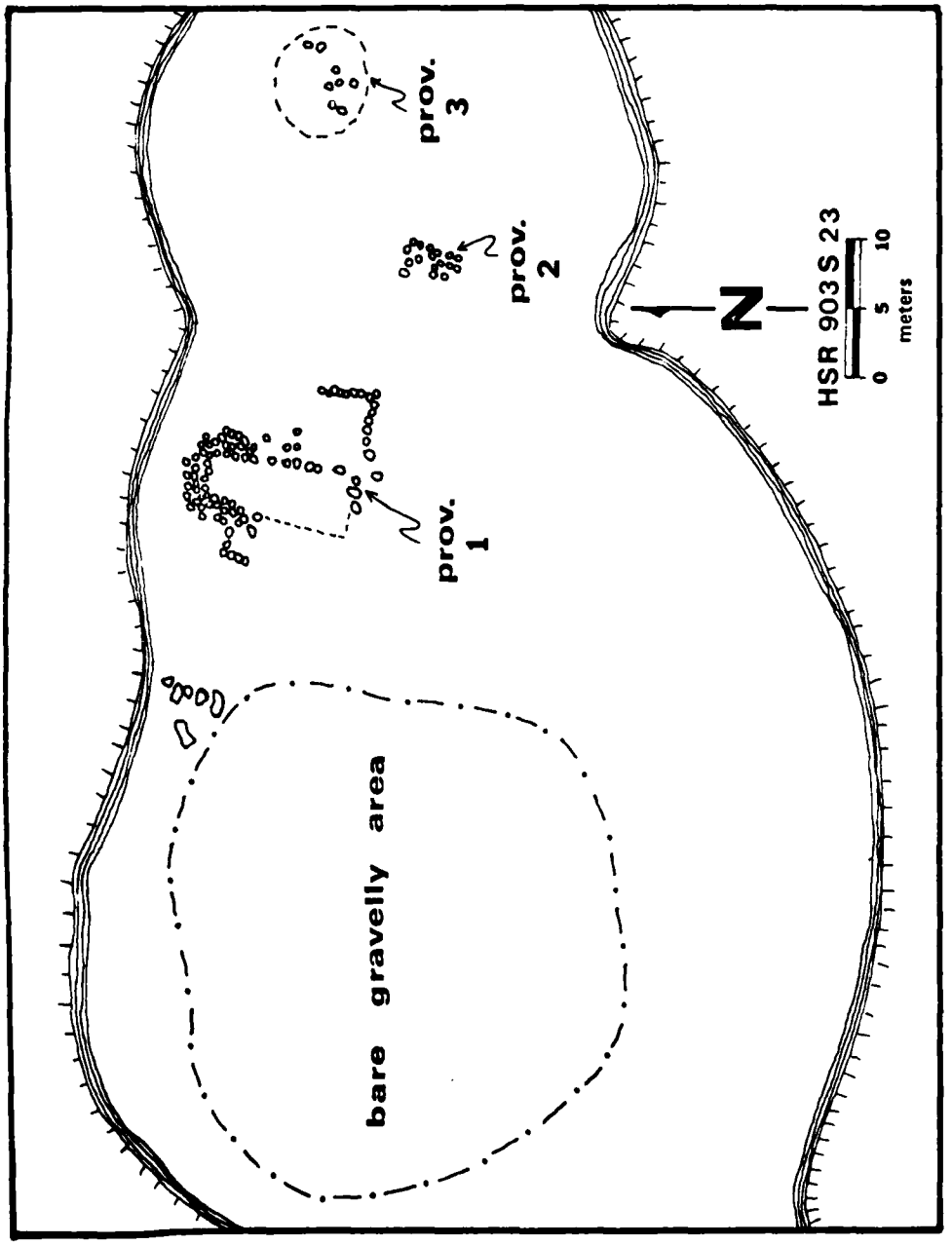
Maximum Length (longest axis): 100 m
Orientation (longest axis): 90^0
Maximum Width: 40 m
Estimated Maximum Area: $3000\ m^2$
Maximum Depth: 0.50 m
Number of Hearths: 2
Number of Structures: 2

Description: This multicomponent site lies on top of a low ridge above the first alluvial terrace along the south side of the Rio Salado, and immediately west of the confluence of La Jencia Creek.

Architecture: This site is multicomponent with both historic and prehistoric structural features. The historic house (1) consists of a two room, adobe and masonry structure with what appears to be an enclosed patio. It is approximately 12 x 3 m with two rooms oriented approximately north-south on the long axis. The north room appears to have been of cobble masonry to the full height of the walls. The south room appears to have been of masonry foundation with adobe walls. An alignment of masonry elements extends from the southeast corner of the south room to a 90^0 angle north and extends north along the front of the building. Three possible prehistoric structures are located on the site. The first (2), approximately 10 m east of the historic house, consists of what appears to be a small two-room unit house constructed of cobble masonry. Cobble alignments of walls 2 x 4 m approximately, define two rooms. The lack of extensive rubble probably indicates that masonry elements were robbed during the construction of the historic component. The second structural indications (3) appear to be the remains of two hearth areas defined by concentrations of fire-cracked rock in an area of approximately 7 x 7 m. A final indication of a possible prehistoric structural component is a large (approximately 20 x 20 m) cleared area containing scattered masonry elements and a moderate increase in density of cultural materials. No definable structural evidence was observed, but it is possible that structures, if present, were raised during the historic occupation.

Flora: Sacaton, creosote, mesquite, broom snakeweed, juniper.

Score	
2	Cultural Litter Density: $6/m^2$
2	Preservation: Good condition, undisturbed except for historic building activities.
2	Stratigraphy: In good condition, up to 50 cm in depth.
3	Rarity: Multicomponent sites are uncommon in the sample.
0	Aesthetics: No unusual features.
2	Restoration Potential: Typical of structural sites.
2	Educational Potential: Good potential for study collections.
13	TOTAL


prov. 3
prov. 2
prov. 1
N
HSR 903 S 23
0 5 10
meters
bare gravelly area

HSR SITE NO: 903/S-24
LA NUMBER: 20944

Stratification Zone: M-N
Elevation: 5280 feet; 1609 meters
Slope: 70%
Aspect: 180°
Temporal Horizon: Unknown
Cultural Litter Density: —
Lithic Pattern: —

Maximum Length (longest axis): 12 m
Orientation (longest axis): 180°
Maximum Width: 3 m
Estimated Maximum Area: —
Maximum Depth: Unknown, possibly 1.0+ m
Number of Hearths: 0
Number of Structures: 0

Description: This small cave is located within a conglomerate ledge on the south face of a rocky ridge above a small canyon drainage. This canyon enters the Rio Salado from the north, just below or east of the *Box*.

Architecture: This site is a small cave into conglomerate formations outcropping in a small side canyon tributary to the Salado on the north side of the drainage, just above the confluence of the La Jencia with the Rio Salado. The cave is presently approximately 2 m wide and .75 m high at the entrance. It is approximately 12 m deep and 1.5 m high in the center of the cave. Deposits as indicated by the active talus at the entrance appear to be approximately 2 m in depth. The ceiling of the cave is heavily smoke blackened, indicating possible human occupation. No cultural materials were observed, and no structural evidence was present.

Flora: Juniper, mesquite, creosote, mormon tea, broadleaf yucca.

Score	
0	Cultural Litter Density: Not determined due to cave situation.
4	Preservation: Deposits are in situ, dry situation has high potential for rare perishable materials.
2	Stratigraphy: Undetermined; probably <1 m.
3	Rarity: Apparently unusual for the study area.
0	Aesthetics: No unusual features.
0	Restoration Potential: None.
4	Educational Potential: Potential is high for perishable materials and for fossil packrat middens.
13	TOTAL

HSR SITE NO: 903/S-25
LA NUMBER: 20945

Stratification Zone: D-M
Elevation: 5290 feet; 1612 meters
Slope: 1%
Aspect: 45°
Temporal Horizon: BM-III/P-I
Cultural Litter Density: 3/m²
Lithic Pattern: —

Maximum Length (longest axis): 130 m
Orientation (longest axis): 120°
Maximum Width: 70 m
Estimated Maximum Area: 5000 m²
Maximum Depth: 0.50 m
Number of Hearths: 0
Number of Structures: 9

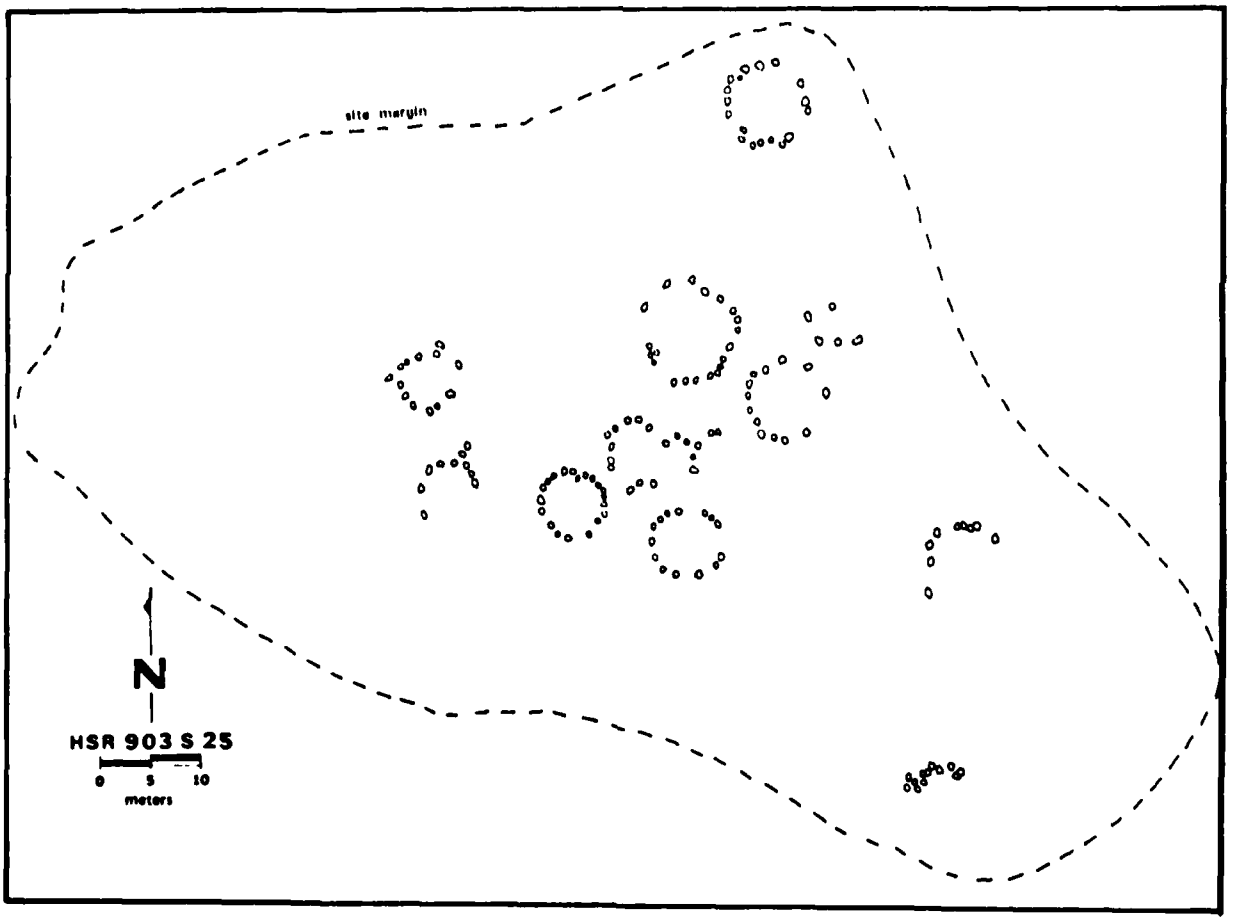
Description: This site is located on a small flat topped bench overlooking the first terrace on the south side of the Rio Salado. This bench is just upriver from the upper end of the Salado *Box*.

Architecture: Nine clear rings of river cobbles and locally available slabs of basalt, as well as possibly three or more other dispersed rings are distributed on a flat bench just above the mouth of the Salado *Box*. These rings are simple, single element alignments very similar to protohistoric tipi rings. The largest is approximately 9 m in maximum diameter, and the smallest is approximately 5 m in diameter (mean: 6.4 m diameter). In addition to the rings, one other rock feature is present on the site. Southeast of the major concentration of rings approximately 35 m is a group of river cobbles and basalt elements in a somewhat dispersed alignment approximately 6 m long and .3 to .4 m wide. No pattern or obvious order could be discerned from surface indications.

Flora: Juniper, broom snakeweed, grama, narrowleaf yucca.

Score

1	Cultural Litter Density: $3/m^2$
3	Preservation: Generally undisturbed, in excellent condition.
2	Stratigraphy: In situ deposits may exceed 50 cm in depth.
4	Rarity: Unusual ring rock alignments are unique in this sample.
0	Aesthetics: No unusual features.
0	Restoration Potential: None.
4	Educational Potential: Excellent; worthy of Register nomination.
14	TOTAL



HSR SITE NO: 903/S-26, Ligon Site
LA NUMBER: 20946

Stratification Zone: D-M
Elevation: 5400 feet; 1646 meters
Slope: 1%
Aspect: 0 to 360°
Temporal Horizon: BM-III
Cultural Litter Density: 3/m²
Lithic Pattern: 3

Maximum Length (longest axis): 75 m
Orientation (longest axis): 60°
Maximum Width: 35 m
Estimated Maximum Area: 1800 m²
Maximum Depth: 1.5 m
Number of Hearths: 0
Number of Structures: 3

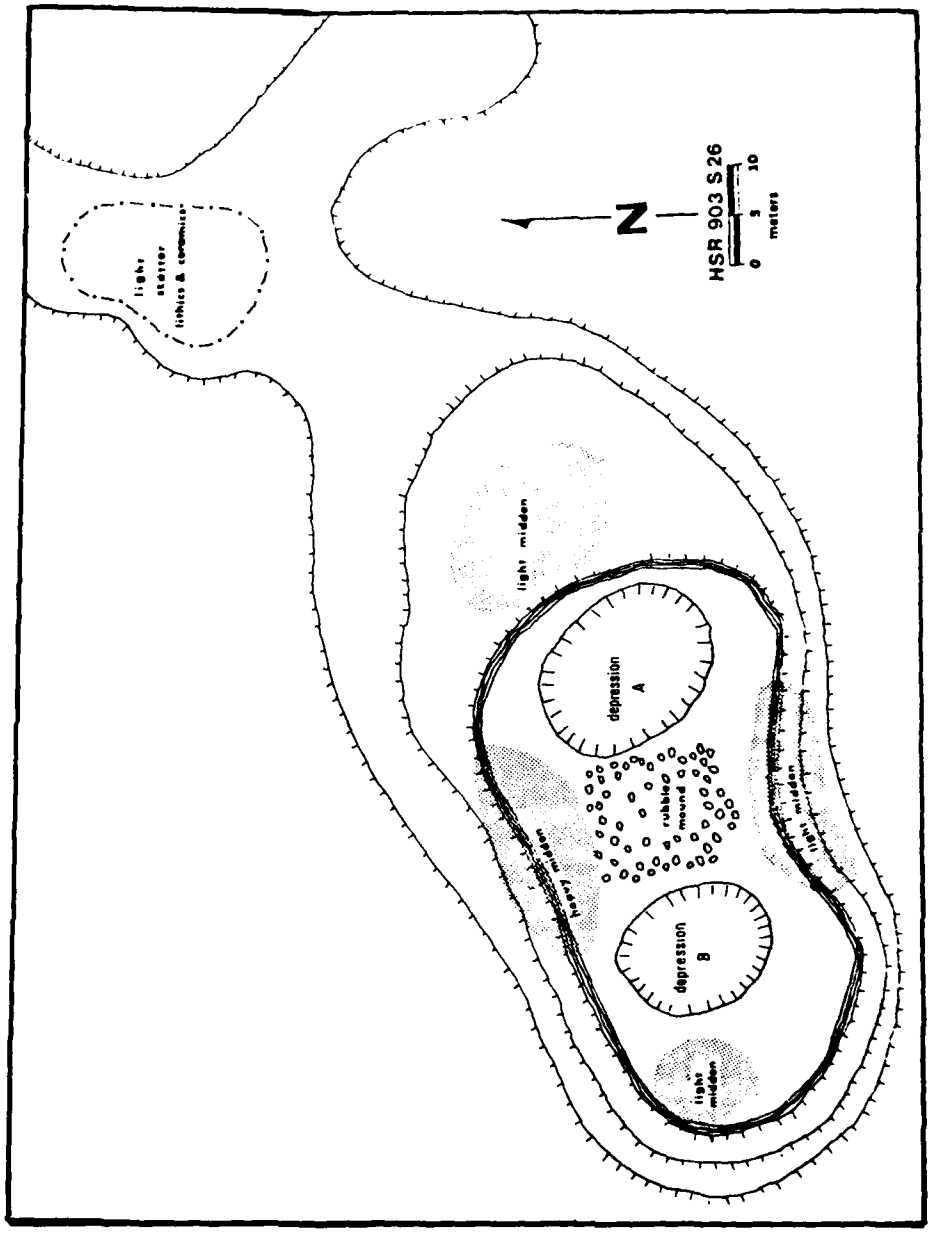
Description: This site is located on top of a high, isolated ridge point at the confluence of La Jencia Creek and Ligon Ranch arroyo. The view commands both drainages in all directions.

Architecture: Structural indications present on this site include two large pit room depressions and a small surface roomblock estimated to contain four rooms. The northern pit room is rectangular to ovoid in appearance and the maximum diameter of the depression is 10 m (actual room is at least 6 m). The southern pit room is circular in appearance and is 8 m edge to edge of the depression (again, room estimated to be 6 m). Between the two pit rooms, a mound of cobble and basalt elements, dark stained earth and cultural materials appears to be a small surface roomblock, approximately 5 x 10 m in area. Cross walls were not observed in the rubble mound, but size of the outside wall alignments suggests four rooms.

Flora: Broom snakeweed, juniper, four-wing saltbush, mesquite, narrowleaf yucca, cholla.

Score	
1	Cultural Litter Density: 3/m²
3	Preservation: Deposits are in very good condition, and may be up to 1.5 m deep.
3	Stratigraphy: Undisturbed, in excellent condition.
3	Rarity: Structural features are somewhat unusual in the study area.
3	Aesthetics: Commanding view of a major tributary confluence.
2	Restoration Potential: Typical of structural sites in sample.
4	Educational Potential: Excellent potential for future study.
19	TOTAL

Photo 46: Ligon Site from south. Note two large pitroom depressions.


N
HSR 903 S 26
0
5
10
meters
light midden
depression A
depression B
rubble mound
light midden
light midden
light midden

HSR SITE NO: 903/S-27, Penol de Santa Rita Pueblo
LA NUMBER: 20947

Stratification Zone: M-H
Elevation: 5700 feet; 1735 meters
Slope: 1%
Aspect: 0 to 360°
Temporal Horizon: Late P-II
Cultural Litter Density: —
Lithic Pattern: —

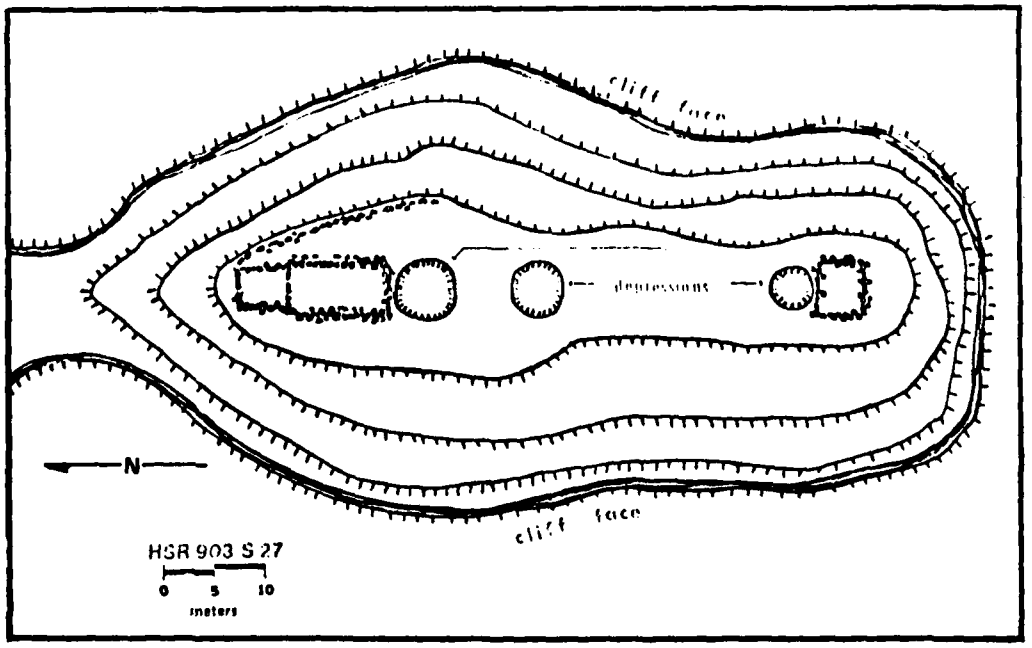
Maximum Length (longest axis): 75 m
Orientation (longest axis): 0°
Maximum Width: 20 m
Estimated Maximum Area: 1500 m²
Maximum Depth: 1.0 m
Number of Hearths: 0
Number of Structures: 2

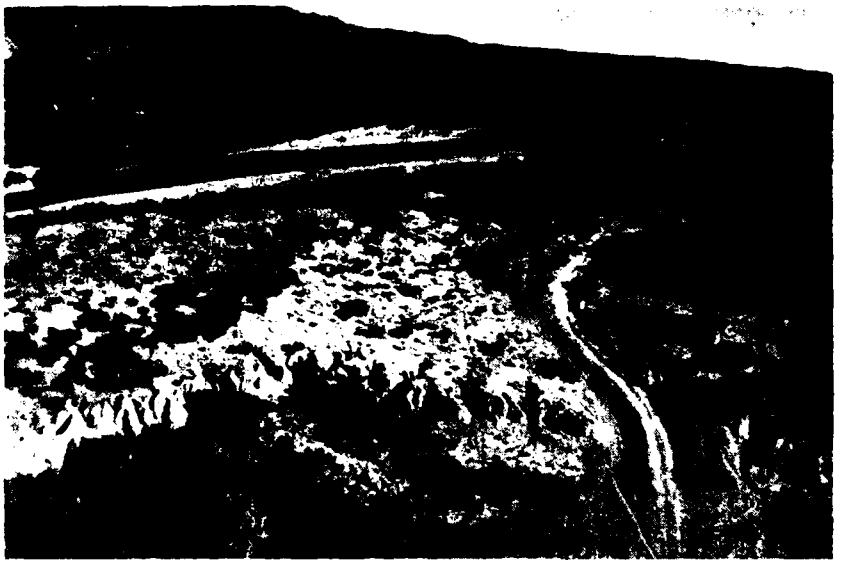
Description: This site is situated on the summit of an elevated mesa which is a conspicuous landmark in the central Rio Salado valley. The site is approximately 1 km north of the drainage some 120 m above the floodplain. Access is restricted to several steep locations along the mesa sides.

Architecture: The site consists of a complex of three large masonry rooms and three subterranean pitrooms. The large rooms are clearly atypical with dimensions of 4 x 5 m, 4 x 5 m, and 5 x 10 m. Wall elevations extend to 50 cms and there is substantial quantities of rubble suggesting original full height masonry constructions. The pitrooms range from 4 to 6 meters in diameter and are defined by conspicuous depressions 50 to 75 cms in depth. There is a linear wall alignment 20 m in length, which exists along the northeast summit margin. Wall elevations of 25 cms and the absence of rubble suggests that this served as an enclosure rather than a defensive barrier.

Flora: Russian thistle, broom snakeweed.

Score	
1	Cultural Litter Density: Light.
2	Preservation: Undisturbed.
2	Stratigraphy: Probably typical of structural sites in sample.
4	Rarity: Large room size, formal alignment are unusual in study area, possibly a special function site.
4	Aesthetics: Located on a major landmark with a commanding view.
3	Restoration Potential: Excellent.
4	Educational Potential: Excellent potential for future study.
20	TOTAL





A Basketmaker III period pitroom site (HSR903/S-22) is eroding from the slope of a peninsula which extends into the confluence of an unnamed arroyo with Rio Salado near La Jencia. Two hearth areas and one pitroom have been partially destroyed by water erosion, cutting the downslope edge of the site. Charcoal present along the exposed floor suggests the possibility of easily dating the occupation through dendrochronology or radiocarbon methods.

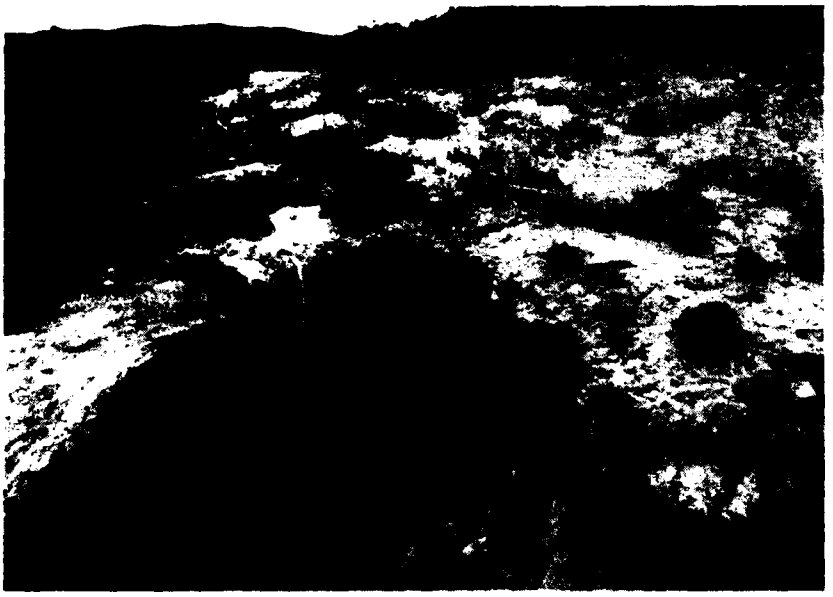


Photo 47 (top): Site occupies flat above cut bank to left of road.

Photo 48 (left) and Photo 49 (below): Pitroom exposed by erosion, dark charcoal stain and burned beams define floor, fill and roof fall.

HSR SITE NO: 903/L-1
LA NUMBER: 20948

Stratification Zone: D-H
Elevation: 5015 feet; 1529 meters
Slope: 1%
Aspect: 240°
Temporal Horizon: Late P-I
Cultural Litter Density: 8/m^2
Lithic Pattern: —

Maximum Length (longest axis): 65 m
Orientation (longest axis): 45°
Maximum Width: 45 m
Estimated Maximum Area: 2900 m^2
Maximum Depth: 0.50 m
Number of Hearths: 3
Number of Structures: 1

Description: This scatter of material is being actively exposed in a blow area at the south edge of a small set of active sand dunes. The site and these dunes occupy the edge of a high sand and gravel terrace overlooking the north side of the Rio Salado.

Architecture: Evidence of one burned jacal structure eroding from a low mound suggests the presence of a maximum 2 x 2 m room. Two hearth areas represented by approximately forty fire-cracked rocks per square meter, were spread over approximately 2 m^2 each. Although no other structural evidence was observed, it is likely that other jacals may be expected if the site were excavated.

Flora: Indian rice grass, four-wing saltbush, mesquite, giant dropseed, creosote, juniper.

Score	
1	Cultural Litter Density: 8/m^2
1	Preservation: Probably surface collected, actively eroding.
2	Stratigraphy: Possible buried deposits up to 50 cm in depth.
2	Rarity: Typical of scatters along the Salado.
0	Aesthetics: No unusual features.
0	Restoration Potential: None.
2	Educational Potential: Potential study collections.
8	TOTAL

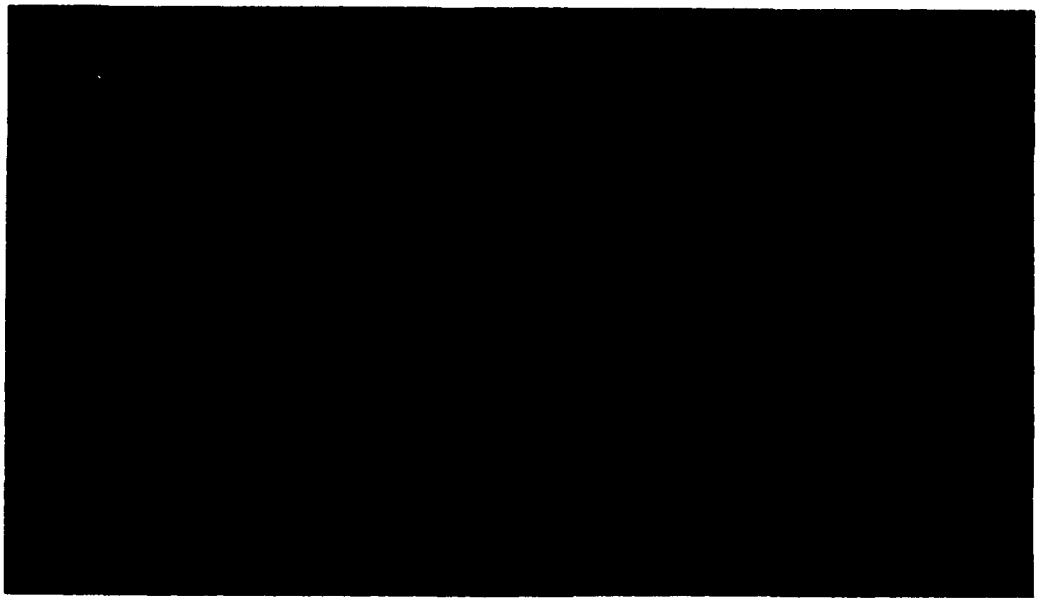
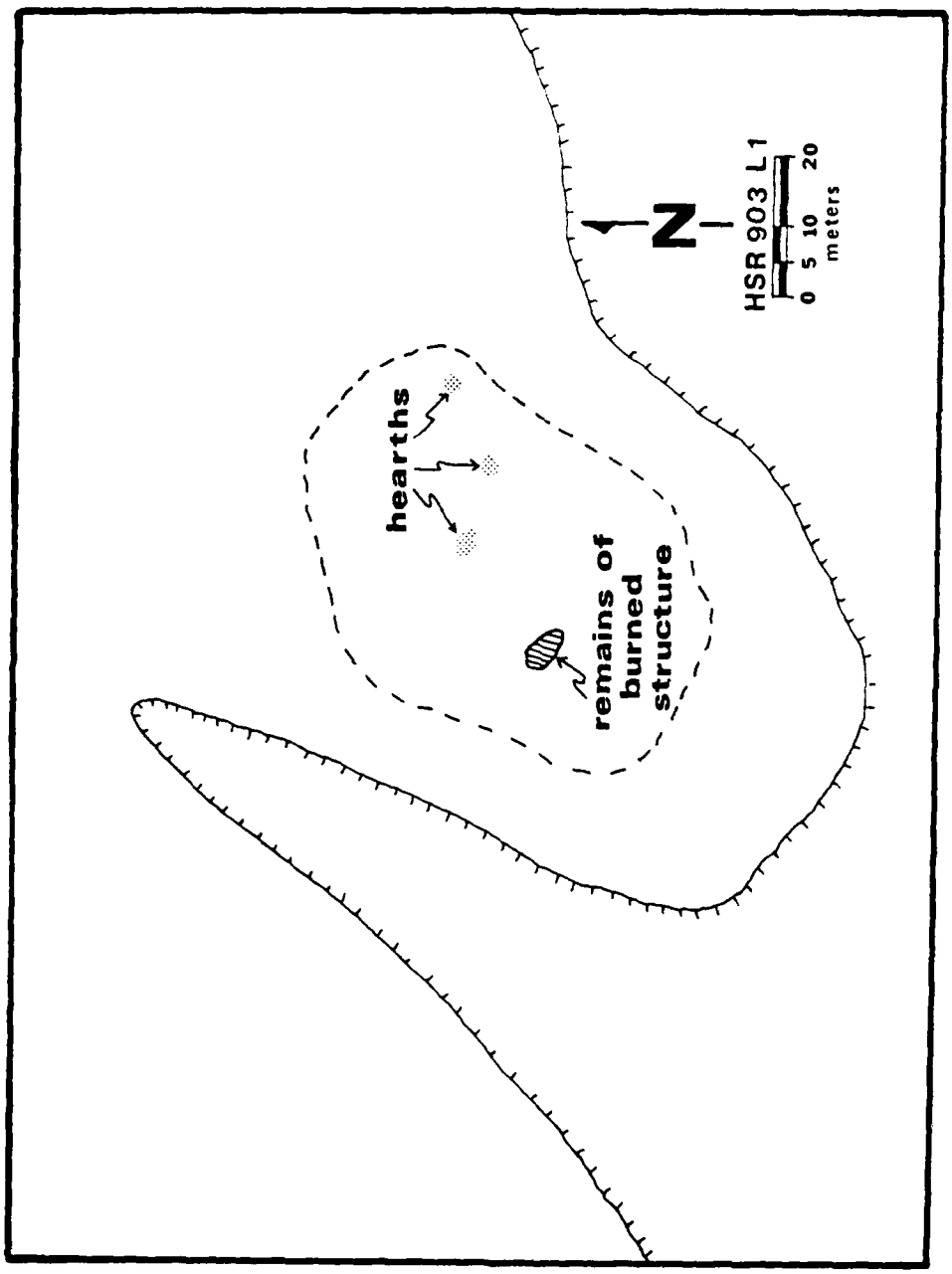


Photo 50: HSR903/L-1 burned adobe "latilla" casts.


N
HSR 903 L1
0 5 10 20
meters
hearths
remains of
burned
structure

HSR SITE NO: 903/L-2
LA NUMBER: 20949

Stratification Zone: J-H
Elevation: 4970 feet; 1515 meters
Slope: 2%
Aspect: 220^0
Temporal Horizon: P-I
Cultural Litter Density: 12/m^2
Lithic Pattern: 3

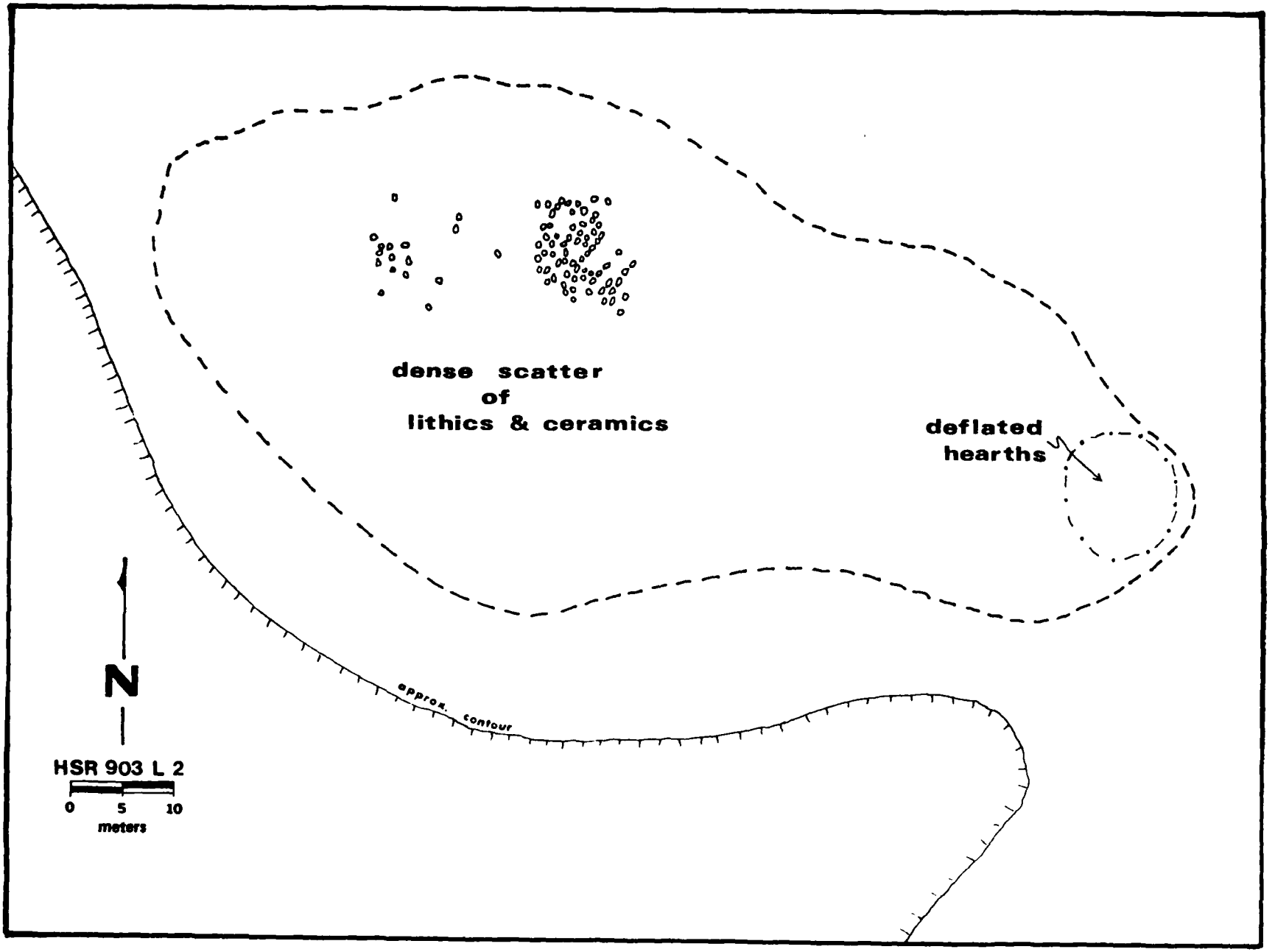
Maximum Length (longest axis): 100 m
Orientation (longest axis): 70^0
Maximum Width: 50 m
Estimated Maximum Area: 3000 m^2
Maximum Depth: 1.0 m
Number of Hearths: 1
Number of Structures: 1

Description: This site is located at the head of a small draw which drops directly into the Rio Salado from the north. Gravel ridges extend down both sides of the draw, and sand has deposited in dune formations over the western ridge.

Architecture: A single masonry structure measuring approximately 8 m in length and 2 m in width was observed. This structure was estimated to contain four rooms measuring approximately 2 x 2 m each. Walls were apparently constructed of rounded river cobbles measuring 10 to 30 cm in greatest dimension. Presence of a cluster of river cobbles on a low, heavily eroded mound to the west of the main roomblock suggest the possibility that a small jacal or ramada room was present. A single fire-cracked rock distribution over approximately 1.5 m was the only evidence of an intact hearth area observed.

Flora: Indian rice grass, *four-wing saltbush*, *broom snakeweed*, *mesquite* and *giant dropseed*.

Score	
1	Cultural Litter Density: 12/m^2
2	Preservation: Typical of study area, in good condition.
2	Stratigraphy: Undisturbed, up to 1 m in depth.
2	Rarity: Typical of unit residence structures in study area.
0	Aesthetics: No unusual features.
2	Restoration Potential: Rubble mound suggests potential is good.
2	Educational Potential: Potential study collections.
11	TOTAL


dense scatter
of
lithics & ceramics
deflated
hearths
approx. contour
N
HSR 903 L 2
0 5 10
meters

HSR SITE NO: 903/L-3
LA NUMBER: 20950

Stratification Zone: J-H
Elevation: 4985 feet; 1519 meters
Slope: 2%
Aspect: 210°
Temporal Horizon: Archaic?
Cultural Litter Density: 10/m²
Lithic Pattern: 2

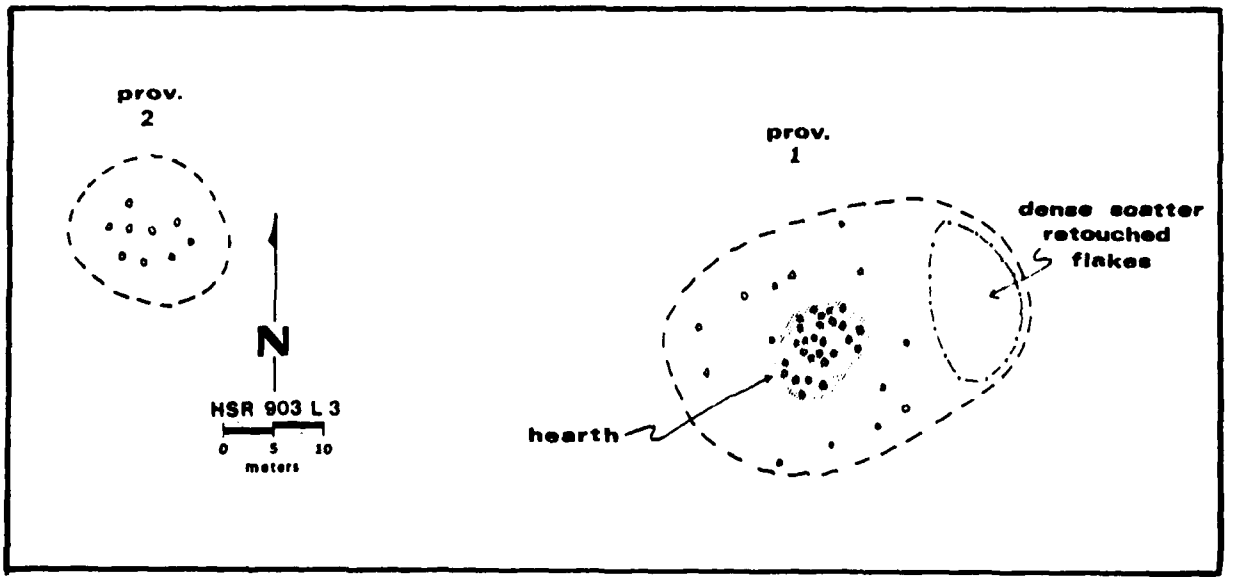
Maximum Length (longest axis): 35 m
Orientation (longest axis): 90°
Maximum Width: 20 m
Estimated Maximum Area: 700 m²
Maximum Depth: 0.25 m
Number of Hearths: 2
Number of Structures: 0

Description: This scatter lies within a sand dune blow area along a lower bench slope along the north side of the Rio Salado.

Architecture: The only evidence of structure on this site consists of two distributions of fire-cracked rock. The largest is approximately 8 x 8 m in size and contains approximately thirty rocks of 5-10 cm in greatest dimension per m². The other hearth is evidenced as a sparse scatter of fire-cracked rock scattered over a 10 x 20 m blow area.

Flora: Mesquite, creosote, broom snakeweed, four-wing saltbush, Indian ricegrass.

Score	
1	Cultural Litter Density: 10/m²
1	Preservation: Deflated but contained.
2	Stratigraphy: Deposits are shallow, but may be intact.
2	Rarity: Typical of aceramic scatters in sample.
0	Aesthetics: No unusual features.
0	Restoration Potential: None.
2	Educational Potential: Potential study collections.
8	TOTAL



HSR SITE NO: 903/L-4
LA NUMBER: 20951

Stratification Zone: I-D
Elevation: 4930 feet; 1503 meters
Slope: 2%
Aspect: 40°
Temporal Horizon: BM-III/Early P-I
Cultural Litter Density: 12/m²
Lithic Pattern: —

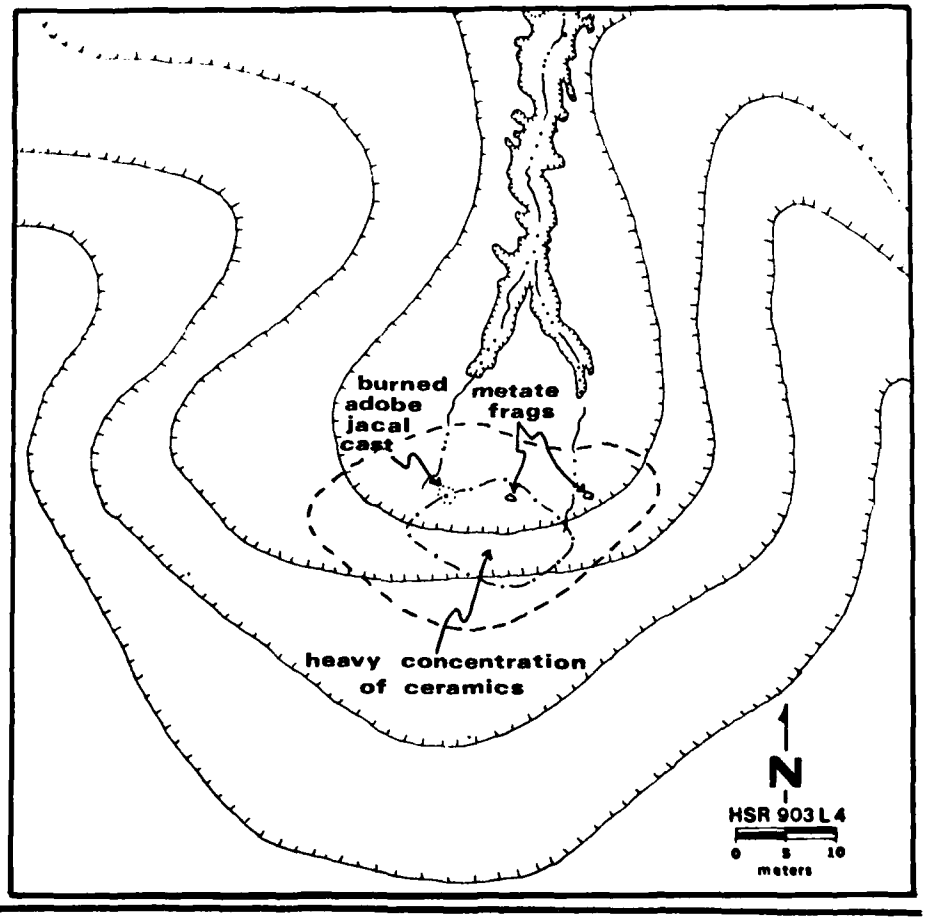
Maximum Length (longest axis): 30 m
Orientation (longest axis): 85°
Maximum Width: 20 m
Estimated Maximum Area: 500 m²
Maximum Depth: 0.50 m
Number of Hearths: 0
Number of Structures: Possible

Description: This site is located at the top of a slight slope along the lower edge of the first terrace along the south side of the Rio Salado.

Architecture: A number of fragments of burned adobe exhibiting casts of latilla or small twigs suggests the possibility of a jacal or ramada structure. The only other structural evidence was a small amount of fire-cracked rock.

Flora: Broom snakeweed, sacaton, four-wing saltbush, mesquite, squawberry, creosote.

Score	
1	Cultural Litter Density: 12/m²
1	Preservation: Eroded.
2	Stratigraphy: Undisturbed, may extend to 50 cm in depth.
2	Rarity: Typical of scatters in study area.
0	Aesthetics: No unusual features.
0	Restoration Potential: None.
2	Educational Potential: Potential study collection.
8	TOTAL



HSR SITE NO: 903/L-5
LA NUMBER: 20952

Stratification Zone: H
Elevation: 5000 feet; 1524 meters
Slope: 1%
Aspect: 205°
Temporal Horizon: Early P-II
Cultural Litter Density: 27/m²
Lithic Pattern: —

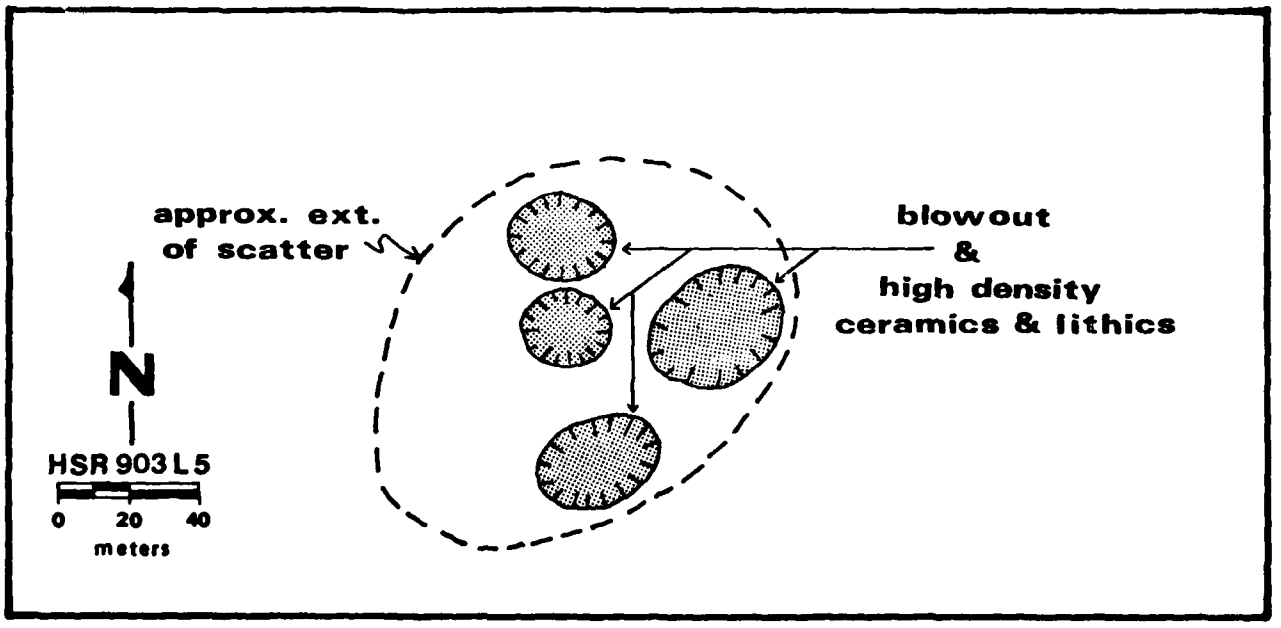
Maximum Length (longest axis): 130 m
Orientation (longest axis): 50°
Maximum Width: 95 m
Estimated Maximum Area: 1000 m²
Maximum Depth: 0.20 m
Number of Hearths: 0
Number of Structures: 0

Description: The site is exposed in several small blow areas at the head of a small, deep draw on top of a high terrace along the north side of the Rio Salado.

Architecture: No evidence of structures or hearths were discovered.

Flora: Indian ricegrass, four-wing saltbush, mesquite, giant dropseed.

Score	
2	Cultural Litter Density: 27/m²
1	Preservation: May be eroded and redeposited.
1	Stratigraphy: <20 cm; may be redeposited.
2	Rarity: Typical of scatters in study area.
0	*Aesthetics: No unusual features.*
0	Restoration Potential: None.
2	Educational Potential: Potential study collection.
8	TOTAL



HSR SITE NO: 903/L-6
LA NUMBER: 20953

Stratification Zone: I
Elevation: 5120 feet; 1561 meters
Slope: 3%
Aspect: 325°
Temporal Horizon: Late P-II
Cultural Litter Density: <1/m²
Lithic Pattern: 2

Maximum Length (longest axis): 100 m
Orientation (longest axis): 360°
Maximum Width: 35 m
Estimated Maximum Area: 3000 m²
Maximum Depth: 0.50 m
Number of Hearths: 0
Number of Structures: 0

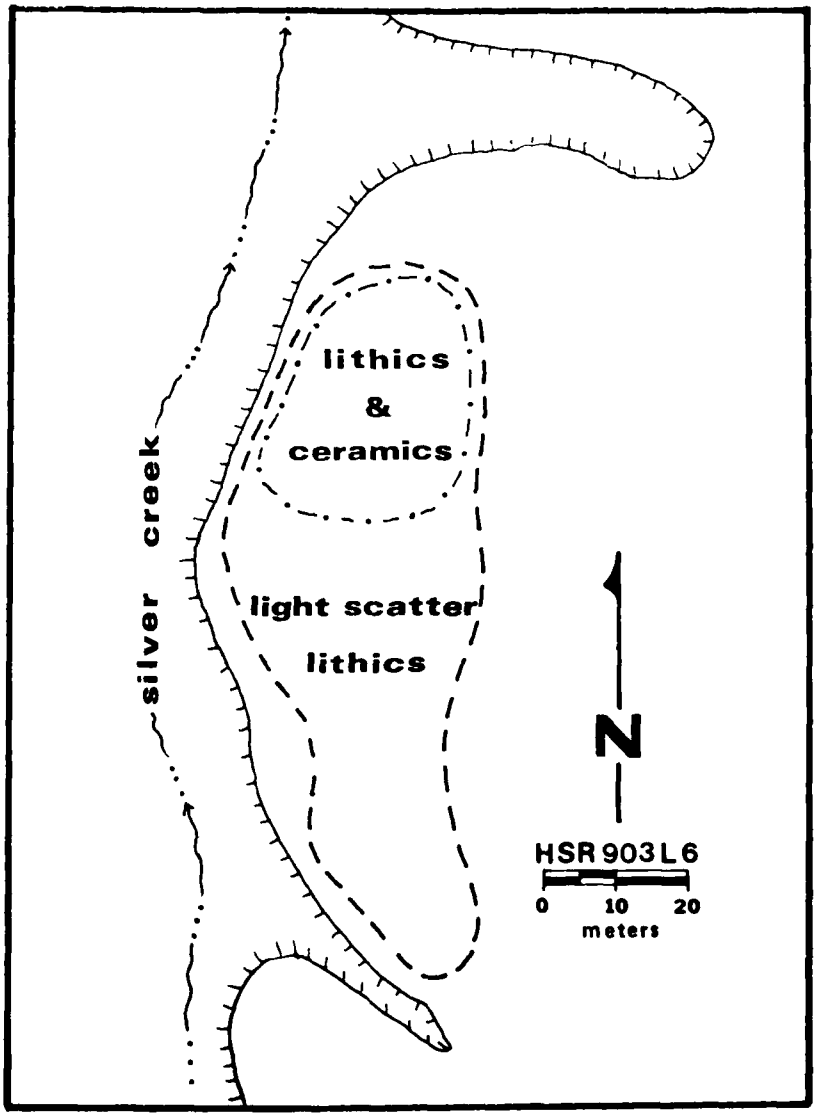
Description: This scatter lies on a low, dune covered knoll on the east side of Silver Creek, 1.2 miles from its confluence with the Rio Salado to the north.

Architecture: Presence of a number of slab-like fragments of sandstone and some fire-cracked rock suggests the possibility of an jacal or ramada and hearth area. However, no direct evidence of such a presence was observed on the surface.

Flora: Four-wing saltbush, willow, juniper, mesquite, giant dropseed.

Score

0	Cultural Litter Density: <1/m²
2	Preservation: May be well preserved below recent sand dunes.
2	Stratigraphy: Potentially intact; buried structures may exist.
2	Rarity: Typical of surface scatters in study area.
0	Aesthetics: No unusual features.
1	Restoration Potential: Unknown.
2	Educational Potential: Potential study collection.
9	TOTAL



HSR SITE NO: 903/L-7
LA NUMBER: 20954

Stratification Zone: D-I
Elevation: 5080 feet; 1548 meters
Slope: 1%
Aspect: 90^0 to 270^0
Temporal Horizon: P-IV, Glaze C-D-E
Cultural Litter Density: $10/m^2$
Lithic Pattern: 3

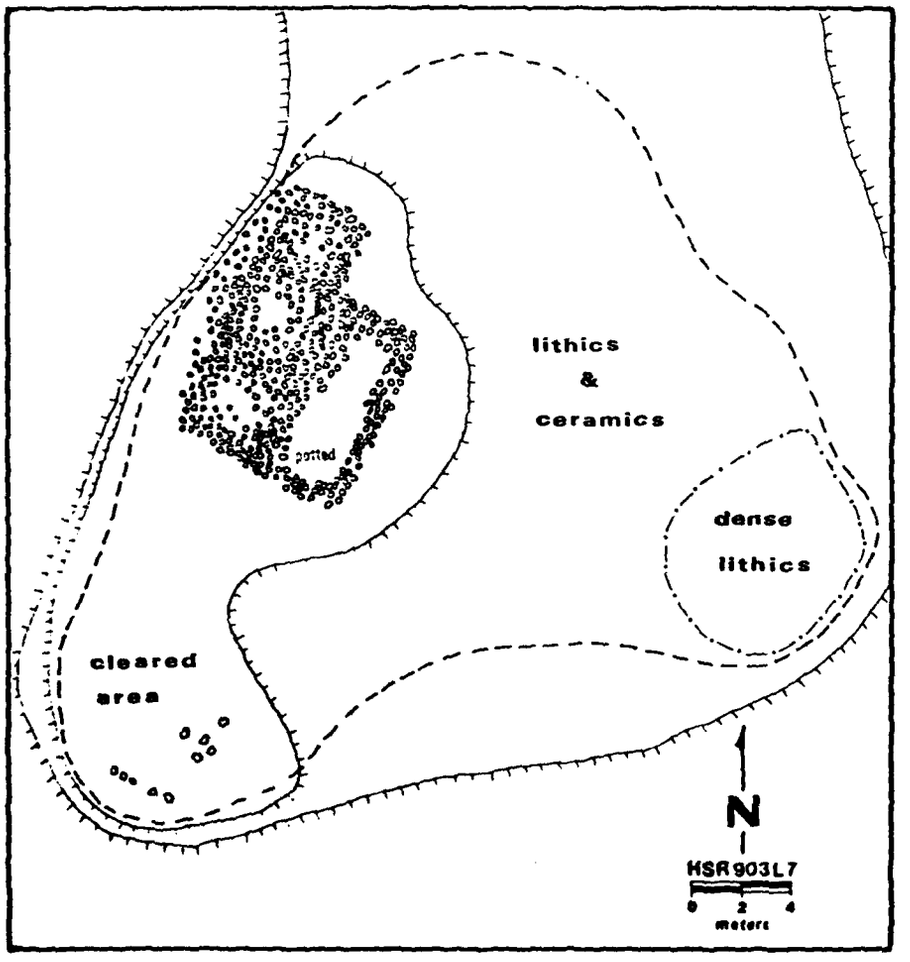
Maximum Length (longest axis): 36 m
Orientation (longest axis): 40^0
Maximum Width: 30 m
Estimated Maximum Area: $1000\ m^2$
Maximum Depth: 1.0 m
Number of Hearths: 0
Number of Structures: 1

Description: This site occupies the top of a low ridge point which extends into a major meander on the north side of the Rio Salado immediately opposite the confluence of Silver Creek.

Architecture: At least four, possibly five cobble masonry rooms are present in a single roomblock, measuring approximately 6 x 10 m in greatest dimension. Three of these rooms measure approximately 2 x 2 m and a fourth is either one room measuring 2 x 4 m or two rooms measuring 2 x 2 m each. Evidence of a dividing wall, if it existed, has been obliterated by a vandal's pot hole. A cleared and slightly depressed area 8 m south of the roomblock suggests the possibility of a pithouse or other structure although nothing definable was observed.

Flora: Creosote, broom snakeweed, mixed grasses.

Score	
1	Cultural Litter Density: $10/m^2$
3	Preservation: In excellent condition except for limited potholes in two rooms.
2	Stratigraphy: Apparently undisturbed, except for 2 small potholes; deposits may extend to 1 m in depth.
3	Rarity: Sites from this period are rare in the study area.
2	Aesthetics: Commanding position on a ridgetop.
2	Restoration Potential: Masonry in good condition.
3	Educational Potential: A fine example of a small Late Glaze period site.
16	TOTAL



HSR SITE NO: 903/L-8
LA NUMBER: 20955

Stratification Zone: D-I
Elevation: 5100 feet; 1554 meters
Slope: 2%
Aspect: 360°
Temporal Horizon: BM-III
Cultural Litter Density: 7/m²
Lithic Pattern: 2

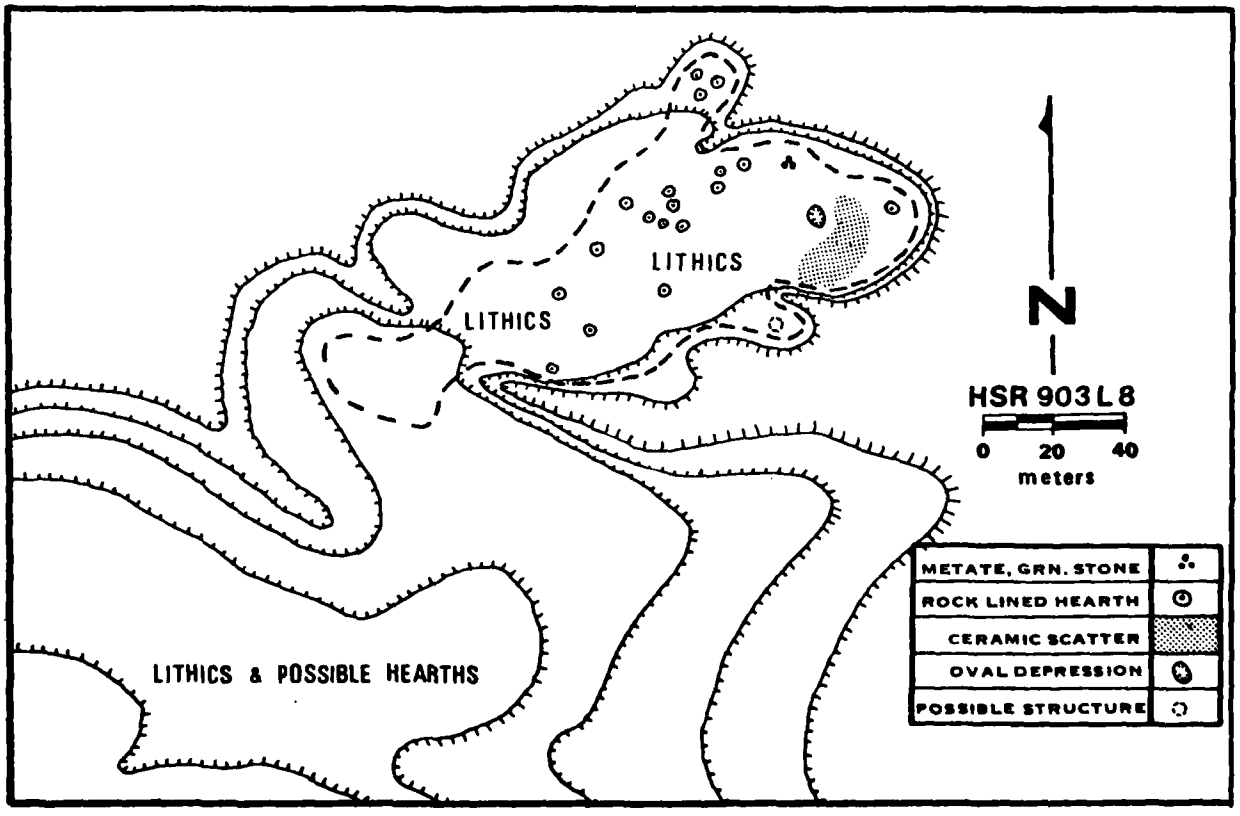
Maximum Length (longest axis): 170 m
Orientation (longest axis): 70°
Maximum Width: 80 m
Estimated Maximum Area: 13,000 m²
Maximum Depth: 0.50 m
Number of Hearths: 18+
Number of Structures: 1

Description: This extensive site is located on the top of a low gravel hill on the south side of the Rio Salado along the east side of the confluence of Silver Creek.

Architecture: At least 18 fire-cracked rock hearth areas (generally small, <1.5 m diameter) were observed on this site. At two locations along the extreme eastern edge of the site some evidence of structures was observed. The first was a rectangular to oval depression measuring approximately 6 x 4 m. Presence of a midden immediately associated suggests that this is a pithouse. Approximately 30 m south of this depression, on the point of a small projection of the flat topped ridge which the site occupies, a suggestion of alignment in river cobbles indicates that this level area may have been a small cobble masonry surface room(s).

Flora: Creosote, broom snakeweed, mixed grasses, juniper.

Score	
1	*Cultural Litter Density*: 7/m²
2	Preservation: Good condition, undisturbed.
2	Stratigraphy: Depth up to 50 cm; pithouses probably present.
3	Rarity: Relatively extensive site for this period.
0	Aesthetics: No unusual features.
1	Restoration Potential: Low potential, although pithouses may be in excellent condition.
2	Educational Potential: Potential study collections.
11	TOTAL



HSR SITE NO: 903/L-9
LA NUMBER: 20956

Stratification Zone: D-I
Elevation: 5120 feet; 1561 meters
Slope: 2%
Aspect: 80^0
Temporal Horizon: Late P-I
Cultural Litter Density: $10/m^2$
Lithic Pattern: –

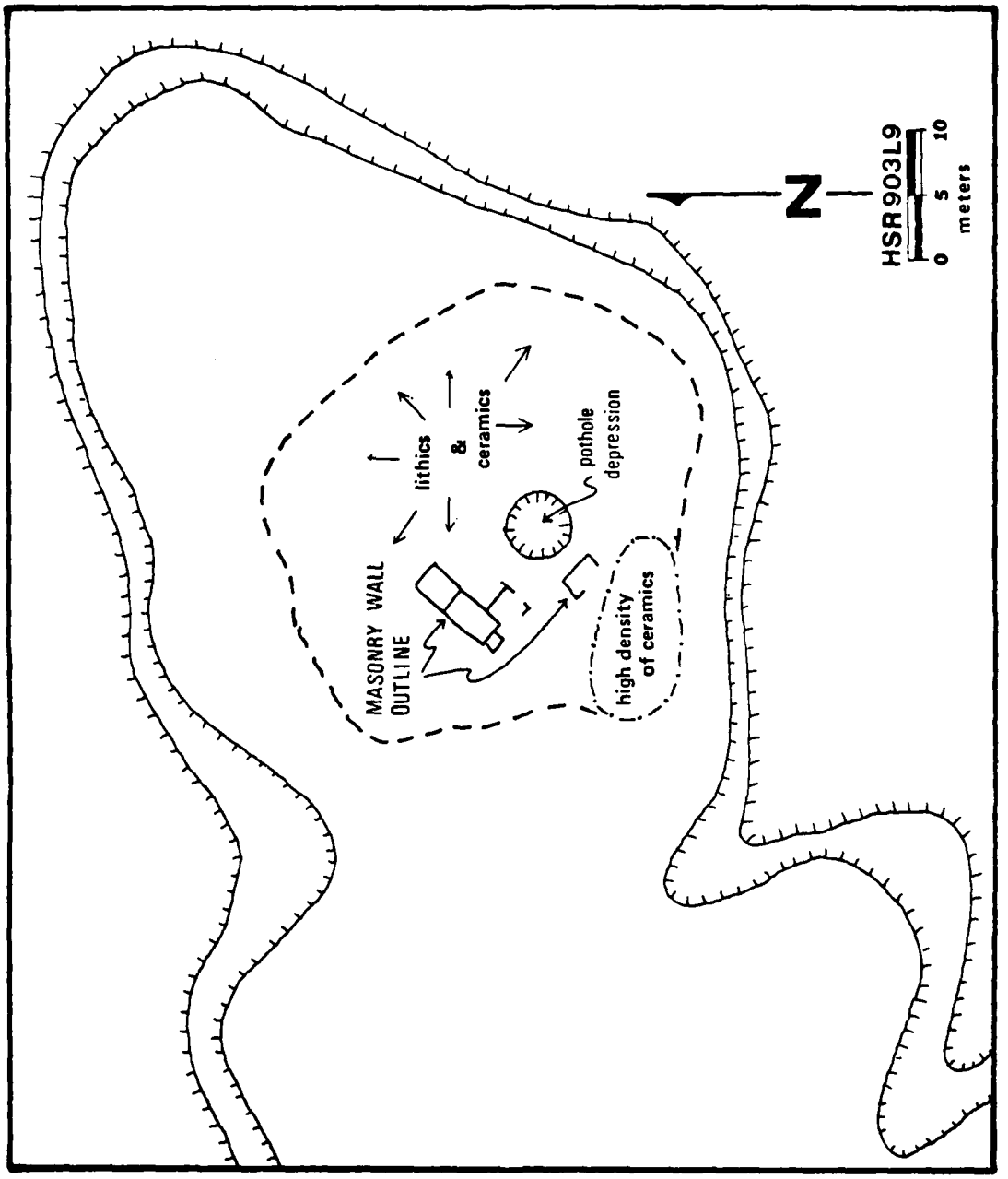
Maximum Length (longest axis): 35 m
Orientation (longest axis): 135^0
Maximum Width: 35 m
Estimated Maximum Area: $1000\ m^2$
Maximum Depth: 1.0 m
Number of Hearths: 0
Number of Structures: 3

Description: This site is situated on the flat surface of a high gravel ridge along the north side of the Rio Salado.

Architecture: Apprxoimately five cobble masonry surface rooms are organized in a roomblock of four rooms and one single room on the northwest and southwest sides of a large pithouse depression. Four rooms are grouped in an L-shape with three large rooms of approximately 2 x 2 m each and a single small (storage type) room measuring 5 x 1 m attached to the lower edge of the L. The pithouse depression is approximately 7 m in maximum diameter. No distinct hearth areas were observed.

Flora: Juniper, mesquite, creosote, broom snakeweed.

Score	
1	Cultural Litter Density: $10/m^2$
2	Preservation: Pit room has been vandalized; other deposits and structures appear to be intact.
3	Stratigraphy: Up to 1 m of deposits, apparently in situ.
3	Rarity: A good example of unit residence site from the lower portion of the drainage.
2	Aesthetics: Scenic view.
1	Restoration Potential: Very little rubble remains, suggesting most rooms may not be restorable.
3	Educational Potential: Very good potential for future study.
15	TOTAL


N
HSR 903L9
0 5 10
meters
lithics
&
ceramics
pothole
depression
MASONRY WALL
OUTLINE
high density
of ceramics

HSR SITE NO: 903/L-10
LA NUMBER: LA 287

Stratification Zone: D-J
Elevation: 4909 feet; 1496 meters
Slope: 2%
Aspect: 0 to 360^0
Temporal Horizon: P-IV, Glaze A
Cultural Litter Density: $74/m^2$
Lithic Pattern: 2

Maximum Length (longest axis): 500 m
Orientation (longest axis): 0^0
Maximum Width: 300 m
Estimated Maximum Area: 100,000 m^2
Maximum Depth: 2.0 m
Number of Hearths: 0
Number of Structures: 10+

Description: This large pueblo occupies the top of an isolated basalt mesa overlooking the Rio Grande along its west side, just south of the confluence of the Rio Salado.

Architecture: This site consists of approximately 75 large rooms in a large rectangular configuration around a central plaza. A single large kiva is present within the plaza, and another large kiva was observed to the south and east of the plaza. In addition, several small structural indications were observed to the south and west of the main plaza. To the north of the plaza, several terrace or dam-like features suggest the presence of a water control technology, and to the north of the terrace several circles of masonry suggest small temporary structures or rooms. Four, and possibly five roomblocks are represented around the main plaza. These average 40 m in length and 3 m in width. The large kiva in the plaza is approximately 10 m in diameter and its depression extends 1.5 m below the surface. The second kiva is slightly smaller, 9 m in diameter.

Flora: Creosote, broom snakeweed, mixed grasses.

Score	
4	Cultural Litter Density: $74/m^2$
3	Preservation: Except for minor disturbance by USGS benchmark placement, in excellent condition.
3	Stratigraphy: Generally intact.
4	Rarity: An excellent example of Glaze A site along the Rio Grande.
4	Aesthetics: Historic significance—principle meridian control point; occupies an unusual isolated mesa with a commanding view.
4	Restoration Potential: Excellent.
4	Educational Potential: Should be detail mapped and nominated immediately to the Register.
26 TOTAL	

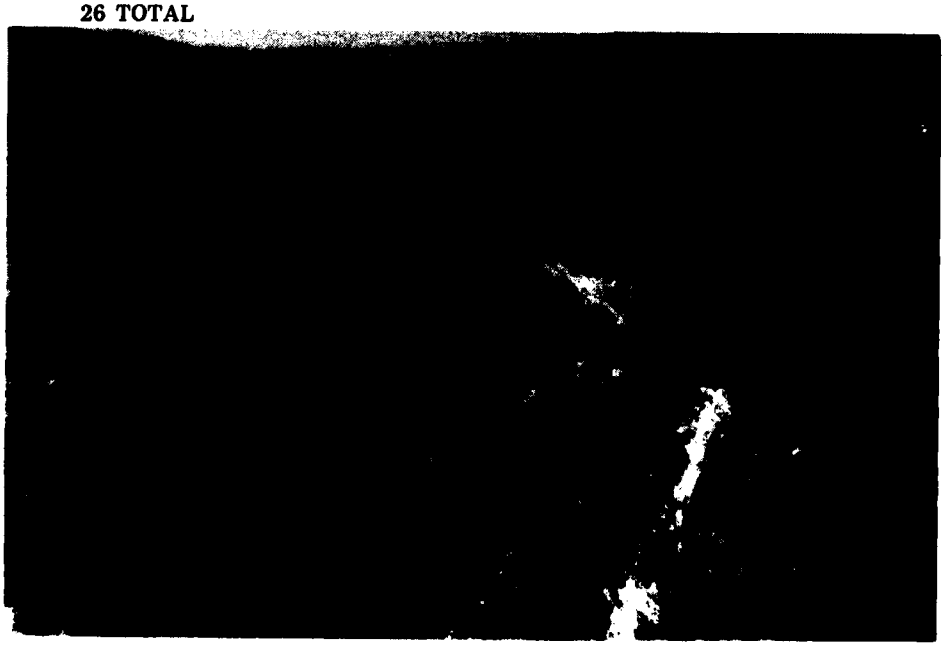


Photo 51: Site HSR903/L-10 (LA 287). Rio Salado drainage seen in middle to right background. A large plaza pueblo of Glaze A period contains a minimum of 75 rooms. Note depressions in drainage right side of mesa top, indicating possible prehistoric reservoirs.

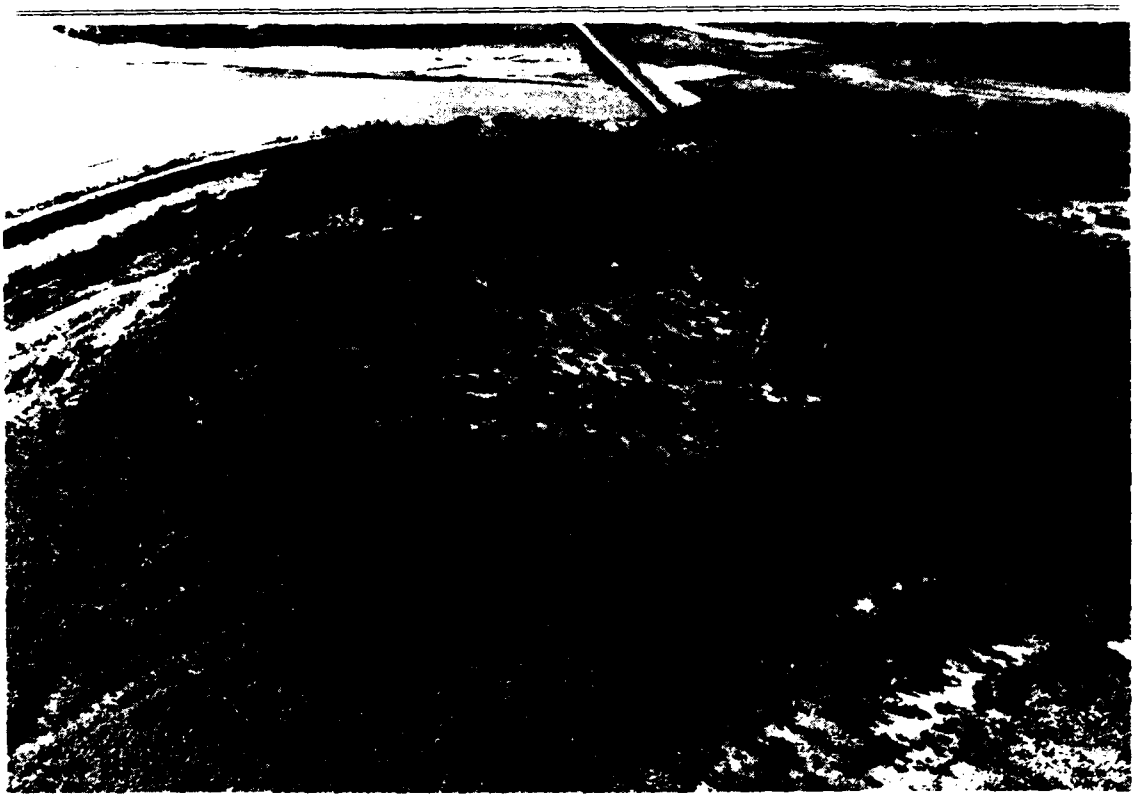


Photo 52 (above) and Photo 53 (right): LA 287 (HSR903/L-10) reported by Mera(1940). Note possible agricultural terraces and trails extending from pueblo. Greatest density of cultural materials was observed in midden area which appears as darkened mound between plaza and terrace structures.

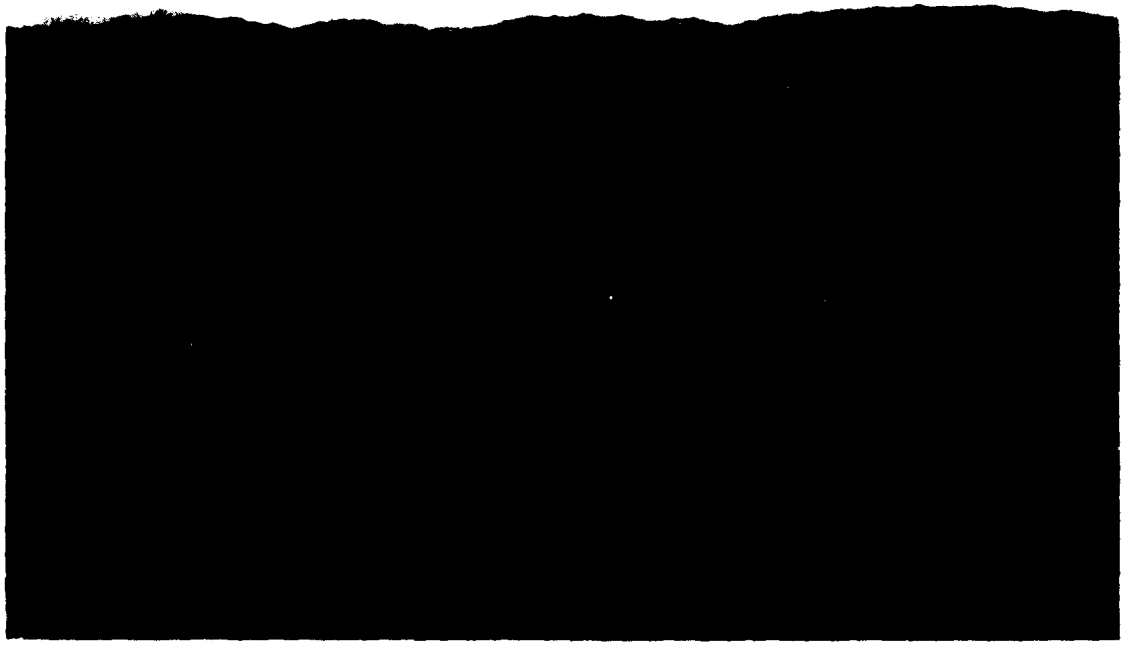


Photo 54: Some material descriptions are based on systematic CLD samples of high density or exposed areas within sites (HSR903/L-1).

Photo 55: At other sites, inventory of cultural materials present in a definable feature proved most reasonable.

PRELIMINARY ANALYSIS OF CERAMIC MATERIALS FROM THE LOWER RIO PUERCO–RIO SALADO DRAINAGES, N.M.

By Michael Marshall

INTRODUCTION

TAXONOMIC CONSIDERATIONS

The archaeological study of potsherds is a pastime which can range from an exact science or fine art to an exercise in the ridiculous. The potential of the potsherd to enlighten is balanced equally by the potential to thoroughly confuse.

The basis of ceramic inquiry is empirical observation. The established taxonomic structure attempts to *code-out* these observations into a fabric that reflects real variability. The use of such taxonomic categories as variants, types and type clusters, wares and ware series, complexes, groups, systems, assemblages, schools, et al., is useful only when the specific attributes and attribute clusters are defined. The student should not be encouraged to force his material into a niche with a name, but more to define what it is that he has found. It is still not altogether an easy task and we must all fall short, by varying degrees, of precise definition.

The taxonomic structure employed in this analysis is a mixture of descriptive and nominal nomenclature. Type and ware names are used in only cases where the material appears to be of classic and defined character.

SAMPLING AND ANALYSIS PROCEDURES

The analysis of the ceramic material was conducted primarily within the field under the *no collection policy*. Occasional type sherds were, however, collected for microscopic and comparative evaluation. The advantages of the *no collection policy* are that the integrity of the site is maintained in the interest of archaeological conservation and the curatorial energies and expenses are curtailed. The disadvantages of the policy are: 1) that the samples cannot be reexamined without a return to the field and then the identical sample cannot be retrieved; 2) the ceramic materials cannot be systematically compared internally or with materials from other districts; and 3) the ceramics cannot normally be examined with a binocular microscope or subjected to other laboratory facility analysis. The collection and laboratory examination of selected ceramic type specimens, in this analysis, has been conducted in an effort to ameliorate the negative aspects of the *no collection policy* but still maintain the integrity of the sites.

All site locations encountered which contained ceramic material were sampled. The sample size was often dictated by the material present on the site surface, as over 50% of the sites under consideration are represented by all visible ceramic material. Other site locations where ceramic materials are abundant are represented by variable quantities of ceramic material ranging from 50 to 200 sherds. All samples taken were of the *systematic grab-type*. Sample spatial stratifications, when employed, were defined with respect to structural features. Such spatial-structural stratification resulted, upon occasion, in the definition of multicomponent sites. Specific spatial limits in terms of meter blocks or transect areas were not normally employed. Sample control was achieved by exercising *non-selective* collection procedures. That is to say, all sherds visible, in sight, from a particular position were sampled regardless of size, color, decoration, etc. It should be noted that grayware materials are often quite visible, whereas brownware sherds seem to

blend into the earth and stones. The utmost care must be taken in selection if a sampling bias is not to result.

Most of the samples obtained are rather small. Certainly, small samples are not as statistically reliable as large samples. Many of the small samples obtained in this analysis are less than adequate but they represent all of the available surface debris obtained by rigorous search. I believe that most of these samples are representative of the actual ceramic content. There is a diversity of ceramic attributes and styles. However, site assemblages are patterned and of limited temporal extent. The temporal stratification based on the ceramic inventory is by no means absolute, but it does represent an accurate relative placement of the sites.

Table 26
RIO PUERCO CERAMIC FREQUENCIES
BASKETMAKER III and PUEBLO I HORIZONS

	BM III	Late P-I	Apparent P-I		Unknown Affinity	
	P-5	P-19	P-8	P-10	P-13	P-12
CIBOLA GRAY WARE						
Lino Gray (Classic)	11	19		2	2	7
Lino Gray (Silted)	39					
Kana'a Banded Smoothed		7				
Corrugated Indented		9				
CIBOLA WHITE WARE						
White Mound B/W	2*					
Red Mesa B/W		8				
Solid Style B/W						2
Unidentified Style B/W	1	16				
MOGOLLON BROWN WARE						
Brown Plain		53	15	4	3	
Banded Smoothed		9	11			
Banded Angular			1			
Basket Impressed				1		
Ribbed (unrubbed)				1		1
Ribbed Indented Rubbed with a plain base				8†		
CARBONACEOUS WHITE WARE						
Solid Style B/W		4				
Unidentified Style B/W		25				1
RIO GRANDE GLAZE WARE (Sand Temper)						
Glaze-on-Red Ext. Int. Tan Cream		1				
Socorro B/W						1
TOTALS	53	151	27	16	5	12

* White Mound B/W sherds from P-5 also have a silted appearance.
† These eight sherds of a Ribbed Indented Rubbed vessel from site P-10 represent a single vessel.

Table 27

RIO PUERCO CERAMIC FREQUENCIES
PUEBLO II EARLY SOCORRO EXPRESSION

	P-6 Prov. 1	P-15	P-16	P-17	P-18
CIBOLA GRAY WARE					
Lino Gray (Classic)			1		
Lino Gray (Silted)			1		9
CIBOLA WHITE WARE					
Red Mesa B/W					1
Solid Style B/W		2	3		8
Hatched Style B/W		4	1		2
Unidentified Style B/W	5	1	1		2
MOGOLLON BROWN WARE					
Plain Brown	54	62	45	45	35
Brown Red Slipped Int. & Ext.		1			
Ribbed Rubbed	21	25	15	16	9
Ribbed (unrubbed)	2	1	2	1	1
Ribbed Rubbed Incised		1			
Ribbed Punctate		2			
Ribbed Indented Punctate with Smudged Interior		1			
Ribbed Indented	5	1	2		4
Ribbed Indented Rubbed	2	2	2	4	
Black-on-Brown		1			
SOCORRO WHITE WARE					
Socorro B/W	1	51	9	16	20
CARBONACEOUS WHITE WARE					
Red Mesa Style B/W				1	
Solid Style B/W		18	7	13	1
Hatched Style B/W		20	3	12	
Unidentified Style B/W	34	25	22	38	22
MIMBRES WHITE WARE					
Boldface B/W		3			
WHITE MOUNTAIN RED WARE					
Puerco B/R				2	
RIO GRANDE GLAZE WARE					
Glaze A Red					2
TOTALS	124	221	114	148	116

Table 28

RIO PUERCO CERAMIC FREQUENCIES
PUEBLO II – EARLY P-III LATE SOCORRO EXPRESSION

	P-2	P-4	P-9	Glaze A Horizon P-20
CIBOLA GRAY WARE				
Lino Gray	2			1
Corrugated Non-indented	5			
Corrugated Indented	6	2		
CIBOLA WHITE WARE				
Red Mesa B/W		3		
Solid Style B/W	9	6	4	
Hatched Style B/W	2	5		
Unidentified Style B/W	13	16	1	
MOGOLLON BROWN WARE (Pitoche Series)				
Plain Brown	33	48	17	2
Plain Int. Smudged	17	7	10	
Los Lunas Smudged (narrow 2 mm smoothed coils exterior)		5	6	
Los Lunas Smudged (medium 4 mm unsmoothed coils ext. neck)	1		9	
Los Lunas Smudged Incised (narrow coils 2 mm w/incisions across unsmoothed coils)	3			
Ribbed Rubbed (narrow coils 2 mm with plain interior)		15	2	
Ribbed Rubbed (medium coils 4 mm with plain interior)			4	1
Ribbed Unrubbed (medium coils)	8		4	
Ribbed Unrubbed Punctate (fine coils 2 mm)			1	
Ribbed Unrubbed (fine coils 2 mm)	3			
Ribbed Indented (narrow coils 2 mm textured neck plain base)		1		
Ribbed Indented (wide coils 4-5 mm)		9	2	
SOCORRO WHITE WARE				
Socorro B/W	22	13	41	1
CARBONACEOUS WHITE WARE				
Red Mesa Style		1		
Solid Style		8	2	
Hatched Style			2	
Unidentified Style	16	15	5	
MIMBRES WHITE WARE				
Boldface Black-on-White ?		2		
WHITE MOUNTAIN RED WARE				
Puerco B/R		1		
Wingate B/R		1	2	
Cedar Creek Polychrome ?		1*		
Kwakina Polychrome				1†

Table 28 (Continued)

	P-2	P-4	P-9	Glaze A Horizon P-20
RIO GRANDE GLAZE WARE				
Glaze A Red			1	3††
UNIDENTIFIED RED WARE**				
Plain Red			42*† (i.e., 2 jars)	
Plain Red with Smudged Interior			2	
TOTALS	140	159	117 (Adapted)	9

* Gray paste, sherd temper. Mineral hatching with kaolin white outline on red within interior and broad kaolin white line on red exterior.

** This unidentified Red Ware series has a brown-red paste with quartz sand temper. The vessels are rather thick (7 mm), extending to 12 mm at the base. One of the Plain Red vessels has a *bumpy* polished surface in deep red with red-brown and gray fire clouds. The other Plain Red vessel is unpolished; it is red but has abundant gray and brown fire clouds. It has a granular surface texture. Both of these vessels tend to resemble historic Isleta and Sandia Red Wares but it is possible that there are a local P-III Red Ware series. The Plain Red Smudged vessel is a possible Los Lunas Plain Smudged but with an oxidized exterior surface and more than usually sandy temper.

† Gray paste, sherd temper. Interior white slip with green glaze. Exterior red slip.

†† Red-brown paste with crushed basalt and sand temper. One sherd is Glaze-on-Red interior and Red Slipped exterior. One is matte Glaze-on-Red exterior and Unslipped interior. One is Red Slipped exterior and Polished Brown interior.

*† These 42 sherds of two vessels have been counted as 2 in the tabulations and ceramic ware frequencies.

Table 29

RIO PUERCO SITES – CERAMIC WARE FREQUENCIES IN PERCENT OF SAMPLE

Site No.	Cibola Gray Ware	Cibola White Ware	Brown Ware	Carbon White Ware	Socorro White Ware	Mimbres White Ware	Wt. Mtn. Red Ware	Rio Grande Glazes	Sample Size
BASKETMAKER III HORIZON									
P-5	94.3	5.7							53
APPARENT PUEBLO I HORIZON									
P-8			100.0						27
P-10	12.5		87.5						16
LATE PUEBLO I HORIZON									
P-19	23.2	15.9	41.1	19.2				.6	151
UNKNOWN TEMPORAL AFFINITY									
P-13	40.0		60.0						5
P-12	58.3	16.7	18.3	8.3	8.3				12
PUEBLO II HORIZON, EARLY SOCORRO EXPRESSION									
P-6, Prov.1		4.0	67.7	27.4	.8				124
P-15		3.2	43.9	28.5	23.1	1.4			221
P-16	1.8	4.4	57.8	28.1	7.9				114
P-17			44.6	43.2	10.8		1.4		148
P-18	7.8	11.2	42.2	17.2	19.8			1.7	116
PUEBLO II – EARLY PUEBLO III HORIZON, LATE SOCORRO EXPRESSION									
P-2	9.3	17.1	46.4	11.4	15.7				140
P-4	1.3	18.9	53.5	15.1	8.2	1.3	1.9		159
P-9		4.3	47.0	7.7	35.0		1.7*	.9	
GLAZE HORIZON									
P-20	11.1		33.3		11.1		11.1	33.3	12
								TOTAL	1,298

* These are Red Ware sherds of an unidentified series.

Table 30 – CERAMIC WARE FREQUENCIES
RIO SALADO SITES OF THE BASKETMAKER III HORIZON

	S-22	S-26	S-23	(Eastern Component) L-8
CIBOLA GRAY WARE (Quartz Temper)				
Lino Plain (Classic)	6	28	90	12
Lino Plain (Silted)		19		5
CIBOLA GRAY WARE (Crushed Black Rock Temper)				
Lino Plain	50*			
CIBOLA WHITE WARE				
White Mound B/W Type Cluster	7	22	8	13
MOGOLLON BROWN WARE				
Brown Plain	7	112		65
Brown Plain (tends toward reduction)				7
Brown Plain Incised		1		
Brown Smudged Interior		1		
Brown Red Slipped	3	3		
TOTALS	24*	186	98	102

* These 50 Lino Gray sherds from site S-22 are fragments of a single jar and are considered as a single sherd in total and percentage tabulations.

Table 31 – CERAMIC WARE FREQUENCIES
RIO SALADO SITES OF THE LATE BASKETMAKER III – EARLY PUEBLO I HORIZON

	S-2	S-25		L-4
CIBOLA GRAY WARE (Quartz Temper)				
Lino Plain (Classic)	44	70		9
Lino Plain (Silted)				16
Lino Plain (Oxidized)				68*
Kana'a Banded Smoothed	5	1		2
CIBOLA GRAY WARE (Crushed Black Rock Temper)				
Lino Plain				2
Kana'a Banded	1			
CIBOLA WHITE WARE				
White Mound B/W Type Cluster	9	30		8
Unidentified (i.e., undecorated) Style	25	5		2
MOGOLLON BROWN WARE				
Brown Plain	3	71		14
Brown Smudged Interior		2		
Brown Fingernail Incised		1		
Brown Banded Smoothed		2		2
AFFINIS SAN FRANCISCO RED WARE				
Red Slipped Interior and Exterior		1		
TOTALS	87	183	(Adapted)	159

* The 68 sherds of Oxidized Lino Gray material from site L-4 appear to represent two vessel clusters. These vessels are tempered with fine multicolored sand grains and exhibit a light gray-yellow paste and surface color. These 68 sherds have been counted as two in ceramic tabulations and ware frequencies.

Table 32 – CERAMIC WARE FREQUENCIES
RIO SALADO SITES OF THE EARLY PUEBLO I HORIZON

	S-9A	S-12	S-16B	S-17A	S-17B	S-19
CIBOLA GRAY WARE (Quartz Temper)						
Lino Plain	11	1	15	56	22	7
Kana'a Banded Smoothed	1		2		6	
CIBOLA WHITE WARE						
White Mound B/W	3	1	3	9	3	2
Red Mesa B/W	7	8	6	3	9	3
Unidentified Style	3	6	12	11	15	13
MOGOLLON BROWN WARE						
Brown Plain	4	24	4	28	7	4
Brown Smudged Interior	1			1		
Brown Red Slipped Exterior		1				
Banded Smoothed				1		
Banded Angular			3*			
Ribbed-Rubbed (medium coil size)		1		1	2	
SOCORRO WHITE WARE				1**	7††	
WHITE WARE (Carbonaceous Paste)			1†			
TOTALS	30	42	46	111	71	29

* All three sherds of Banded Angular, site S-16B, are from a single vessel. Coil width is wide (7-8 mm) and style is clearly distinct from Ribbed Unrubbed of later affinity.
** This single sherd of Socorro Black-on-White is a probable contaminate from site S-16A which exists some 200 meters to the southwest.
† *Probable contaminate from S-16A.*
†† Also possible contaminate from S-16A.

Table 33 – CERAMIC WARE FREQUENCIES
RIO SALADO SITES OF THE LATE PUEBLO I HORIZON

	S-11	S-13	L-1	L-9	(Apparent Pueblo I) L-6
CIBOLA GRAY WARE					
Lino Plain	4	4	29	70	10
Kana'a Banded Smoothed	2	3	16	19	3
Kana'a Banded Rounded				2	
CIBOLA WHITE WARE					
Red Mesa B/W	2	3	14	9	
Unidentified Style	8	10	8	32	
MOGOLLON BROWN WARE					
Brown Plain		10	63	75	
Brown Banded Smoothed (10 mm coils)		1			
Brown Scored		1			
Ribbed Rubbed (medium coil 4 mm)	2	1		4	
Ribbed (Unrubbed)				1	
Ribbed Rubbed Punctate				1	
Brown Red Slip			1		
Ribbed Indented Smoothed		3			
WHITE WARE (Carbonaceous)		1			
TOTALS	18	37	131	213	13

Table 34

CERAMIC WARE FREQUENCIES
RIO SALADO SITES OF EARLY PUEBLO II HORIZON

	S-9B	L-2	L-5
CIBOLA GRAY WARE			
Lino Plain			1
Kana'a Banded Smoothed			2
Unidentified Style			1
CIBOLA WHITE WARE			
Red Mesa Style	5	10	25
Solid Style (Escavada)	3		
Hatched Style (Gallup)	3	2	1
Unidentified Style	20	39	20
MOGOLLON BROWN WARE (Pitoche Series)			
Plain Brown	65	122	183
Plain Brown (Reduced)		11	
Plain Red Slip Ext.		1	2
Banded Smoothed (wide coils)			1
Ribbed (Unrubbed)			2
Ribbed Rubbed (coils 4-5 mm)	15	7	18
Indented (Unrubbed)			1
Indented Rubbed		12	4
WHITE WARE (Carbonaceous)			
Unidentified Style	2		
SOCORRO WHITE WARE			
Socorro B/W		1	
MIMBRES WHITE WARE			1
Mimbres Boldface B/W		2	
TOTALS	113	207	262

Table 35

CERAMIC WARE FREQUENCIES RIO SALADO SITES OF THE LATE PUEBLO II HORIZON, SOCORRO EXPRESSION

	S-5	S-6	S-8	S-14	S-16A
CIBOLA GRAY WARE					
Lino Plain	2	11		6	6
Lino Punctate					1
Kana'a Banded Smoothed					1
CIBOLA WHITE WARE					
White Mound B/W					2
Red Mesa B/W		1	1		2
Solid Style B/W	1	4	2		
Hatched Style B/W	1		2		
Unidentified Style		12	10		
MOGOLLON BROWN WARE (Pitoche Series)					
Brown Plain	31	45	18	39	72
Plain with Smudged Interior	1				
Brown Scored	1				
Ribbed (Unrubbed, medium coil)		1		6	
Ribbed (Unrubbed, fine coil)	1				
Ribbed Rubbed (medium coil, 3-5 mm)	4	8	6	10	33
Ribbed Indented	5	1			1
Brown Red Slipped Interior	1				1
SOCORRO WHITE WARE					
Socorro B/W (apparent early styles)	30	45	22	58	26
WHITE WARE (Carbonaceous)					
Solid Style B/W			3		
Unidentified Style	1	4	9		6
WHITE MOUNTAIN RED WARE					
Puerco B/R		2			
TOTALS	79	134	73	119	151

Table 36

CERAMIC WARE FREQUENCIES
RIO SALADO SITES, MULTICOMPONENTS

	S-4	S-7	S-21
CIBOLA GRAY WARE (Quartz Temper)			
Lino Plain	18	8	17
Kana'a Banded Smoothed	3	2	10
Kana'a Banded "Rounded"		3	
Corrugated Indented		2	
CIBOLA GRAY WARE (Black Rock Temper)			
Lino Plain	2		
CIBOLA WHITE WARE			
White Mound B/W	4	1	
Red Mesa B/W	2	13	25
Solid Style B/W	5	2	
Hatched Style B/W	6	3	
Unidentified Style B/W	27	16	15
MOGOLLON BROWN WARE			
Brown Plain	11	6	30
Brown Red Slipped			1
Ribbed (Unrubbed)			4
Ribbed Rubbed			7
Los Lunas Smudged ? (Int. Smudged, Ext. medium coils upper body, plain lower body)	1		
SOCORRO WHITE WARE			
Socorro B/W	24	6	19
WHITE WARE (Carbonaceous)			
Red Mesa Style			1
Hatched Style	2		1
Unidentified Style	7		2
MIMBRES WHITE WARE			
Boldface B/W			1
WHITE MOUNTAIN RED WARE			
Wingate B/R		(all one vessel)	3
TOTALS	112	62	136

Table 37

CERAMIC FREQUENCIES – RIO SALADO SITES

SITE L-7 (LA 20954), SILVER CREEK PUEBLO – GLAZE C-D-E

UTILITY WARE: (Brown to Gray angular feldspar and quartz temper)

Exterior smooth gray to black. Interiors light polished with black surface colors	52

RIO GRANDE GLAZE WARE: (Crushed black rock temper. Red-black color, fine-grained with no phenocrysts. Basaltic (?) paste is brown)

Red exterior slip and interior polished gray	3
Glaze-on-Red bowl interior and exterior red slip	2
Plain brown to red slip interior and exterior	3
Plain polished, no slips, brown and thin (appear similar to Glaze series but apparently undecorated. Three vessel clusters of 6, 41, and 4) One "D" rim.	51

RIO GRANDE GLAZE WARE: (Crushed white rock temper, rock is opaque with black phenocrysts. Paste is brown)

Glaze-on-Red interior, red slip exterior	2
Glaze-on-White exterior, interior unslipped	1
Glaze-on-Red exterior, interior unslipped	1
Glaze-on-Red interior and exterior, "E" rim, all one vessel	6
Glaze-on-White exterior, interior polished brown, "C" rim	1
Polished brown-red interior and exterior, "C" rim	2
Polished brown to red body sherds	11

LITTLE COLORADO GLAZE SERIES: *(Gray paste with sherd temper, probably 4 different vessels present)*

Heshotauthla Polychrome, 5 sherds of a bowl with rim	5
Glaze-on-Red interior, exterior red slipped	1
Glaze-on-Red exterior, interior red slipped	2
Red slipped interior and exterior; appear to be one vessel	23
Red slipped exterior, gray unslipped interior, jar	1
Glaze-on-Red exterior, gray unslipped interior, jar	1
TOTAL	168

SITE S-18 (LA 20938), MIRA LADRON PUEBLO – GLAZE D HORIZON

UTILITY WARE: (Primarily brown with tendencies toward reduction. Temper is white angular fragments of opaque feldspar and translucent to semitranslucent quartz)

Plain unpolished	15
Plain polished	34
Plain polsihed exterior, matte smudged interior	4
Red slipped brown	2
Plain variant with calcite temper	2

RIO GRANDE GLAZES: (Gray-brown to red-brown paste with various types of crushed rock temper. The majority is dark basalt and also diabase(?), less quantities of crushed white rock with black phenocrysts is also present)

Glaze D rim sherds, Glaze-on-Red exterior, red slip interior	2
Glaze-on-Red body sherds	5
Glaze-on-White body sherds	2
White and red slip with glaze divider line	5
Undecorated body sherds of glaze material	29

Table 37 (Continued)
Ceramic Frequencies – Rio Salado Sites

SITE S-18 (LA 20938), MIRA LADRON PUEBLO – GLAZE D HORIZON (Continued)

LITTLE COLORADO GLAZE WARES: (Gray paste with sherd temper)

Acoma Glaze Polychrome with Gamma *2 rim form, black glaze and red on exterior, yellow-cream with red slipped interior at neck	1
Glaze-on-Red exterior with interior unslipped gray	1
Red slipped interior and exterior	1

CIBOLA WHITE WARE:

Red Mesa B/W	1
Unidentified style B/W	1
TOTAL	105

SITE L-10 (LA 282), INDIAN HILL PUEBLO – GLAZE A HORIZON

UTILITY WARE: (Apparent brownware with decided tendencies toward reduction. Often brown and gray zone in core. Temper is primarily coarse angular and opaque feldspar and also angular to rounded translucent and semitranslucent quartz. Occasional small, rounded, glassy black minerals are also present in most specimens)

Plain smoothed	67
Plain with polished interior	14
Jar rims with polished interiors	13
Bowl rim with polished interior	1
Fingernail incised, smoothed	1
Corrugated indented, smoothed	4

RIO GRANDE GLAZE WARE: (Brown to red paste, 90% exhibit crushed basalt temper and 10% sand)

Agua Fria G/R Glaze A Red rim sherds, all bowls	20
Agua Fria G/R Glaze A Red jar rim sherds	5
Agua Fria G/R Glaze A Red bowl body sherds	41
Agua Fria G/R Glaze A Red jar body sherds	22
Cieneguilla G/Y Glaze A Yellow, red or yellow exterior, bowls	2
San Clemente G/P Glaze A Polychrome, Glaze-on-White and red slip, jars	4

LITTLE COLORADO GLAZE SERIES(?): (Gray paste with sand temper)

Brown Glaze-on-White interior, exterior red-brown slip, bowl	1
Red slip on exterior, interior unslipped, jar	1
White slip interior, yellow-cream exterior, bowl	1

CASA COLORADO WHITE WARE: (jars)	6
TOTAL	209

The LA 287 Laboratory of Anthropology site card 1939 indicates, in addition, the presence of Kuaua, Trenquel, and Tiquex Glaze Polychromes. These later glaze sherds, which were not noted in the recent sample, are apparent trace-intrusives from the historic pueblo LA 286, which exists at the western foot of Indian Hill. *"Quite a number of bowl sherds show western influence such as the use of green glaze and slipping either the interiors or exteriors with contrasting colors. Black on White fragments are very rare and the site is very nearly pure 'Group A'."* (Museum of New Mexico, LA 287 site card 1939).

Table 38

RIO SALADO SITES – CERAMIC WARE FREQUENCIES IN PERCENT OF SAMPLE

Site No.	Cibola G W	Cibola W W	Brown Ware	Carbon W W	Socorro W W	Mimbres W W	S.F. R W	Wt.Mt. R W	Sample Size
BASKETMAKER III HORIZON									
S-22	29.2	29.2	41.7						24
S-23	91.8	8.2	None						98
S-26	25.3	11.8	62.9						186
L-8 (east)	16.7	12.7	70.6						102
BASKETMAKER III – EARLY PUEBLO I HORIZON									
S-2	57.5	39.1	3.4						87
S-25	38.8	19.1	41.5				.5		183
L-4	54.4	17.5	28.1						57
EARLY PUEBLO I HORIZON									
S-9A	40.0	43.3	16.7						30
S-12	2.4	35.7	61.9						42
S-16B (east)	37.0	45.7	15.2	2.2					46
S-17A	50.5	20.7	27.9		.9				111
S-17B	39.4	38.0	12.7		9.9*				71
S-19	24.1	62.1	13.8						29
LATE PUEBLO I HORIZON									
S-11	33.3	55.5	11.1						18
S-13	18.9	35.1	43.2	2.7					37
L-1	34.4	16.8	48.9						131
L-9	42.8	19.2	38.1						213
APPARENT PUEBLO I HORIZON									
L-6	100.0								13
EARLY PUEBLO II HORIZON									
S-9B	None	27.4	70.8	1.8	None	None		None	113
L-2	None	24.6	73.9	None	.5	1.0		None	207
L-5	1.5	17.6	80.5	None	None	.4		None	262
LATE PUEBLO II HORIZON, EARLY SOCORRO EXPRESSION									
S-5	2.5	2.5	55.7	1.3	38.0	None		None	79
S-6	8.2	12.7	41.0	3.0	33.9	None		1.5	134
S-8	None	20.5	32.8	16.4	30.1	None		None	123
S-14	5.0	None	46.2	None	48.7	None		None	119
S-16A	5.3	2.6	70.9	4.0	17.2	None		None	151
MULTICOMPONENT SITES									
S-4	20.5	39.3	10.7	8.0	21.4	None		None	112
S-7	24.2	56.5	9.7	None	9.7	None		None	62
S-21	19.9	29.4	30.9	2.9	14.0	.7		2.2	136

GLAZE HORIZON SITES

Site No.	Glaze Period	Rio Grande Glaze Series	Little Colo. Glaze Series	Brown Ware	White Ware	Sample Size
S-18	"D"	41.0	2.9	54.3	1.9	105
L-7	"C-D-E"	49.4	19.6	31.0	None	168
L-10†	"A"	45.0	1.4	47.8	2.9	209
					TOTAL	3,458

* These Socorro B/W sherds from site S-17B are apparent contaminates from site 16B.
† The sample from site L-10 is selected, thus the service-utility ratio is in error.

DESCRIPTIVE NOTES

CIBOLA GRAY WARE

LINO GRAY: All Lino Gray sherds are plain and untextured. Most specimens are smoothed although occasional vessels exhibit a polish. Lino sherds may represent either fragments of entirely plain vessels or basal fragments of Kana'a Neckbanded vessels. Lino Gray sherds occur throughout the continuum in the study area but are most frequent in the early horizons. There are three variants of Lino Gray defined in this analysis, which are based on variations of temper type, paste color, and surface coverage.

The Classic Variant: This material is similar to that which occurs throughout the northern plateau. It is tempered with translucent to smokey opaque quartz grains and the paste is a clear-clean light to dark gray color. Temper grains are conspicuous on the surface. In the Salado samples there is also an abundance of angular *clay pellets* and occasional traces of hornblende temper.

The Silted Variant: This variant of Lino Gray, defined here, is somewhat similar to the Classic form but the paste tends to be carbonaceous, the temper consists of a variety of darker colored quartz grains and temper grains are not visible on the surface. The temper grains are also finer and traces of black crystalline rock may occur but clay pellets are not present. The paste which is often a gray-brown color is *silted* and tends to adhere to the temper grains. The surfaces are usually smoothed with a matte luster and the granular appearance of Classic Lino is lacking due to the coverage. This *Silted Variant* occurs within only the BM-III and P-I sites and in less frequency than the Classic form. The variant is also noted in the San Marcial Type Site LA 1151. It was coded here as a possible *southern variant* or *brownware intermediate*, but it does not appear as such. It may simply represent an alternate clay source used by potters who produced Classic style. The variant should, however, be recognized in an effort to ascertain its association.

The Black Rock Variant: Lino Plain Gray materials with conspicuous black rock temper were encountered in traces at the Rio Salado sites S-4, S-14, S-22 and L-4. The paste and surface texture resemble Classic Lino Gray materials. The rock temper in the L-4 specimen is large, reddish-brown crystals which appear within a lesser mass of yellowish feldspar(?). The material resembles somewhat the San Juan Series temper. The other examples are an apparent intermediate volcanic rock or perhaps a diabase. The rock has a gray to gray-brown mass containing small black phenocrysts. The origin of this variant of Lino material is unknown. Similar traces were also encountered in the Seboyeta area (Carroll and Marshall 1979), and in only Lino Gray style.

LINO GRAY PUNCTATE: A single sherd of Classic Lino Gray material with circular stick impressions was encountered at site S-16A.

KANA'A GRAY NECKBANDED: Kana'a Gray Banded is a style which is recognized throughout the Anasazi Province in various forms. The style is characterized by wide to narrow, nonindented coils which exist about the neck area of plain gray jars. The examples encountered in the study area are similar to the quartz tempered materials of the northern plateau. The temper and paste is similar to the *Classic Variant* of Lino Gray although a single specimen with black rock temper as the *Black Rock Variant* of Lino was encountered at site S-2.

Most of the Kana'a material encountered here has wide (8-15 mm) and angular coils which have been smoothed to varying degrees. The coil sutures in most specimens are visible, however, occasional smoothing has obliterated such evidence. Kana'a material with angular unsmoothed coils of clapboard style are also noted from sites L-5, L-9 and S-21. Occasional specimens of *Rounded Style* with unflattened coils 6-8 mm wide were noted at sites S-7 and L-9. It is interesting to note that the *Silted Variant* recognized in the Lino Gray material is not present in the Kana'a Gray. Also, Kana'a Gray with incised coil sutures was not noted.

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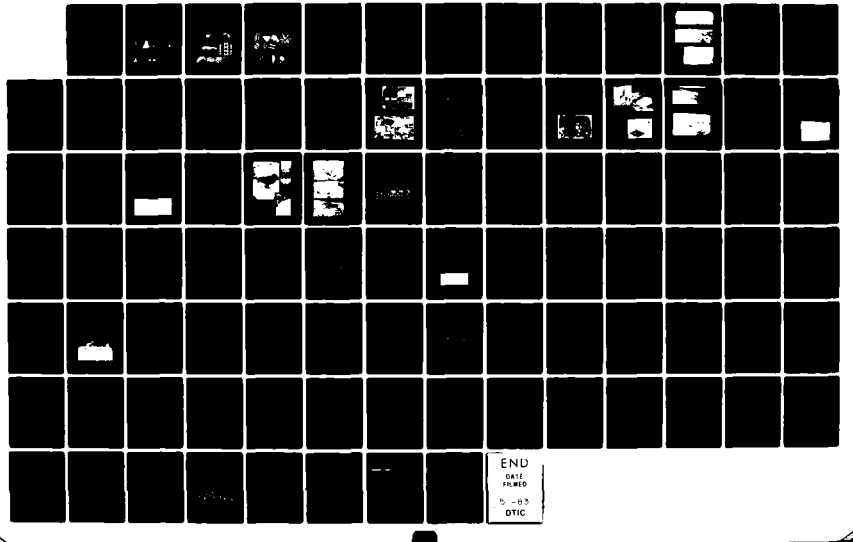
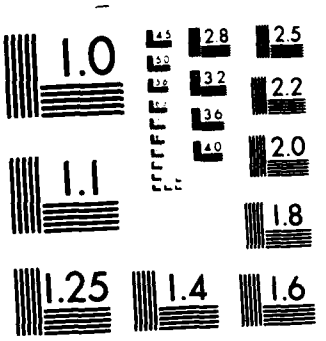




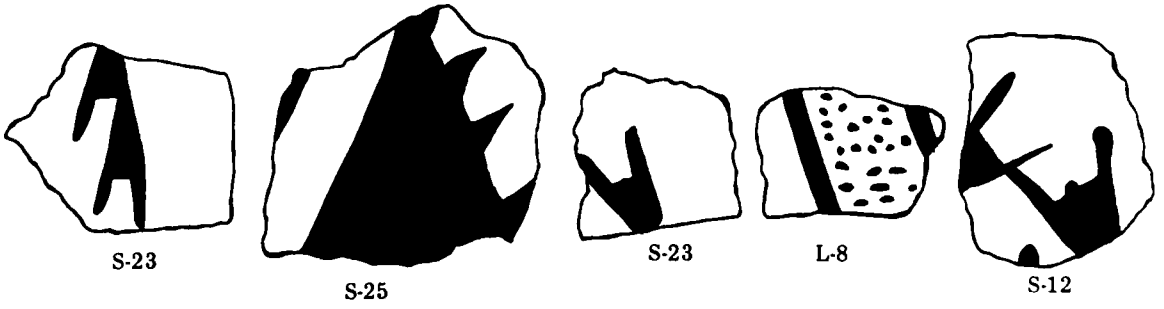
CORRUGATED-INDENTED: Typical Cibola Gray Ware Corrugated Indented materials with a gray paste and quartz and sherd temper were encountered with extreme infrequency within the study areas. The materials present are typical of the *exhuberant* or *Tusayan* style although a single sherd from site S-7 has wide coils and indentations suggestive of the early *Medicine Style* (i.e., Corrugated Indented neck, plain base).

The near absence of Corrugated-Indented material, with intrusive traces noted at sites S-7, P-2, P-4 and P-19 only, relates to the fact that the Anasazi occupation of the district was early during the BM-III and P-I periods prior to the development of the Corrugated-Indented style and that the Pueblo II and III occupation of the region was by Socorroan populations manufacturing brownware utility materials.

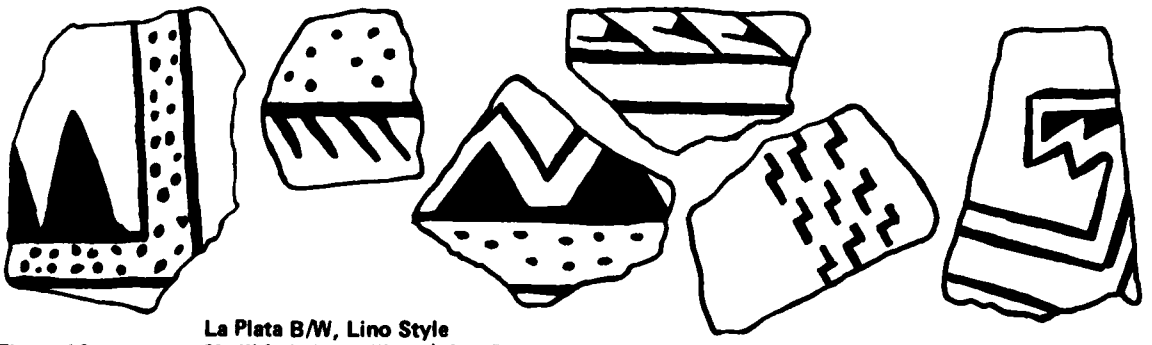
CIBOLA WHITE WARE

I have failed in this analysis to define the various style of Basketmaker III, Early Pueblo I Cibola White Ware material. I have, instead, used the term White Mound Black-on-White for all. Research subsequent to the fieldwork indicates that the La Plata Black-on-White, White Mound Black-on-White, and San Marcial Black-on-White types can be differentiated with near consistency. It is apparent, however, that most of the early Cibola White Ware material encountered in the study area is a White Mound style affiliate whereas, La Plata Black-on-White and San Marcial Black-on-White occur with infrequency. There are no sites identified within the study area which can be defined as the San Marcial Phase. There are BM-III and Early P-I sites which contain high frequencies of brownware material (S-26, L-8 and S-12), but the associated white ware is not consistently similar to the San Marcial Black-on-White material from the type site LA 1151.

LA PLATA BLACK-ON-WHITE: (Hawley 1936) La Plata Black-on-White is the earliest member of the Cibola White Ware series. It is an unslipped, mineral painted type which is decorated in Lino style (see Figure 13). The



La Plata B/W, Lino Style
Rio Salado District



La Plata B/W, Lino Style
Shalik'eshchee Village (after Roberts 1929)

Figure 13

surfaces are scraped and smoothed and the quartz temper grains are conspicuous on the surface. Tree-ring dates for the type are ca. A.D. 575-875 (Breternitz 1966:82).

WHITE MOUND BLACK-ON-WHITE: (Gladwin 1945:22-23) White Mound Black-on-White is an unslipped to flotated, mineral painted white ware which succeeds La Plata Black-on-White in the Cibola White Ware series. Quartz temper grains are conspicuous on the surface like La Plata but the surfaces are better finished. The material is decorated in White Mound style (see Figure 14 and Gladwin which is characterized by multiple parallel lines bordering solid areas, ticked lines, and *Z* forms. Breternitz (1966:102) summarizes the tree-ring data to indicate a ca. A.D. 675-900 date. Dates from White Mound Village in the Rio Puerco of the west are A.D. 750-800.

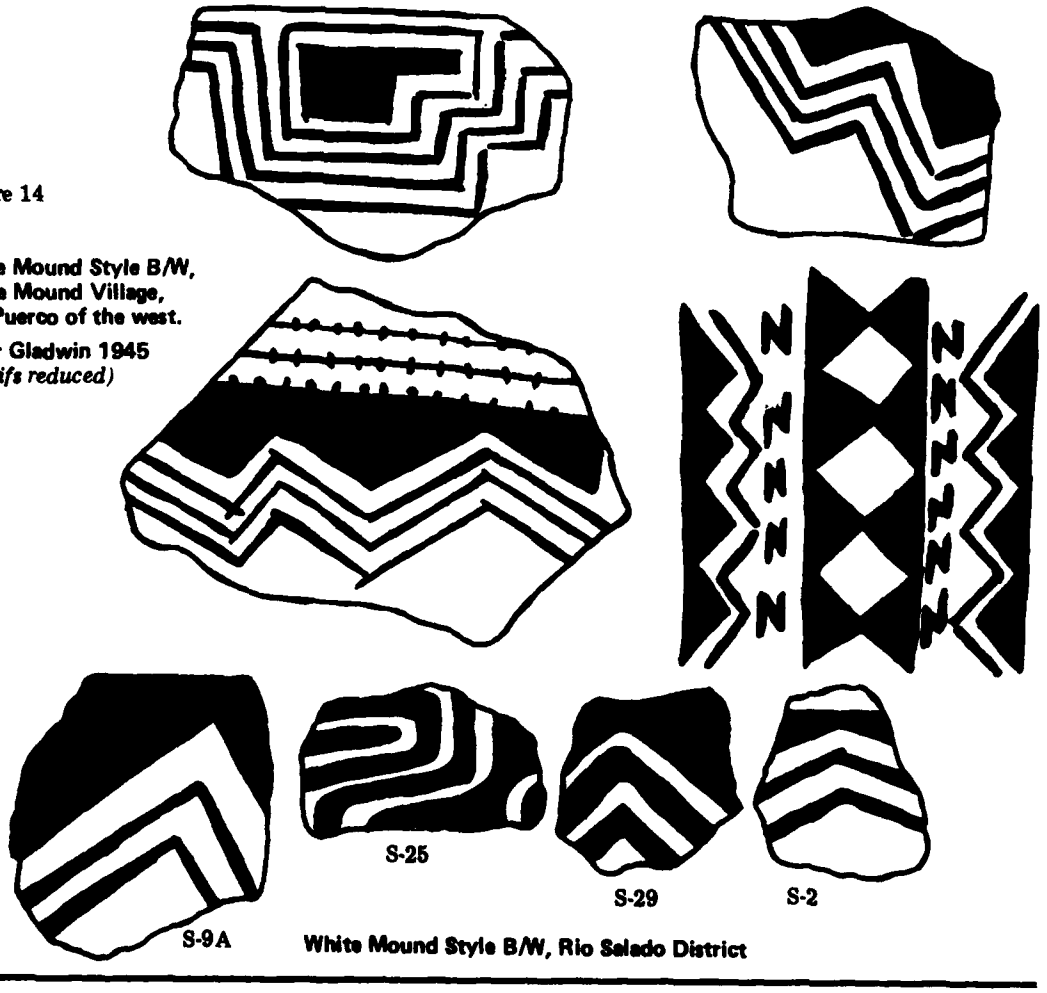
REGARDING LA PLATA B/W AND WHITE MOUND B/W IN THE RIO SALADO DISTRICT

The paste of both La Plata and White Mound is usually a clean, light to dark gray color. All specimens exhibit an abundance of fine to coarse quartz temper. Nearly all specimens also have angular and rounded *clay pellets* in the temper. These are not crushed sherd but apparently unworked and nonplastic clay particles. These pellets are fully opaque white to gray, soft but not porous, and range from a dull to slick luster. The La Plata Black-on-White specimens from the Rio Salado nearly all exhibit multiple *A* forms of the Lino style and have unpolished granular gray surfaces. La Plata Black-on-White materials were noted in traces at sites S-12, S-25, and S-23.

Figure 14

White Mound Style B/W, White Mound Village, Rio Puerco of the west.

After Gladwin 1945
(motifs reduced)



White Mound Style B/W, Rio Salado District

SAN MARCIAL BLACK-ON-WHITE: (A description of San Marcial Black-on-White from the type site LA 1151) (see Mera 1935: 25-26; Hawley 1936:25.)

Temper: The temper consists of primarily angular and subangular quartz, most of which are opaque, smokey gray with occasional translucent pieces. There are also occasional pink rock fragments which appear to be hematite stained quartz. Also present in traces, but characteristic, is a *black crystalline rock* which is apparently hornblende-latite. The paste adheres to the temper grains and is usually an ivory-yellow color.

Slip: Surface treatment ranges from smoothed, flotated to slipped, but characteristically the *temper grains are not visible on the surface.* The vessels tend to be *thick* and surfaces *bumpy.*

Paint: Mineral — a review of 74 decorated sherds from the type site revealed that 35% exhibit pigments which fired to a dark reddish-brown.

Decoration: (see Figure 15) San Marcial style designs are clearly unlike those of Lino and White Mound style forms in the Northern Plateau. The *style is bold*, consisting of wide parallel lines, solid triangles, and serrated solids.

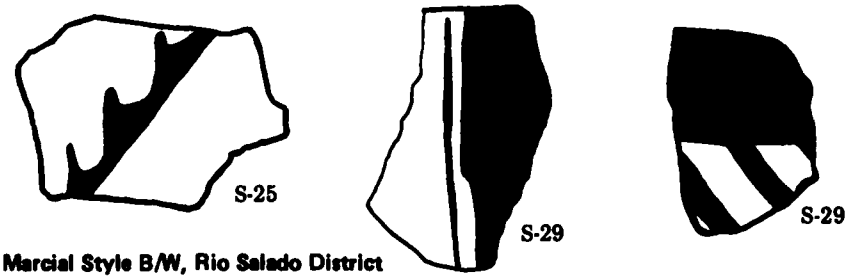
Associated Assemblage: (see Ceramic Frequencies, LA 1151.)

Tree-ring Dates: There are no dates for San Marcial Black-on-White; however, the date for the associated Mogollon Red-on-Brown is estimated at A.D. 775 or 800 to A.D. 950 (Breternitz 1966:87).

(actual size)

San Marcial Style B/W, San Marcial Type Site LA 1151

Figure 15



San Marcial Style B/W, Rio Salado District

Table 39

THE SAN MARCIAL TYPE SITE LA-1151

Location: Lower Rio Grande Valley, 2.75 miles north of San Marcial Railroad Station on the west side of the Rio, N½ Sec. 9, T7S, R1W, Val Verde 5' Quad.

	No. of Sherds	Percent of Sample
Cibola Gray Ware	22	6.2%
Lino Gray (Classic)	12	
Lino Gray (Silted)	10	
Cibola White Ware	101	28.5%
San Marcial B/W, oxidized pigment—red	26	
San Marcial B/W, reduced pigment—black	48	
Undecorated fragments	27	
Mogollon Brown Ware	208	58.6%
Plain Brown	196	
Brown Smudged	4	
Brown Scored	5	
Brown Banded Smoothed	3	
Mogollon Red Slipped Brown Ware*	24	6.8%
Mogollon Red	20	
Mogollon Red-on-Brown (i.e., Terracotta)	4	
TOTAL	355	

* These Red Ware materials are not specifically identified as to the ware series. The paste ranges from a gray-brown to clear buff color. The temper is angular feldspar. The slip is a dull but moderately polished red in the plain slipped specimens and an orange-terracotta in the bichrome specimens. The vessel wall has a mean 5 mm thickness.

(H.W. Yeo's Site No. 156, notes on file at Museum of New Mexico, Laboratory of Anthropology; LA 1151 Museum of New Mexico Site Data Card; Mera 1935:25-26)

Remarks: Helene Warren (1978) recognizes San Marcial B/W as far north as Chaco Canyon as a polished form of La Plata Black-on-White. In the Alamito Coal Lease Survey, this polished form of La Plata Black-on-White, in association with Lino Polished, Lino Red, Lino Smudged and Woodruff Brown, is defined as Ceramic Group I with estimated dates of A.D. 500 to 675.

RED MESA BLACK-ON-WHITE: The Red Mesa Black-on-White material recognized in the study area appears to be quite similar to that of the northern plateau districts. The Red Mesa *Ticked* and *Squiggle Line hatched* styles are recognized. The Kiatuthlana style was also noted at sites S-9A, S-7, S-21 and P-18, but are included within the Red Mesa group. There is some variation in surface finish but all exhibit a hard white slip. The temper is fine to coarse quartz and sherd. Occasional specimens exhibit traces of fine black crystalline rock temper. The paste is gray and carbon streaks are frequent.

To reiterate, this student cannot perceive a difference in the Red Mesa material recognized here and that of the central Chaco District.

THE SOLID AND HATCHED STYLES: These styles of Cibola White Ware material have not been named specifically since these materials, in contrast to Red Mesa Black-on-White, do not consistently resemble the Escavada and Gallup Black-on-White types of the Chaco District. They are instead, apparently local Lower Puerco-Southern Rio Grande versions of the Chaco III types. They are a heterogenous group difficult to define and may represent materials from diverse sources. The Solid style is simply broad lines and solid triangles, and the hatched style diagonal straight-line hatching. Paste colors are light to dark gray and temper is quartz and sherd. I have compared the material to typical Kwahe'e Black-on-White which exhibits a dark gray paste and unslipped exterior, and see little direct similarity. The limited quantity and diversity of the material may relate to the abandonment of the region by the Anasazi during its period of manufacture, and to the experimentation of the Mogollon populace with White Ware manufacturing.

CARBONACEOUS WHITE WARE

This term has been used to define a group of White Ware materials for which I have found no adequate description. I do not propose that this name be entered into the taxonomic structure, but I use it in lieu of a Ware-Series definition.

This White Ware material is characterized by a dark gray carbonaceous paste and a white slip applied to mask the dark paste colors. The slip is often worn from the surface, revealing the contrasting paste below. Both interior and exterior surfaces of bowls and exterior surfaces of jars are slipped. Interiors of jars are smoothed. The dark paste and worn white slip give the group a distinctive appearance but, even so, it is a heterogenous group. Some appear similar to Kwahe'e Black-on-White, others are like Casa Colorado Black-on-White, and still others as if an inferior Socorro Black-on-White. The temper is usually sherd but also opaque angular white rock may be present. In addition, fine black crystalline rock similar to that within Socorro Black-on-White may be present. The designs are primarily solid triangles, checkerboard squares and triangles, and diagonal hatched forms.

This material occurs within greater frequency in the lower Puerco than within the Rio Salado and is clearly a Pueblo II-III development. It is most probable that the material was produced by populations which also manufactured Brownware utility vessels. I have seen similar White Ware materials along the lower Rio Grande near Socorro in pre-Glaze, non-Socorroan components, but otherwise know little of its distribution and character.

SOCORRO WHITE WARE

The Socorro Black-on-White material recognized here is of the Classic form as described by Mera (1935:27). The material is usually quite distinctive; it is characterized by a gray to blue-gray paste and surface color, a hard and often subvitrified paste, the presence of fine black rock temper fragments, and a broad line and fine hatched style. The vessel walls are often quite thin and hard, and the sherds will usually *ring* when struck. Vitrification is often visible in the wall and subglazing of the mineral paint may also occur. The paste color may range from light gray to dark blue-gray throughout. The inclusions of black crushed crystalline rock, apparent hornblende-latite, is characteristic but a few specimens fail to contain such. Other temper constituents are opaque and translucent quartz and occasional clay pellets. Designs often employ large solid areas and fine hatched forms which are well executed. A Red Mesa-like style is also recognized in the lower Puerco and Rio Salado samples which appears to represent the earliest expression of the type within the Early P-II period.

MIMBRES WHITE WARE

Only traces of Mimbres Black-on-White material in obvious intrusive context were

encountered in sites of the P-II and Early P-III period (sites S-21, L-2, P-4 and P-15). The material is typical and is recognized on the basis of its distinctive cream colored slip, gray-brown paste, and brown-black pigment. The temper is opaque white angular fragments, some of which contain brown-black phenocrysts, and also quartz grains. Boldface style is suggested in the specimens recovered.

WHITE MOUNTAIN RED WARE

The traces of White Mountain Red Ware materials which occur within the study area are typical of the described types and are obviously intrusive. These materials are characterized by a gray paste with sherd temper. The presence of Puerco Black-on-Red at sites P-17 and P-6 and Wingate Black-on-Red at site S-21, indicates an occupation which extended into the Early P-III horizon, ca. A.D. 1050-1100. The presence of Cedar Creek Polychrome at site P-4, Kwakina Polychrome at site P-9, and Heshotauthla Polychrome at site L-7 indicates late P-III—Early P-IV occupations.

BROWNWARE

The Brownware materials encountered are a heterogenous lot. I have found it difficult to define with consistency the affinity of these materials with described Ware-Series. I have, therefore, simply defined the materials as Brownware with varying styles of surface treatment. The late P-II—III Ribbed-Rubbed and Indented styles which appear in association with Socorro Black-on-White are no doubt the materials which have been previously identified as the Pitoche Brownware Series (Mera 1935:29). It is probable, based on the geographic location and the various styles of early surface texturing, that the Plain, banded, scored and Plain-Smudged Brownwares are affiliated with the Alma series. It should be noted, however, that certain sherds resemble the El Paso Brownware variability and a study of this scope cannot resolve them.

The Brownware materials encountered in the lower Rio Puerco and Rio Salado drainages exhibit a wide variety of plastic surface texturing. Embellishment of Brownware materials with painted pigments such as the bichrome and Polychrome forms defined in the Jornada Brownware and El Paso Brownware series, is absent.

The Brownware encountered here range from a gray-brown to buff, to verious shades of tan and brown, to a red-brown color. The tempering materials are primarily white angular fragments of apparent feldsapr, quartz grains, and occasional black rock. These materials indicate an igneous source. The feldspar is opaque and appears in white, yellow, and pink colors. Some of late Ribbed-Rubbed and Indented vessels appear to be tempered with white angular fragments of an unidentified sedimentary (evaporate) stone. There are a few Brownware sherds from the Puerco sties P-16, P-18 and P-19 which are tempered with crushed basalt.

BROWN PLAIN: Untextured Brownware vessels are the most frequent style within the group in both the early and late sites. Plain sherds represent not only untextured Plainware vessels, but Plain basal portions of Neckbanded, Ribbed, and Indented vessels as well. Continued analysis should define Brownware rim sherds as indicators of Plain *overall* vessels. The Brown Plain material observed is usually smoothed although some specimens are polished. Polished specimens tend to range into the brown-red and buff colors more than unpolished materials. Most of the Plain Brown rim forms suggest wide-mouthed jars although occasional bowls are present.

RED SLIPPED BROWNWARE: Red Slipped Brownware materials were encountered upon occasion in only the Rio Salado sites S-22, S-26, S-12, S-11 and L-1. The type appears to be most frequent in the BM-III to P-I periods, although a single sherd was recovered from a late P-II component S-5.

The paste tends to be a light brown, gray-brown or buff color. The slip is a deep red-brown color and is thinly applied, often revealing the buff surface color below. The slip is usually lightly polished. The vessel walls are rather thick (5-6 mm). A single surface or both interior and exterior may be

slipped. The paste contains an abundance of near opaque angular feldspar fragments of white and yellowish color.

The material does not resemble San Francisco Red Ware. It is quite similar to the Red Slipped Brownware materials which preceed the development of San Andres Red-on-Terracotta in the Tularosa Basin. In fact, one sherd from S-5 shows a possible broad line decoration on the interior.

BROWN PLAIN INCISED: Only traces of brown incised material were encountered at sites S-25 and S-26, both of which are BM-III and BM-III—Early P-I sites. The specimen from site S-25 is textured with fingernail incisions located at apparent random. The specimen from site S-26 consists of horizontal stick incisions spaced 8 mm apart to resemble banded coils.

BROWN SCORED: Only traces of Brown Scored material were noted at site S-13 and S-5 of Late P-I and Late P-II affinity. The material is characterized by grass or corncob scratched exteriors similar to that present on Navajo utility ceramics. The interior surfaces are smoothed.

PLAIN BROWN SMUDGED: Plain Brownware sherds with black smudged interiors appear within early BM-III—Early P-I context in the Rio Salado sites (S-25, S-26, S-9A, S-17A) and in late P-II—Early P-III context in the Rio Puerco sites (P-2, P-4 and P-9), and also the Salado site S-5. The later materials are obviously sherds from plain portions of Los Lunas Smudged vessels. The early Rio Salado examples are affiliated with the Plain-Smudged tradition of the Early Developmental Era.

BROWN NECKBANDED: Occasional fragments of Brown Neckbanded material were encountered within BM-III and P-I sites in both the Rio Salado and Lower Puerco drainages. Banded Smoothed specimens are most frequent (sites S-13, S-17A, S-25, L-4, P-8 and P-19), although a Banded Angular specimen from site S-16B was also encountered. The Banded Smoothed material exhibits coils 10-12 mm in width which are well smoothed to a series of concave depressions with the coil sutures entirely obliterated. This contrasts to the frequently visible coil sutures in the analogous style Kana'a Gray. A single sherd of Banded Angular Brownware was noted at site S-16B which exhibits angular coils 7-8 mm wide. The relief in the coils distinguishs this material from the later Ribbed-Unrubbed style.

BROWN BASKET IMPRESSED: A single sherd exhibiting impressions of a coil basket was encountered within the apparent P-I site of P-10.

BLACK-ON-BROWN: A single sherd of painted Brownware was found at site P-15, occupied during the Pueblo II period. This sherd may be an intrusive bichrome of the El Paso series.

BROWN RIBBED: Brown Ribbed material of apparent *Pitoche Style* appears in both falttened Unrubbed and in flattened Rubbed or Smoothed forms. The coil widths normally range within the 4-6 mm zone. Fine coils of 1-3 mm are *multiple folded* and are associated with the Los Lunas style which is not included in this group. The Pitoche materials are essentially the Corrugated Nonindented style of the Anasazi but they tend to be flat in contrast to the clapboard style seen in the northern plateau. The Pitoche materials are also usually Ribbed (i.e., Corrugated) only on the upper vessel body, while the base remains plain. Occasional Ribbed specimens exhibit additional incisions within the coil sutures or punctate impressions with a stick end as further embellishment.

The Pitoche Ribbed style is in effect a survival of the Neckbanded-like style into the Pueblo II and III periods. The style first appears in traces in the Pueblo I era.

BROWN RIBBED INDENTED: The Brown Ribbed Indented material occurs in either unobliterated or smoothed forms. The interior surfaces are smoothed and brown. The unobliterated forms are less frequent than the smoothed, and exhibit wide and well defined *scalloped* coils and indentations, or fine, *multiple folded* coils of alternated indented

style. The Pitoche indented style appears to have originated in the Early P-II period, although the fine multiple folded coiled forms are an apparent Early P-III development associated with the Los Lunas style. Both the Pitoche and Los Lunas styles of Ribbed Indented material appear to usually have plain basalt areas.

LOS LUNAS SMUDGED: Los Lunas Smudged material, according to Mera (1935: 28), is a Brownware having a *smudged interior with many different exterior treatments.* Coils are normally of the fine, 1-3 mm, multiple folded type, and are usually but not always rubbed. Texturing is restricted to the exterior upper vessel body and the lower vessel is plain. Fine unindented coils are often alternated with wider indented coils. Incising and punctate embellishments may be added. The smudged interior is distinctive of the described type, however, the fine multiple folded coils should also be considered an element of Los Lunas style. There is, therefore, an unsmudged form of Los Lunas Ribbed Indented described above.

The Los Lunas Brownware style is clearly a development of the Early P-III era and continues to be manufactured into the Glaze A horizon.

AFFINIS SAN FRANCISCO RED WARE (?)

A single sherd of a polished Red Ware from site S-25 is tentatively identified as San Francisco Red Ware. The vessel wall is thin, the surface color is red-orange and polished and the temper feldspar, quartz and black rock. The sherd actually resembles the Red Ware material from the San Marcial type site LA 1151 more than it does the classic deep red and thin walled San Francisco Red material. The actual affinity of the sherd remains in question. It is interesting to note that true Mogollon Red Ware materials (other than Red Slipped Brownware) are absent from the Salado sites even though there is a substantial BM-III and P-I occupation there.

THE RIO GRANDE GLAZE SERIES

The Rio Grande Glaze Ware material has been described according to established rim form definitions (Kidder 1936; The Eighth Southwestern Ceramic Seminar 1966), and the nature of surface decoration. The paste of the Rio Grande Glaze material is usually brown or brown-red but specimens with a gray core and brown margins are also present. The Glaze materials encountered in the study area reveal a crushed black rock (apparent basalt) group and a crushed white rock tempered group. Occasional specimens of sand tempered materials were noted at site L-10 near San Acacia on the Rio Grande.

LITTLE COLORADO and ACOMA GLAZE SERIES

Little Colorado and Acoma Glaze materials were encountered at sites S-18, L-7, and L-10. These glaze materials are characterized by a gray paste and sherd temper. They are described according to surface decoration and type name if possible. Rim forms of the *Acoma Glaze material accord with Harlow in* the 1965 Seventh Southwestern Ceramic Seminar notes.

ACKNOWLEDGEMENTS

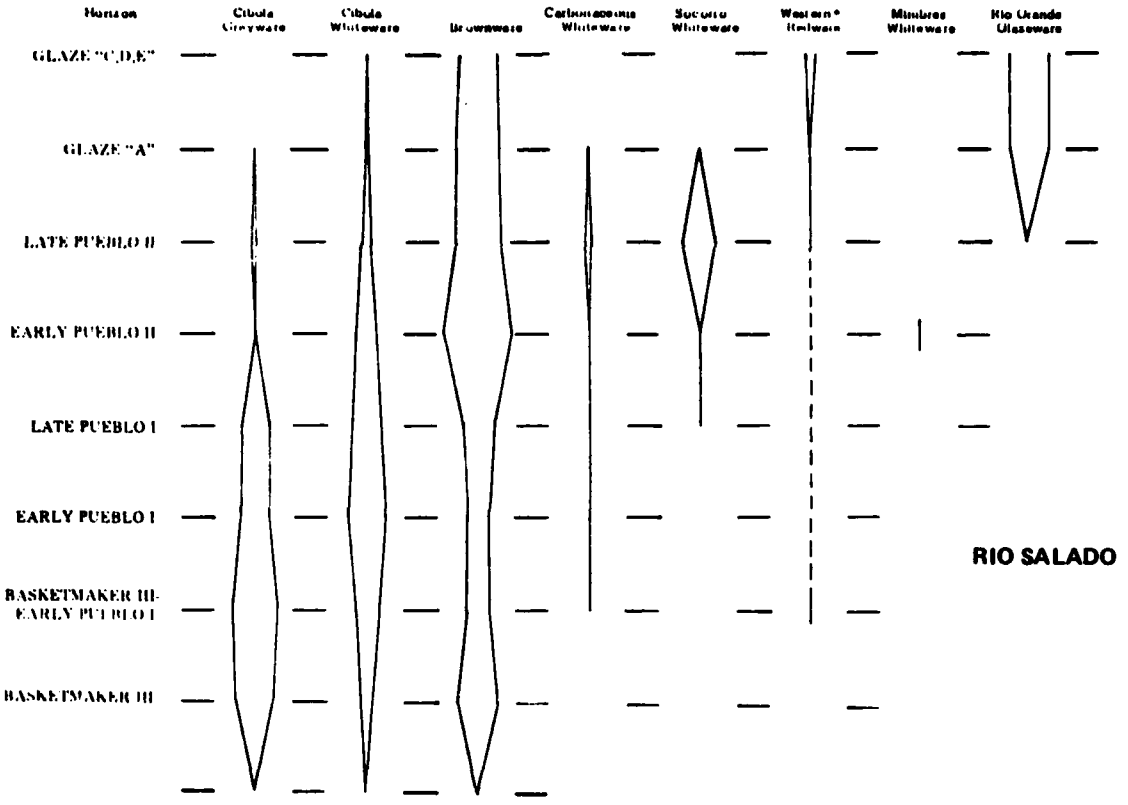
H. P. Mera, in 1935 and 1940, laid the foundations for ceramic studies in the region. He and H. W. Yeo were the first individuals to explore and document the archaeology of the study area.

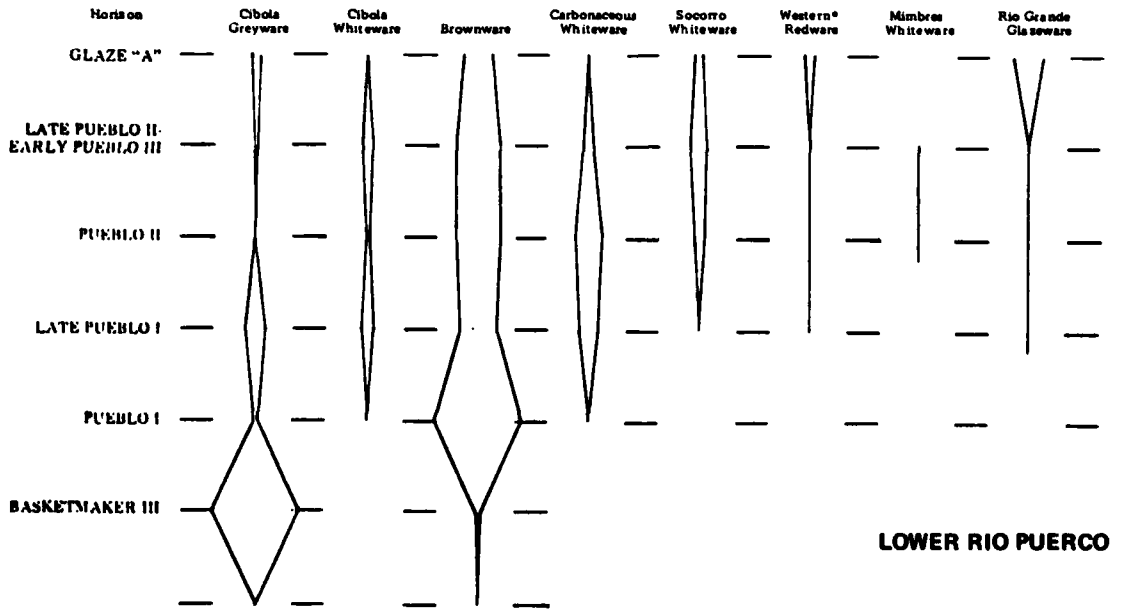
I would like to express my appreciation to Stewart Peckham, Helene Warren, Tom Windes, and Peter McKenna, all of whom provided information helpful to this study.

Table 40
DATED CERAMIC TYPES – RIO SALADO
(Based on Breternitz 1966)

Type	Indigenous	Best	Trade	Best
Lino Gray	354+ to 1275	572 to 872	702 to 1045	702 to 875
White Mound B/W	720+ to 1275	750 to 910	636+ to 1093	675 to 775 (900)
Kana'a Gray	675 to 1189+	760 to 900	687 to 965	775 to 965
Red Mesa B/W	720+ to 1231	850 to 1125	993+ to 1285	
Socorro B/W			1004 to 1393	1050 to 1300?
Mimbres Boldface B/W	739+ to 927	775 to 927		
Puerco B/R	1031+		921+ to 1275	1030 to 1124
Wingate B/R	1031+		828 to 1447	1050 to 1200
Heshotauthla Polychrome			1051 to 1612+	1300 to 1393

Figure 16: CERAMIC WARE FREQUENCIES (Mean Frequencies of Wares on Single Component Sites)





*Includes Little Colorado Glazeware, San Francisco and White Mountain Redwares

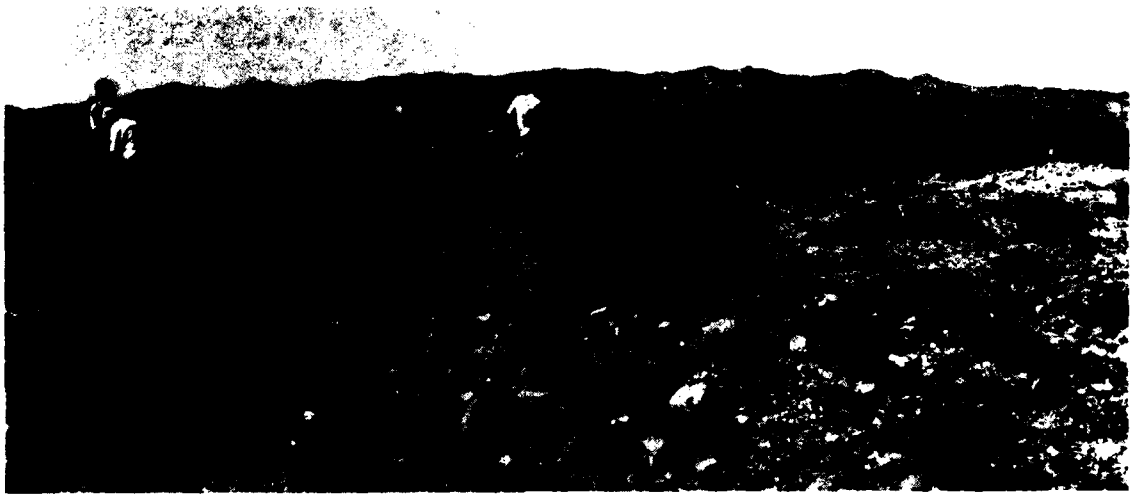


Photo 56 (top):
Site HSR903/L-2

Photo 57 (center):
Site HSR903/S-26

Photo 58 (right):
Site HSR903/L-3

Two and nine-tenths person days of field-work were expended for each site recorded. A crew of five persons required approximately 1.5 hours to record each site (minimum 20 minutes, maximum 3 hours).

LITHIC ASSEMBLAGES FROM THE LOWER RIO PUERCO–RIO SALADO DRAINAGES, N.M.

By Cye Gossett

Stone tools and by-products of their manufacture and use occur on prehistoric sites recorded in this sample of the Rio Salado and Rio Puerco. These lithic artifacts and by-products are often the only surviving clues to the activities carried out at particular sites or in their environments. The relationship expressed by percentages of types of tools, amounts of by-products, and types of raw material can serve as measures for past human activities.

SAMPLING METHOD

Commonly, several hundred lithic artifacts are exposed on the surface of the archaeological sites within the Puerco-Salado drainages. Consequently, in most cases, it was necessary to sample in order to expedite tabulation and description of the artifacts. Most often chipped stone material was collected from the ten locations in areas of highest surface density selected by the CLD sample (described in Method, this volume). On sites which exhibited less than 100 artifacts on the entire surface an inventory collection was made. Artifacts from CLD circles (and inventory, where applicable) were then analyzed under specific attribute categories in the field. No artifacts were collected. Some non-artifactual material samples were taken to the laboratory for further analysis.

METHOD OF CLASSIFICATION

The by-products of stone tool manufacture and use found within archaeological sites exhibit formal attributes. These attributes are the direct result of specific human activities which include: 1) procurement of raw materials required for the manufacture of tools; 2) reduction of those raw materials into tools for general and specialized tasks; and 3) the maintenance through actual modification of specific tools in order to increase their durability and utility.

It is assumed that the type of tools and by-products of manufacture remaining within an archaeological site reflect the types of activity carried out at the site or within the adjacent biotic communities. Distinct patterning may be evident in both functional tool categories and total assemblages.

CLASSIFICATION DESCRIPTION

Reduction of stone materials produces three basic products: 1) angular fragments; 2) flakes; and 3) cores. In the primary stages of stone tool manufacture, a type of material is selected which may vary in size, shape and quality. Through geologic weathering, the exterior of the piece may exhibit a cortical material of different color and texture from that of the interior minerals. The cortex is detached from the parent material in the initial reduction stage. If the natural shape of the material lacks an existing sharp angle or striking platform for the detachment of flakes, then such a beginning point is prepared by the fracture of a fragment that provides a flat surface to facilitate further reduction. As the flakes are detached from the raw material, a bulb of percussion can be seen on the internal or ventral surface of the flake. During detachment, the force and direction of the blow and quality of material determine the size of the percussion bulb and the dimensions of the product. In finer quality materials the blow to the striking platform oscillates through the material in a wave-like form leaving a *ripple* scar and producing a long thin fragment. These product specimens may be found in varying quantities throughout archaeological sites, possibly having a correlation with:

1) distance to parent raw material; 2) size of the raw material; 3) type of material selected and its fracture planes; and 4) specific tasks performed at or near the site. Large pieces of raw material which exhibit multiple scars of percussion are called cores.

ANGULAR FRAGMENTS

Large percentages of angular fragments detached from selected raw material exhibit cortex on the external surfaces and have no bulbs of percussion. It is assumed that these are produced in the initial stage of reduction of the raw material, which may be either nodular or tabular. Angular fragments also result from faulted raw material and secondary modification of the core.

FLAKES

The long thin flakes produced in the reduction process may exhibit some cortex on the dorsal or external surfaces due to the type and size of the parent material. The ventral or internal surface exhibits a bulb of percussion created by the blow of detachment.

UTILIZED LITHICS

Products of the manufacturing process may be selected to be *used* for some task. These tools include utilized flakes, utilized angular fragments and cores. These items have not been reduced or modified by pressure or secondary reduction, but evidence wear along the applied edges. Formal tools are lithic pieces which have been modified or shaped by secondary reduction, and are in some cases maintained by rejuvenation of edges and angles. These include bifaces, unifaces, projectile points, and some core choppers. Reduction is exhibited both surficially and marginally on both the ventral and dorsal surfaces of bifaces and projectile points, and surficially and marginally on one surface of a uniface. Wear may be seen on modified tools, utilized flakes, angular fragments, utilized cores and nonchipped hammerstones, in the form of battering, polish, grinding, attrition and step fracture. This wear may appear on one or more edges or angles.

NONCHIPPED HAMMERSTONES

Hammerstones have been used to modify flakes, cores, and angular fragments into tools. These specimens exhibit battering on one or more surfaces. Hammerstones may have been used for tasks other than tool manufacture.

RETOUCH OR REJUVENATION FLAKES

Rejuvenation flakes are created in the process of retouching or resharpening a formal tool. The facial retouch used in modifying the flake into the original tool may be seen on the dorsal surface of the small detached flakes and a small portion of the exhausted edge is usually present on the bulb of the flake.

GROUND STONE

Tools placed within this category include trough, basin and slab metates and one-hand and two-hand manos. These pieces of stone have been modified to perform some grinding task. Other items in this category include ground stone utilized as pot or vessel covers.

Ground stone attributes recorded on this survey apparently have no particular correlation with sites exhibiting structures. They occur equally with the open scatters and structures alike. Numbers and types of ground stone recorded are presented in Table 41.

LITHIC MATERIALS USED ABORIGINALLY ON THE RIO PUERCO–RIO SALADO

The Santa Fe gravels eroded from upland sources and deposited in the depressions and basins and along the course of the middle Rio Grande, provide a very high percentage of the locally available stone materials selected for tool manufacture. These gravels, produced by erosion of tectonic, metamorphic and sedimentary rocks, and alluvially deposited, have differentially

Table 41
LITHIC DATA FROM RIO PUERCO–RIO SALADO DRAINAGES, N.M.

Site No.	Unut Flake	Unut. Ang. Frag.	Utilized Flake	Ret. Flake Tool	Utilized Ang. Frag.	Ret. Rejut. Flake	Core	Utilized Core	Hammerstone (nonch.typed)	Biface	Uniface	TOTAL	Trough Metate	Basin Metate	Slab Metate	Mano (one-hand)	Mano (two-hand)
RIO PUERCO AREA																	
P-2	70	18	2	1	0	0	3	0	3	1	0	98					
	71.4%	18.3%	2.0%	1.0%	0	0	3.0%	0	3.0%	1.0%	0	99.7%					
P-3,	167	6	1	1	0	8	1	0	0	0	2	186			1		
Prov.1	89.7%	3.2%	.5%	.5%	0	4.3%	.5%	0	0	0	1.0%	99.7%					
P-3,	110	10	2	0	0	0	1	0	0	0	0	123					
Prov.2	89.4%	8.1%	1.6%	0	0	0	.8%	0	0	0	0	99.9%					
P-5	35	17	4	0	0	3	1	0	5	1	2	68			1	2	
	51.4%	25.0%	5.8%	0	0	4.4%	1.4%	0	7.3%	1.4%	2.9%	99.6%					
P-6,	84	18	5	0	0	8	1	0	0	1	0	117			1	4	
Prov.1	71.7%	6.8%	4.2%	0	0	6.8%	.8%	0	0	.8%	0	99.6%					
P-6,	85	34	1	2	1	9	1	0	0	1	0	134				3	
Prov.2	63.4%	25.3%	.7%	1.4%	.7%	6.7%	.7%	0	0	.7%	0	99.6%					
P-7	64	31	10	5	1	16	4	0	2	0	0	136			1	1	
	47.0%	25.0%	7.3%	3.6%	.7%	11.7%	2.9%	0	1.4%	0	0	99.6%					
P-8	89	8	2	0	0	63	0	0	0	0	0	162					
	54.9%	4.9%	1.2%	0	0	38.8%	0	0	0	0	0	99.8%					
P-9	42	17	8	0	3	3	4	0	0	0	0	77			1		
	54.5%	22.0%	10.3%	0	3.8%	3.8%	5.1%	0	0	0	0	99.5%					
P-10	36	10	0	0	0	1	2	0	1	0	0	50					
	72.0%	20.0%	0	0	0	2.0%	4.0%	0	2.0%	0	0	100%					
P-11	22	24	1	0	0	0	32	8	2	0	0	89					
	24.7%	26.9%	1.1%	0	0	0	35.9%	8.9%	2.2%	0	0	99.7%					
P-12	145	16	1	1	0	9	5	1	0	6	1	186					
	78.3%	8.6%	.5%	.5%	0	4.8%	2.7%	.5%	0	3.2%	.5%	99.6%					
P-13	18	15	3	0	0	3	2	3	0	0	0	44					
	40.9%	34.0%	6.8%	0	0	6.8%	4.5%	6.8%	0	0	0	99.8%					
P-14	78	4	1	0	0	44	3	1	0	3	0	134			1		
	58.2%	2.9%	.7%	0	0	32.8%	2.2%	.7%	0	2.2%	0	99.7%					
P-15	36	34	3	0	0	8	3	2	0	1	2	89			1		
	40.4%	38.2%	3.3%	0	0	8.9%	3.3%	2.2%	0	1.1%	2.2%	99.6%					
P-16	15	27	15	0	0	1	2	3	0	1	2	66			1		
	22.7%	40.9%	22.7%	0	0	1.5%	3.0%	4.5%	0	1.5%	3.0%	99.8%					
P-17	31	25	2	0	0	0	1	1	2	1	1	64			5	1	
	48.4%	39.0%	3.1%	0	0	0	1.5%	1.5%	3.1%	1.5%	1.5%	99.6%					
P-18	60	40	0	2	1	36	4	1	0	1	0	145					
	41.3%	27.5%	0	1.3%	.6%	24.8%	2.7%	.6%	0	.6%	0	99.4%					
P-19	11	61	0	0	8	9	7	3	0	0	0	102	3				
	13.7%	59.8%	0	0	7.8%	8.8%	6.8%	2.9%	0	0	0	99.8%					
P-20	11	11	0	0	0	44	0	0	0	1	0	100					
	11.0%	11.0%	0	0	0	44.0%	0	0	0	1.0%	0	100					
RIO SALADO AREA																	
S-2	10	8	7	1	2	0	0	3	0	0	0	31					
	32.2%	25.8%	22.6%	3.2%	6.0%	0	0	9.0%	0	0	0	98.6%					
S-4	8	5	1	1	5	0	1	0	0	0	0	21			2		
	38.0%	23.8%	4.7%	4.7%	23.8%	0	4.7%	0	0	0	0	99.7%					
S-5	19	13	4	2	1	0	1	1	0	0	1	42			2		
	45.2%	30.9%	9.5%	4.7%	2.3%	0	2.3%	2.3%	0	0	2.3%	99.5%					
S-6	19	10	1	0	1	0	1	3	0	0	0	35			3	1	
	54.2%	28.5%	2.8%	0	2.8%	0	2.8%	8.5%	0	0	0	99.6%					
S-7	2	1	1	1	2	0	2	0	1	0	1	11			1		
	18.1%	9.0%	9.0%	9.0%	18.1%	0	18.1%	0	9.0%	0	9.0%	99.3%					

Table 41 (Continued)

Site No.	Unut. Flake	Unut. Ang. Frag	Utilized Flake	Ret. Flake Tool	Utilized Ang. Frag	Ret. Repair Flake	Core	Utilized Core	Hammerstone (nonchipped)	Biface	Uniface	TOTAL	Trough Metate	Basin Metate	Slab Metate	Mano (one hand)	Mano (two hands)
Rio Salado Area (Continued)																	
S-8	9 25.7%	7 20.0%	7 20.0%	3 8.5%	2 5.7%	0 0	4 11.4%	1 2.8%	0 0	1 2.8%	0 0	35 99.7%			3		
S-9	25 54.3%	13 28.2%	3 6.5%	1 2.1%	2 4.3%	0 0	2 4.3%	0 0	0 0	0 0	0 0	46 99.7%					
S-11	5 83.3%	1 16.6%	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	6 99.9%				1	
S-12	9 39.1%	7 30.0%	2 8.6%	1 4.3%	3 13.0%	0 0	0 0	1 4.3%	0 0	0 0	0 0	23 99.3%			1		
S-13	7 33.3%	9 42.8%	1 4.7%	1 4.7%	1 4.7%	1 4.7%	1 4.7%	0 0	0 0	0 0	0 0	21 98.9%			2		1
S-14	0 0	1 16.6%	0 0	1 16.6%	1 16.6%	0 0	2 33.3%	0 0	0 0	1 16.6%	0 0	6 99.7%			1		
S-16	26 48.1%	9 16.6%	2 3.7%	1 1.8%	2 3.7%	3 5.5%	7 12.9%	2 3.7%	1 1.8%	1 1.8%	0 0	54 99.6%			1		
S-17	29 54.7%	9 16.9%	9 16.9%	2 3.7%	1 1.8%	0 0	1 1.8%	1 1.8%	0 0	1 1.8%	0 0	53 99.4%					
S-18	11 55.0%	3 15.0%	4 20.0%	1 5.0%	0 0	0 0	0 0	0 0	1 5.0%	0 0	0 0	20 100.0%			1		
S-19	17 80.9%	4 19.0%	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	21 99.9%					
S-21	33 58.9%	15 26.7%	3 5.3%	0 0	1 1.7%	0 0	2 3.5%	2 3.5%	0 0	0 0	0 0	56 99.6%					
S-22	26 36.7%	14 20.0%	7 10.0%	0 0	3 4.2%	13 18.5%	4 5.7%	0 0	4 5.7%	0 0	0 0	70 99.8%					
S-24	13 50.0%	9 34.6%	2 7.6%	0 0	0 0	0 0	1 3.8%	0 0	0 0	1 3.8%	0 0	26 99.8%					
S-25	18 36.7%	8 16.3%	3 6.1%	0 0	4 8.1%	6 12.2%	2 4.0%	1 2.0%	2 4.0%	3 6.1%	0 0	49 99.6%			3	1	
S-26	29 39.7%	20 27.3%	13 17.8%	3 4.1%	3 4.1%	0 0	3 4.1%	2 2.7%	0 0	0 0	0 0	73 99.8%	2		2		1
LOMA BLANCA AREA																	
L-1	32 59.2%	8 14.8%	0 0	2 3.7%	0 0	6 11.1%	3 5.5%	1 1.8%	1 1.8%	0 0	1 1.8%	54 99.7%		2	1		
L-2	12 25.0%	8 16.6%	8 16.6%	7 14.5%	3 6.2%	1 2.0%	6 12.5%	0 0	1 2.0%	1 2.0%	1 2.0%	48 99.4%				1	
L-3	17 20.4%	11 13.2%	0 0	0 0	0 0	50 60.2%	0 0	0 0	0 0	2 2.4%	3 3.6%	83 99.8%					
L-4	2 16.6%	5 41.6%	0 0	0 0	0 0	0 0	1 8.3%	1 8.3%	3 25.0%	0 0	0 0	12 99.8%	1	1	1		1
L-5	28 47.4%	17 28.8%	0 0	1 1.6%	0 0	8 13.5%	5 8.4%	0 0	0 0	0 0	0 0	59 99.7%				2	
L-6	45 55.5%	15 18.5%	2 2.4%	4 4.9%	2 2.4%	8 9.8%	1 1.2%	0 0	0 0	4 4.9%	0 0	81 99.6%		1		1	
L-7	30 49.1%	15 24.5%	6 9.8%	5 8.1%	1 1.6%	2 3.3%	1 1.6%	0 0	0 0	1 1.6%	0 0	61 99.6%		1			
L-8	18 28.1%	3 4.6%	6 9.3%	4 6.2%	1 1.5%	27 42.1%	1 1.5%	0 0	0 0	4 6.2%	0 0	64 99.5%			2	1	
L-9	41 60.2%	14 20.5%	10 14.7%	2 2.9%	0 0	0 0	1 1.4%	0 0	0 0	0 0	0 0	68 99.7%		1	1		
L-10	26 22.2%	32 27.3%	8 6.8%	2 1.7%	2 1.7%	43 36.7%	0 0	0 0	0 0	2 1.7%	2 1.7%	117 99.8%					

Table 42

LITHIC MATERIAL TYPE CODES

Chert	1	see silicified wood
	2	white
	3	white with black inclusions
	4	white with yellow inclusions
	5	opaque white (milky)
	6	gray: varies from vitreous fine grained to dull coarser grained
	7	black
	8	light gray with gray/brown inclusions
	9	opaque white with blue and/or red inclusions
	9a	tan/brown with white/dark brown inclusions
	9b	dark brown
	9c	dark red chert: varies from solid to red and/or blue inclusions
	9e	pink with yellow and/or blue inclusions
	9g	yellow/brown with red inclusions
	9h	pink/brown with white inclusions
	9i	beige/brown with transparent quartz inclusions
	9j	tan/brown: banded
	9k	rose/tan
	9l	black with blue matrix
	9m	light blue with transparent quartz inclusions
	9n	green: medium coarse grained
	9o	cream/white w/red inclusions
Chalcedony	10	dark gray transparent
	11	white transparent with black inclusions
	12	gray/white transparent with red inclusions
	13	blue/gray w/black inclusions
	14	white transparent
	15	beige with red inclusions
	16	dark brown transparent
	17	dark blue w/white inclusions
	18	white/brown with pink and/or blue inclusions
	19	dark gray to black: transp.
Quartzite	20	yellow/tan/browns
	21	yellow with black inclusions
	22	rose/yellow/tan
	23	white
	24	rose/vermillion
	25	gray
	26	rusty-rose
	27	pink
	28	red
Fire Grained Basalt	30	gray-black: varies to black
	31	gray-green
	32	red-brown
	33	cream w/brown/red inclusions
	34	white-gray with vermillion inclusions: coarse grained
	35	gray-purple
	36	mustard yellow vitreous
	37	yellow w/transparent quartz inclusions: coarse grained
	90	red
	91	green
Obsidian	40	black:opaque
Jasper	50	red
	51	yellow with red and/or black inclusions
Silicified Wood	60	gray banded with yellow, brown, red and gray
	61	white banded with yellow
	62	gray banded with brown
Fossiliferous	70	varies in fossil content: all is vitreous and hard with a waxy luster.
	80	palm wood
Quartz	100	white
Rhyolite	110	varies from gray to pink with inclusions
Limestone	120	gray-black
	150	black
Metallic	130	heavy iron type metal
Slate	140	light green
Gneiss	160	pink
	161	agua green

distributed nodules and tabular fragments of chert, chalcedony, silicified wood, obsidian, jasper, fossiliferous cherts, quartzite, basalt and rhyolite.

Cryptocrystalline varieties of quartz found within the Sana Fe gravels are of two types: fibrous and granular. Fibrous varieties consist of chalcedony and silicified wood. Granular varieties are of chert and jasper. Quartz is found in both igneous and metamorphic rocks and may be formed as a replacement in limestone horizons. When deposited in sandstone and then metamorphosed, it becomes quartzite. Varieties of igneous rocks, such as rhyolite and basalt, have also been used. Rhyolites are fine grained and dull to glassy in luster, obsidian being the glassy form of rhyolite. Basalts are dark, fine grained and dull in luster. Cryptocrystalline materials vary in hardness, color and fracture.

LITHIC MATERIAL CLASSIFICATION

As distinct materials were identified during the field sample, a numerical code was assigned to each. The variety of raw materials found on sites on the Puerco ranged in number from 9 to 20 with a mean of 13.8 per site. The sites in the lower Salado contained numbers of materials ranging from 7 to 18 with a mean of 13. The upper Salado ranged from 3 to 20 with a mean of 12 types of materials per site. Descriptions of material types are given in Table 42.

LITHIC MATERIAL PATTERNING

The kind and amount of material types selected on any given site may be indicative of the spatial distribution of those materials in the surrounding environment and the preference for particular types of material for specific tasks. The relative percentages of various material types were plotted for each site. Material types for the total assemblage were found to be considerably different from predominant types used in the production of specific functional tools. Relative percentages of total assemblage materials were compared with those represented in tools that were retouched or rejuvenated. An example of this patterning may be seen in Figure 17 and Table 43.

Figure 17: **PERCENTAGE RELATIONSHIPS of MATERIAL TYPES in the STUDY AREA**

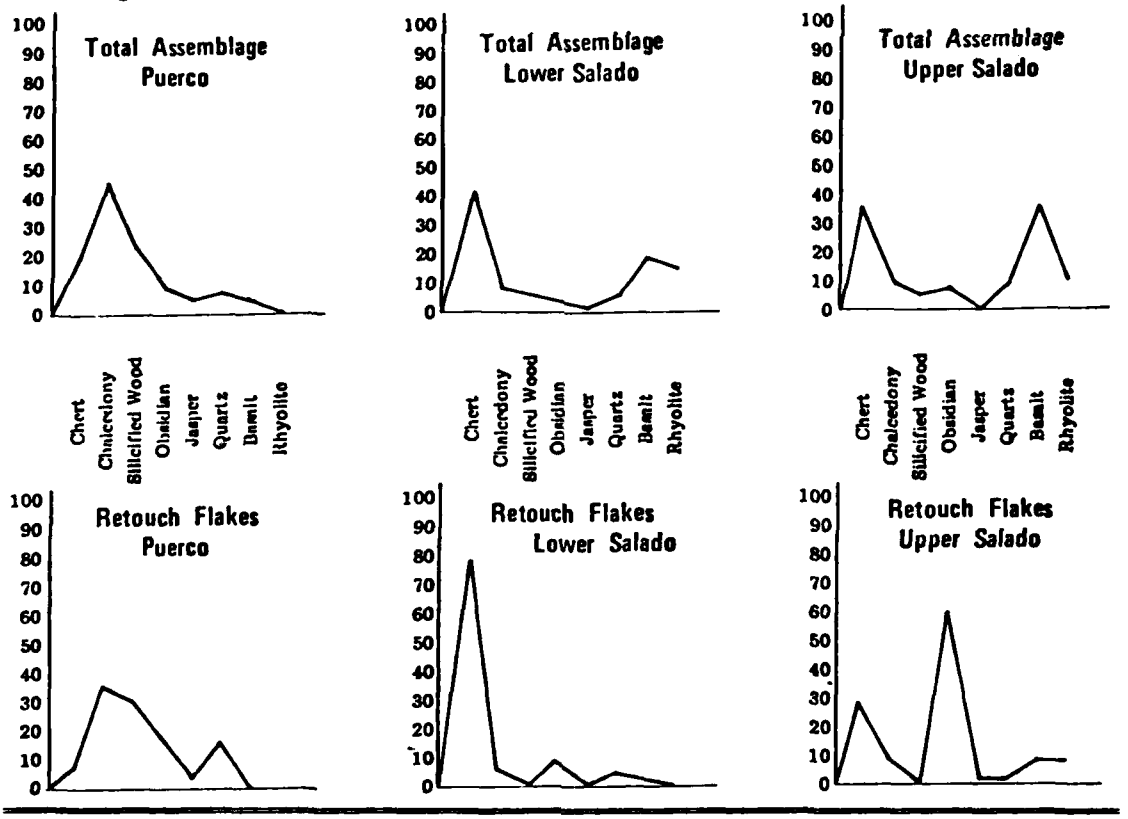


Table 43

PERCENTAGE OF MATERIAL TYPES FOR ALL ARTIFACTS ON THE RIO PUERCO–RIO SALADO

	Chert	Chal-cedony	Silicified Wood	Obsidian	Jasper	Quartzite	Basalt	Rhyolite
Lower Salado	42.2	7.3	4.6	2.2	.1	3.6	20.7	18.9
Upper Salado	34.6	9.5	2.8	3.6	.3	5.6	37.8	9.5
Puerco	18.6	42.4	21.1	8.2	2.6	5.4	1.3	0

PERCENTAGE OF MATERIAL TYPES FOR RETOUCHED FLAKES ON THE RIO PUERCO–RIO SALADO

Lower Salado	76.1	6.1	2.7	6.1	0	4.7	2.7	1.3
Upper Salado	25.9	3.7	0	62.9	0	3.7	0	3.7
Puerco	5.9	34.2	31.0	12.7	2.7	12.7	.3	2.7

The high percentages of obsidian rejuvenation flakes on the upper Salado is evident. Low percentages of basalt and rhyolite rejuvenation flakes on both drainages should also be noted. Strategies employed in the procurement of materials and in the manufacturing of task specific tools may account for this variability. If obsidian is preferred for a particular tool and is not easily obtained in the immediate environment of the upper Salado, then energy expended upon maintenance of obsidian tools would be the more expedient strategy. This would account for the high percentages of obsidian rejuvenation flakes found on this upper drainage. If the rhyolite and basalt were more readily available, then the more expedient strategy may have been to discard the worn and broken tools rather than to rejuvenate them. If all of the raw materials found on a site could be easily obtained from the local environment and selection of a particular material was not made, then the percentages of material types should closely correspond with the percentages of unusable materials found in the surrounding environment. The basic variability in materials used at different locations, and apparently for different purposes, should be further investigated in future studies.

LITHIC ASSEMBLAGE PATTERNING

The variability between assemblages from site to site may also be indicative of distance to raw material sources and types of activities carried out at a particular site. Amounts and kinds of manufacture and use by-products remaining on a site may relate to the distance to the material source. Also, relative percentages of tool types may correlate with specific activities carried out at each site. Therefore, similar percentages of tool types from different sites might be considered to be indicative of similar activities performed at each location. In graphing the relative percentages of tools at each site located on both drainages, four distinct patterns emerge (Figure 18).

Pattern descriptions are as follows:

Pattern No. 1 High percentages of unutilized flakes. Low percentages of unutilized angular fragments, cores, hammerstones and utilized tools.

Pattern No. 2 Approximate equally high amounts of unutilized flakes and rejuvenation flakes. Medium percentages of unutilized angular fragments. Low percentages of utilized tools, cores and hammerstones.

Pattern No. 3 High relative percentages of unutilized angular fragments and unutilized flakes. Low percentages of utilized tools, cores and hammerstones.

Pattern No. 4 High percentages of unutilized flakes, angular fragments and cores. Low percentages of utilized cores and hammerstones. An absence of utilized tools.

The high percentages of unutilized flakes, unutilized angular fragments and cores is expected on sites where primary reduction in the manufacturing process is a major activity. A quarry site in the middle portion of the Puerco study area is typical of Pattern No. 4. However, high frequencies of these categories appear on sites other than quarry sites and represent primary reduction as only one of several activities carried out at the site. Pattern No. 3 is a representation of sites which contain a strong element of primary reduction activity as well as evidence of tool use. This may relate to the more long-term habitation sites. Also of note are the low percentages or absence of unutilized angular fragments found for some sites, as seen in Pattern No. 1. In this case, the primary stages of the reduction process may have been carried out at a different location, or particular materials or techniques which did not produce such fragments, characterize the sites.

High percentages of rejuvenation flakes, Pattern No. 2, indicates that distance to the raw material source, quality or rarity of the material, or intensity of the activity at these particular sites created the necessity for rejuvenation of utilized tools.

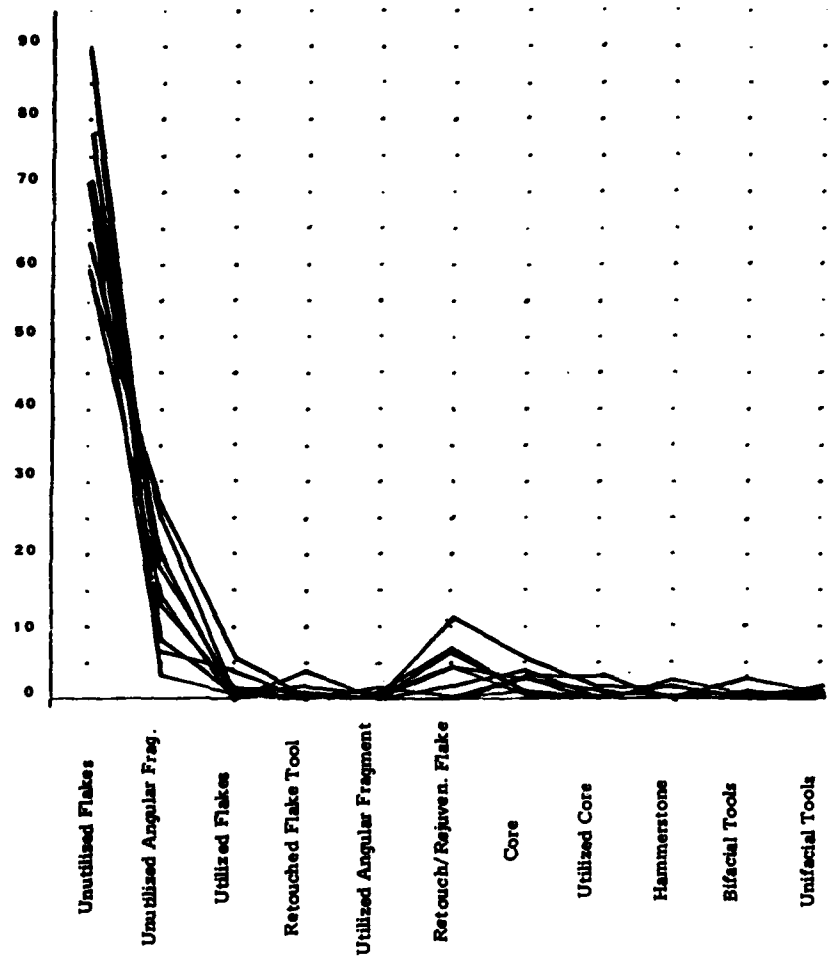
In general, no sites exhibit high percentages of any functional type of tool. This phenomenon may be related to prior collecting of the sites. Both the Apaches and Navajos have been noted for using tools found lying on the surface of sites, and modern collecting has occurred in the area. However, the sample size may not be monitoring all sites that exhibit high percentages of functional tools and specific activities.

None of the patterns specifically correlate with time periods or particular spatial distributions. However, some correlation between presence of structures and lithic Pattern No. 3 does occur. At this preliminary stage, Patterns No. 1 and No. 2 appear to correlate with open scatters exhibiting no structures.

Photos 59 (above) and 60 (below): At each site, lithic materials systematically sampled from surface distributions were sorted into formal and material categories for recording both on the lithic form and through photography.

HSR-903
LITHIC
ASSEMBLAGE
PATTERN NO. 1

Site Nos:
- P-2
- P-3, Prov. 1
- P-3, Prov. 2
- P-6, Prov. 1
- P-6, Prov. 2
- P-10
- P-12
- S-21
- L-1



HSR-903
LITHIC
ASSEMBLAGE
PATTERN NO. 2

Site Nos:
- P-8
- P-14
- P-18
- P-20
- S-22
- L-3
- L-6
- L-8
- L-10

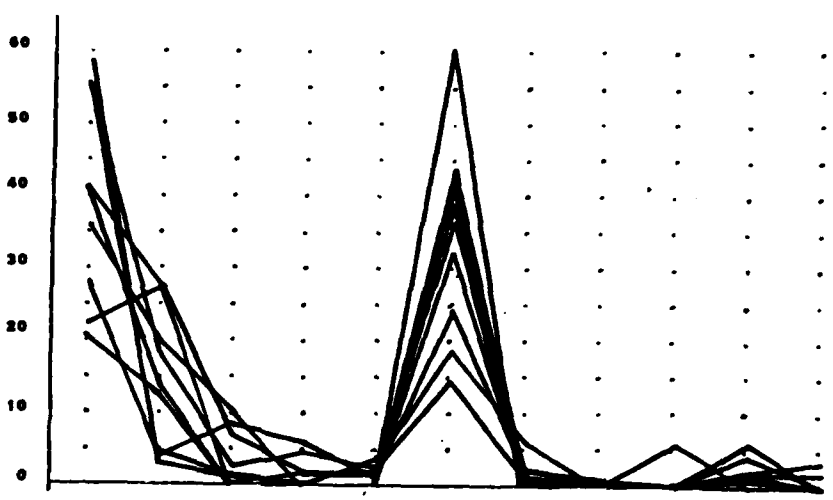
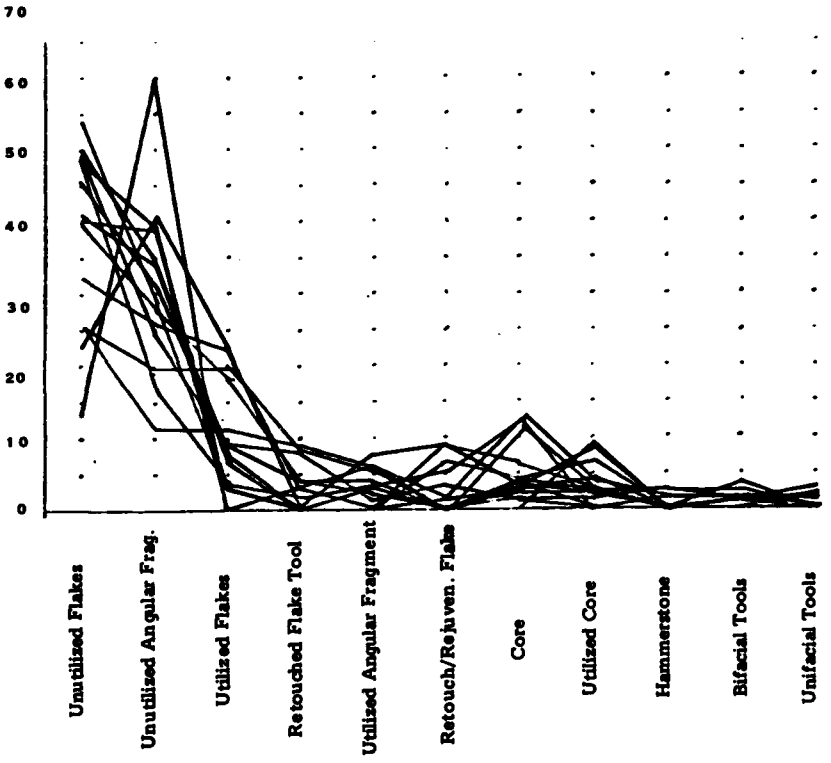
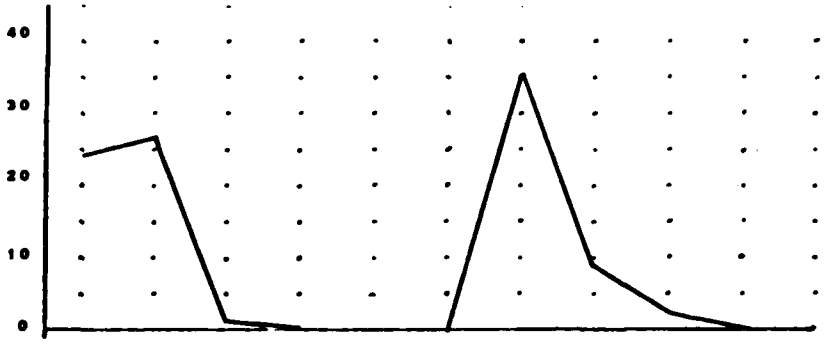


Figure 18
LITHIC ASSEMBLAGE PATTERNS
ON THE RIO PUERCO–RIO SALADO DRAINAGES, N.M.



HSR-903 LITHIC ASSEMBLAGE PATTERN NO. 3

Site Nos:
P-13
P-15
P-16
P-17
P-19
S-2
S-5
S-6
S-8
S-16
S-23
S-26
L-2
L-7



HSR-903 LITHIC ASSEMBLAGE PATTERN NO. 4

Site No:
P-11

RECOMMENDATIONS FOR FUTURE RESEARCH

Should additional lithic research be conducted on the Rio Puerco and Rio Salado drainges, several suggestions are presented below for problems which could be approached.

MATERIAL VARIABILITY

1. Samples of materials within the Santa Fe gravels compared with material types represented in the total assemblage and in formal tools for both drainages will indicate any preference for particular materials.

2. Distance between specific activity sites and selected raw material sources and quarry sites should also be monitored. This data may be used to examine energetics of rejuvenation versus replacement of tools.

3. A determination of relative quality of preferred raw materials used for specific tasks should also be considered in the sample of the Santa Fe gravels.

ASSEMBLAGE VARIABILITY

1. In additional survey, a check should be made on sites located outside the sample area, but within the drainages, to determine if the assemblage patterning remains the same as the patterns determined in this sample survey.

2. As previously stated, collection of the sites may have been made prior to this survey. In order to test the validity of surface items in determining assemblage patterning, a series of controlled test pits should recover in situ lithic samples. These samples should reveal evidence of formal tools and the association of patterns with functional site types.

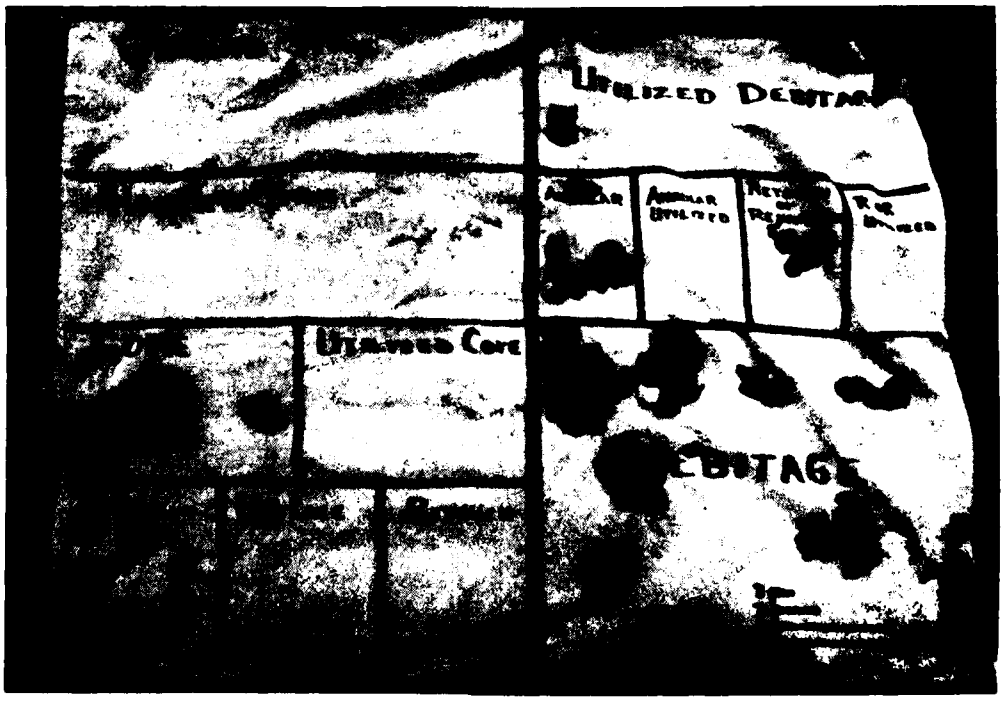
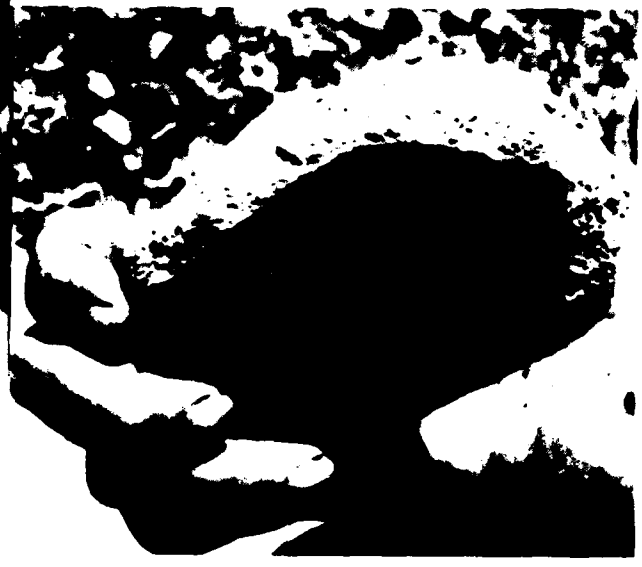


Photo 61

Photos 62 (left) and 63 (below): Hammerstone, primary reduction flakes and core from Santa Fe gravels exposed on east side Puerco valley. Site (HSR903/P-11) is a type example for lithic Pattern No. 4.



Photos 61 (facing) and 64 (right): On-site analysis was conducted at each location. HSR forms and sorting methods insured that analysis was consistently conducted and recorded.

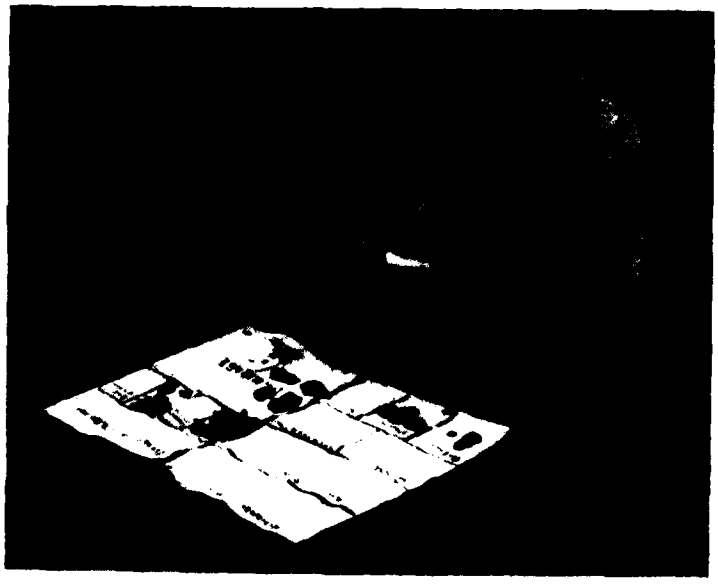


Photo 65: Basketmaker III, Pueblo I and Pueblo II sites are located on the second terrace immediately associated with the La Jencia-Salado confluence. Pueblo III sites are reported by Cibola National Forest (Tainter, personal communication) in and around mountain valleys seen at the head of the drainage.

Photo 66: Along the lower Salado, Pueblo I and Pueblo II sites are located at the heads (top) of short draws that open steeply onto the first valley terrace.

PREDICTION OF CULTURAL RESOURCES IN THE LOWER RIO PUERCO–RIO SALADO DRAINAGES, N.M.

INTRODUCTION

Although a variety of investigators have conducted limited surveys in both the Puerco and Salado study areas, these have generally been informal in methodology, with the sole purpose of locating sites whenever possible. In addition, most of these limited surveys have concentrated on the immediate margins of the major drainages, where the larger sites were expected to occur. In none of these instances was an attempt made to formally estimate actual densities or distributions of archaeological sites. Thus, while the general nature of archaeological resources is known, no formal statement of the number of resources and their distribution has been available for management purposes. Further, most of the previous survey effort took place before the enactment of legislation regulating impacts on cultural resources, and judgements of individual significance were not made.

In order to develop an accurate estimate of the numbers, character, distribution and significance of cultural resources in the study areas, a formal sample was conducted. This sample was stratified on the basis of Landsat imagery since sites were expected to correlate with major environmental features. Since impact from proposed dams would be greatest and most immediate within the actual floodpool, stratification assured that each zone and its characteristic resources could be assessed and predicted separately.

Each zone was sampled, using identical field procedures, in a random manner appropriate to a situation where little formal site data is available. A random sample was necessary at this first stage since, although a few sites had been recorded, the particulars of density, distribution and character were unknown. Future samples will undoubtedly be more sophisticated since they can be based on the results reported here.

The size of individual sample plots was consistent throughout the survey, 40 acres in extent, which allows a very simple means for the prediction of additional sites. The actual frequency of sites located in sample plots can be compared to the total number of plots directly surveyed. The result is a probability of site occurrence within any particular plot. This probability can then be easily converted to an area estimate of numbers of sites, by multiplying by the number of 40 acre units within any particular land area. Thus, if the probability of site occurrence within a 40 acre sample plot is 0.10, and an estimate of sites expected per square mile is desired, then the probability is multiplied by the number of 40 acre plots per square mile (16). The result in this case would be 1.6 sites per square mile.

SITE DENSITY IN ZONAL AND INTERZONAL SAMPLE STRATA

The modified sample design (including zone boundary plots) allows a direct comparison of the probability of a site occurring *within* a gross physiographic zone versus the probability of a site occurring in direct proximity to the boundary *between* two zones. A variety of authors have suggested that such boundary locations allow the subsistence exploitation of two or more zones from one residence or activity site and are thus favored by human populations.

Not surprisingly, this hypothesis is confirmed by site prediction values developed from formal field sampling of zones and *interzones* (boundary areas) along the Puerco and Salado drainages.

Table 44
MEAN PROBABILITY AND RANGE OF SITES PER SAMPLE UNIT IN THE STUDY AREAS

Study Area	Mean Probability and (Range) of Sites per Sample Unit	
	Within Zones	Along Zone Boundaries
Rio Puerco	.089 (0.0 to .313)	.298 (0.0 to 1.0)
La Jencia	.194 (0.0 to 1.616)	.612 (0.0 to 3.0)
Loma Blanca	.041 (0.0 to .143)	.262 (0.0 to 2.0)

Although actual mean values are somewhat skewed by varying numbers of unoccupied zones and *interzones*, an overall pattern is clear in both the mean values themselves and in the upper range values. Sites are roughly three times as likely (i.e., three times as dense) within *interzones* (along zone boundaries) than in zones, for all three separate study areas.

This result also points out the necessity of the sampling modification which included boundary sample units after the initial ground truth preliminary sample.

Standard sampling methods often discard sampling units which include more than one sampling stratum because of the complexity introduced (the number of strata increased from 13 to 31), and the difficulty of controlling the resultant information. If, however, the original sampling design had been pursued without modification, on the order of 75% of sites within the 10% sample would not have been located, and predicted values would have been only 25% of those offered here.

TOTAL NUMBER OF ARCHAEOLOGICAL SITES PREDICTED WITHIN EACH STUDY AREA

RIO PUERCO:	
Lower Hidden Mountain Dam	157
RIO SALADO:	
Loma Blanca Dam	38
La Jencia Dam	204

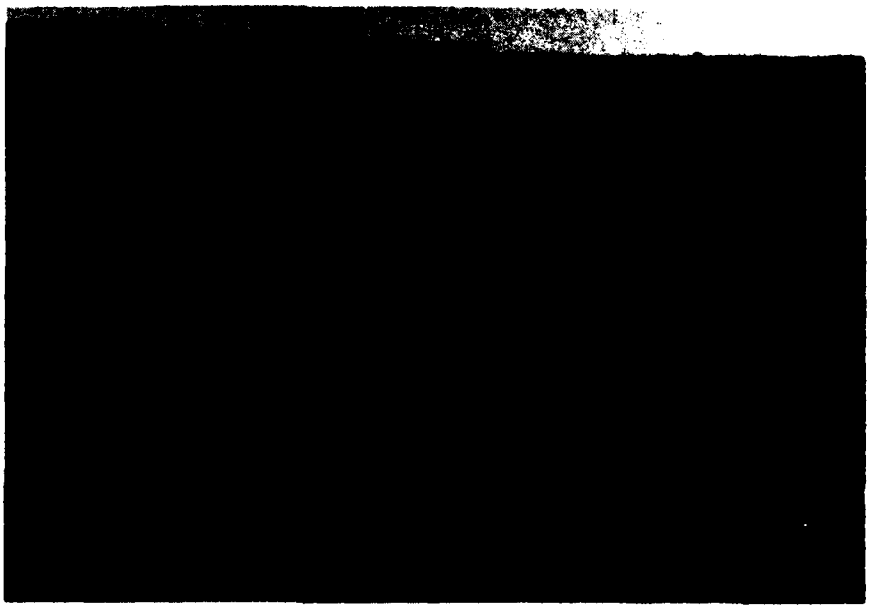


Photo 67: An unrecorded masonry structure overlooks the Rio Salado near the western end of the Salado study area.

Table 45
OCCUPIED ZONES AND INTERZONES IN ORDER OF DENSITY

Zone	Density per mi²	Description	Site #	Period	Pattern: Lithics	Site Type
			RIO PUERCO – ($\bar{x}$ = 6)			
D	2	floodplain	P-20	P-IV,Glaze A	2	scatter
D-J	3	floodplain/talus	P-5	BM-III		scatter
E	3	alluvial flats	P-2	late P-II/early P-III	1	scatter?
C	5	colluvial slopes	P-11	?	4	scatter (quarry)
			P-15	P-II	3	pueblito
			P-16	P-II	3	pueblito
			P-17	P-II	3	pueblito
			P-19	late P-I	3	scatter
C-E	5	colluvial slopes/alluvial flats	P-18	P-II	2	scatter
D-E	5	floodplain/flats	P-1	historic	—	homestead?
C-D	9	colluvial slopes/floodplain	P-9	late P-II/early P-III		scatter
			P-10	historic?	1	scatter
			P-12	P-I?	1	scatter
			P-13	P-I?	3	scatter
			P-14	?	2	scatter
D-K	16	drainage confluence	P-6	P-II	1	scatter
			P-7	Archaic?		scatter
			P-8	P-I	2	scatter
			LA JENCIA – ($\bar{x}$ = 21.2)			
M	1	canyons and ridges	S-1	historic		corral
D-M	14	floodplain/canyons	S-13	late P-I		scatter
			S-16	early P-I/late P-II	3	pueblito
			S-17	early P-I		pueblito
			S-19	early P-I		jacal?
			S-20	modern		corral
			S-21	late P-I/late P-II	1	pueblito
			S-22	BM-III	(2)	pithouse
			S-23	BM-III	3	pueblito
			S-26	BM-III	3	pithouse
D-P-O	16	floodplain/talus	S-10	historic		homestead
			S-11	late P-I		pueblito
P	27	canyon/talus	S-2	BM-III/early P-I	(3)	jacal?
			S-3	historic		ranch
			S-4	early P-I/late P-II		pueblito
			S-5	late P-II	3	pueblito
			S-6	late P-II	(3)	pueblito
O-M-H	48	canyon/talus	S-7	P-I/P-II		pueblito
			S-8	late P-II	3	pueblo
			S-9	early P-I/early P-II		jacal?
			LOMA BLANCA – ($\bar{x}$ = 9.25)			
I	1	broken hills	L-6	late P-II	2	scatter
H	2	ancient llano	L-5	early P-II	(2)	scatter
D-I	2	floodplain/eroded hills	L-4	BM-III/early P-I		jacal?
H-J	32	llano/talus	L-2	P-I	3	pueblito
			L-3	Archaic?	2	scatter

Table 46

SAMPLE RESULTS and PREDICTED VALUES:
ARCHAEOLOGICAL and HISTORIC SITES
WITHIN STRATIFICATION ZONES and ALONG ZONE CONTACTS

Zone	Total No. of Sample Units*	No. of Units* Sampled	Percent of Zone Sampled	No. of Sites	Mean Probability: Sites / Unit*	Total No. of Sites Predicted w/in Zone
			RIO PUERCO			
B	72	7	9.7%	0	0.0	0
C	118	16	13.6%	5	0.313	37
D	97	9	9.3%	1	0.111	11
E	69	5	7.2%	1	0.200	14
H	27	3	11.1%	0	0.0	0
J	148	15	10.1%	0	0.0	0
K	4	2	50.0%	0	0.0	0
Σ TOTAL:	535	57	10.65%	7	($\bar{x}$ = 0.089)	62
Contact Interzone						
B-C	75	6	8.0%	0	0.0	0
C-D	105	9	8.6%	5	0.555	58
C-E	21	3	14.3%	1	0.333	7
D-E	30	3	10.0%	1	0.333	10
D-J	58	6	10.3%	1	0.166	10
H-J	44	3	6.8%	0	0.0	0
K-D	10	3	30.0%	3	1.0	10
K-J	45	3	6.7%	0	0.0	0
Σ TOTAL:	388	36	9.28%	11	($\bar{x}$ = 0.298)	95
			LOMA BLANCA			
D	56	6	10.7%	0	0.0	0
H	63	7	11.1%	1	0.143	9
H′	3	0	0.0%	0	0.0	0
I	204	16	7.8%	1	0.062	13
M	26	0	0.0%	0	0.0	0
Σ TOTAL:	352	29	8.24%	2	($\bar{x}$ = 0.041)	22
Contact Interzone						
D-H	11	1	9.1%	0	0.0	0
D-J	7	1	14.3%	0	0.0	0
D-I	98	10	10.2%	1	0.100	10
D-M	6	0	0.0%	0	0.0	0
H-I (H′-I)	13	1	7.7%	0	0.0	0
H′-M	4	0	0.0%	0	0.0	0
I-M	10	1	10.0%	0	0.0	0
J-H	3	1	33.3%	2	2.000	6
Σ TOTAL:	152	15	9.87%	3	($\bar{x}$ = 0.262)	16

Table 46 (Continued)

Zone	Total No. of Sample Units*	No. of Units* Sampled	Percent of Zone Sampled	No. of Sites	Mean Probability: Sites /Unit*	Total No. of Sites Predicted w/in Zone
			LA JENCIA			
D	1	0	0.0%	0	0.0	0
H	4	0	0.0%	0	0.0	0
H′	27	3	11.1%	0	0.0	0
I	1	0	0.0%	0	0.0	0
M	277	12	4.3%	1	(0.036){0.083	(10){23
		16 (BLM)	5.8%	0	0.0	0
N	4	1	25.0%	0	0.0	0
O	7	1	14.3%	0	0.0	0
P	33	3	9.1%	5	1.666	55
Σ TOTAL:	354	36	10.17%	6	($\bar{x}$ = 0.194)	78
Contact Interzone						
D-I	2	0	0.0%	0	0.0	0
D-M	102	10	9.8%	9	0.900	92
D-P-O	16	2	12.5%	2	1.0	16
H′-M (H-M)	29	3	10.3%	0	0.0	0
I-M	1	0	0.0%	0	0.0	0
M-N	10	0	10.0%	0	0.0	0
O-M-H	6	1	16.6%	3	3.0	18
P-M	6	0	0.0%	0	0.0	0
Σ TOTAL:	172	17	9.88%	14	($\bar{x}$ = 0.612)	126

* (40 acre units)

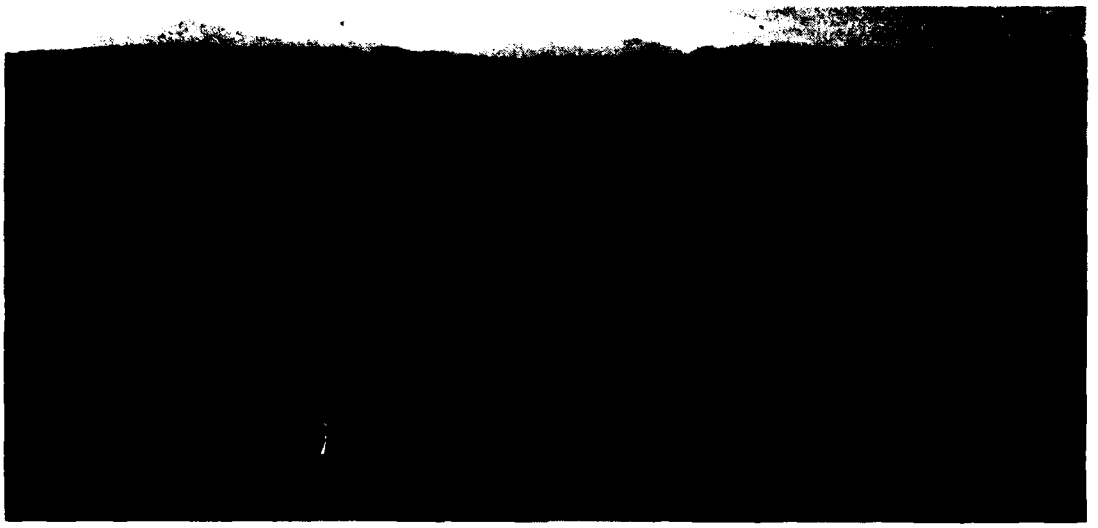


Photo 68: Site HSR903/L-2, typical of P-II sites, overlooking the lower Rio Salado.

Table 47

SUMMARY OF PREDICTION BY SQUARE MILE

Zone	Description	Predicted Site Density (Sites/mi^2)		
		Rio Puerco	*La Jencia*	*Loma Blanca*
B	talus slopes and ridges	0		
C	lower colluvial slopes	5		
D	floodplain, active channel	2		0
E	alluvial flats	3		
H	ancient llano	0		2
H′	high mesa top flats		0	0
I	oroken eroded hills			1
J	talus slopes and ridges	0		
K	tributary drainage channels	0		
M	canyons and ridges		1	
N	mountain slope		0	
O	talus slopes		0	
P	canyons and talus slopes		27	
B-C		0		
C-D		9		
C-E		5		
D-E		5		
D-H				0
D-I			0	2
D-J		3		0
D-K		16		
D-M			14	0
D-P-O			16	
H-I				0
H-J		0		32
H′-M			0	0
I-M			0	0
J-K		0		
M-N			0	
O-M-H			48	
P-M			0	

Photo 69: Above the La Jencia confluence with the Rio Salado (and above the Box on the Rio Salado) site density is highest in areas where active drainage channel, arable bottomlands, and raised terraces are in conjunction. Pictured above and in details (Photos 70 and 71), four structures -- three early P-I and one P-II -- are set near the edge of silt bottomlands.

Photo 70: HSR903 S-17 a & b

Photo 71: HSR903 S-16 a & b

Photos 72 (top), 73 (center) and 74 (bottom): Site HSR903 S-18. A sizeable Glaze C-D Pueblo IV period occupation overlooks the middle Rio Salado. Other similar sites are expected in the immediate area.

The notable absence of Pueblo III through Glaze A, Pueblo IV sites in the middle Rio Salado area becomes more interesting in light of the abundance of later period occupations such as this site. Large Pueblo III settlements have been recorded in the upper Rio Salado and headwater tributaries. From this preliminary evidence it would appear the central portions of the Rio Salado were briefly abandoned by ca. A.D. 1300 populations to be occupied a short time later.

CHAPTER V

REVIEW OF ARCHAEOLOGICAL RESEARCH IN THE RIO PUERCO–RIO SALADO WATERSHED, N.M.

By Bill Gossett

Looking east towards mesa across a tributary to La Jencia Creek from S-26 (LA 20946).
[E. Shearin]

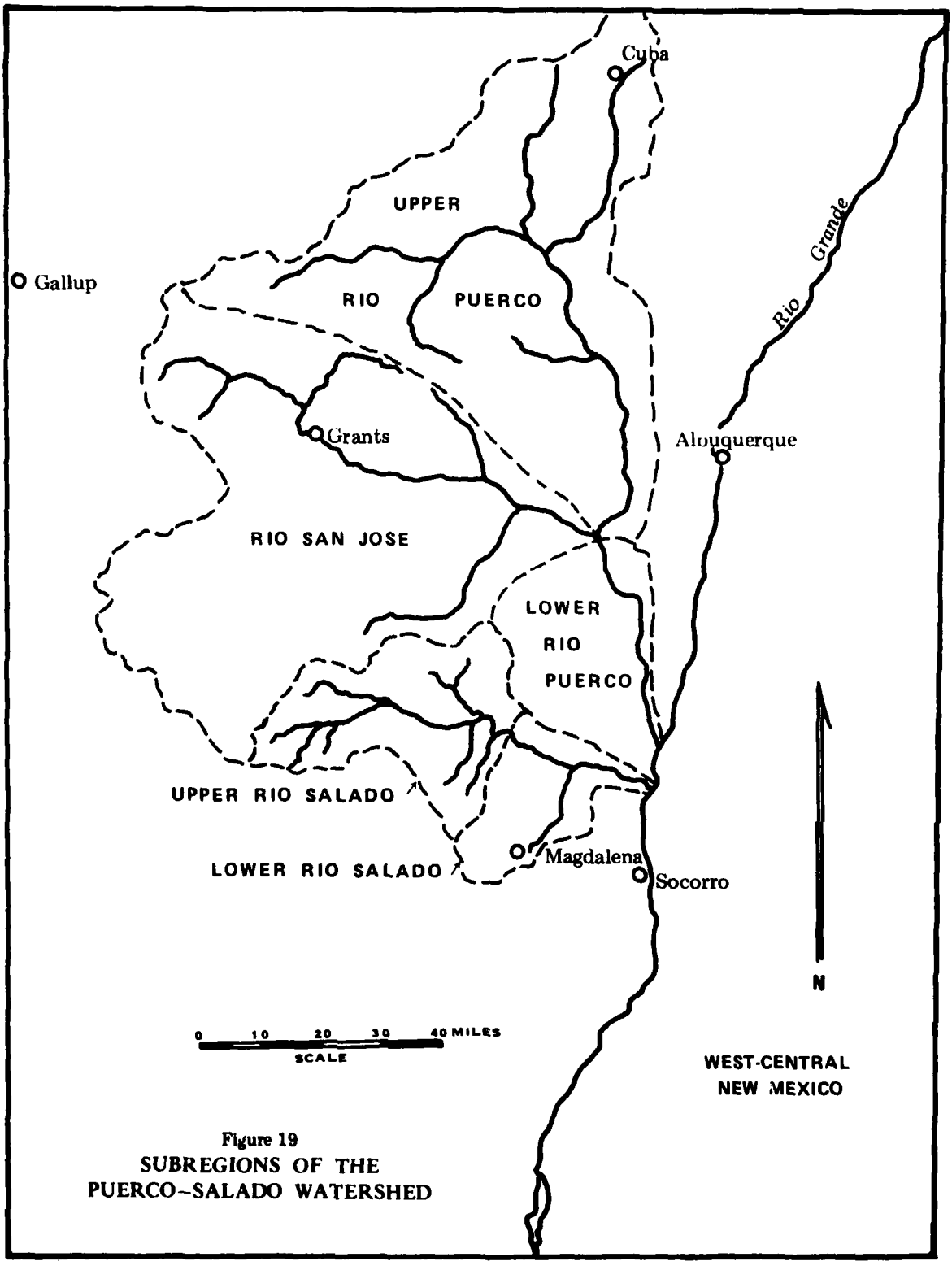


Figure 19
SUBREGIONS OF THE
PUERCO–SALADO WATERSHED

REVIEW OF ARCHAEOLOGICAL RESEARCH IN THE RIO PUERCO–RIO SALADO WATERSHED, N.M.

By Bill Gossett

PURPOSE AND OBJECTIVES

A first level review of pertinent archaeological literature, site, and survey records from previous research within the entire watershed area of the Rio Puerco and Rio Salado has been completed. For this examination, Human Systems Research has contacted major institutions holding records of such research. We have obtained copies of records, compiled maps of both survey coverage and site locations, and summarized both the scope of these studies and the general significance of resources recorded. Because of time and funding constraints, this summary will fall short of an exhaustive evaluation and should be considered only a preliminary compilation. However, the literature has been assembled in the form of site records, survey descriptions and maps. The compiled information and original maps are deposited with Army Corps of Engineers, Albuquerque.

The scope of the search includes all lands east of the Continental Divide to the Rio Grande Valley, including land north to Regina, New Mexico, and south to Magdalena, New Mexico, along Highway 60. For the purpose of discussion, the region in question has been divided into five subregions. These are: the upper and lower Rio Puerco drainages; the upper and lower Rio Salado drainages; and the Rio San Jose drainage. Physiographic features of the region include: the lowland area south of Chacra Mesa; the San Mateo Mountains; the Grants Lava Flow; the Sierra Ladrones; the Llano de Albuquerque; Cebolleta Mesa; Sierra Lucero; the Datil Mountains; and the southern Gallinas Mountains.

In an attempt to evaluate the referenced material, fourteen categories of information were identified. Although very general, these categories monitor the variability in reporting and research procedures over time. A list of projects by author (see Table 50) provides basic information for each project or site. Table 48, estimating percentage of land coverage in each area of the drainage, shows that only very limited portions of the drainage have received even minimal attention.

Table 48

ESTIMATED PERCENTAGE OF LAND COVERAGE IN EACH AREA OF THE WATERSHED

Types of Projects and %-Total Land Area Covered	Upper Puerco	Lower Puerco	Upper Salado	Lower Salado	Rio San Jose	Grants Lava Flow	TOTALS
Total Land Area by Region	2,400	700	1,700	225	2,550	800	8,375
Inventory @ 100% Coverage	75	10	2	1	80	41	209
Reconnaissance @ 10% Coverage	13	5	15	4	18	3	58
Total Land Area Covered	88	15	17	5	98	44	267
Total % of Land Covered	4%	2%	1%	1%	4%	5%	3%

(Note: Figures represent number of Sections, or nominal square miles, of land)

METHOD

Actual records consultation was conducted by Bill and Cye Gossett. Regge Wiseman, of the Laboratory of Anthropology, was most helpful in familiarizing the consultants with the records and publications housed at the facility. His knowledge of past and present literature, both published and unpublished, helped to establish the format of the records search. Upon locating pertinent information, a records form was filled out for each project/site report and the project location was transferred onto a USGS 1:250,000 map. In most cases, copies of portions of original survey/site reports were added to the records form. Whenever possible, copies of original project and site location maps were obtained. Hopefully, these records will aid future researchers in pinpointing the location of the areas surveyed and give adequate descriptions of site dimensions and attributes, when such were originally recorded. Although the quality of project and site information varies over time, every attempt was made to compile as much information as possible for each particular study area.

Stewart Peckham, also of the Laboratory of Anthropology, contributed an interview summary of the archaeological work in the region of the upper Rio Puerco and Rio San Jose drainages. In addition, collaboration with Mike Marshall on pueblo architecture and ceramics proved invaluable. His knowledge of settlement patterns of puebloan communities was of great assistance.

Randy Morrison, of the Albuquerque Bureau of Land Management District, and Bill Kight, of the Socorro BLM District, were helpful in supplying the consultants with pertinent survey/site records of archaeological work conducted on BLM lands.

Table 49

MAN-DAYS SPENT AT EACH INFORMATION SOURCE

Number of Man-Days	Information Source
7	Laboratory of Anthropology, Museum of New Mexico
1½	Office of Contract Archeology, University of New Mexico
½	Public Service Company of New Mexico Albuquerque, New Mexico
2	Bureau of Land Management Albuquerque District Office
1	Bureau of Land Management Socorro District Office
1	Clark Field Library University of New Mexico
1	Zimmerman Library University of New Mexico
TOTAL 14	

THE UPPER RIO PUERCO DRAINAGE

This region extends north from the confluence of the Rios Puerco and San Jose to the village of Regina, New Mexico. Its eastern boundary extends from the slopes of the Llano de Albuquerque to the western slopes of the San Mateo Mountains. It also includes Mesa San Luis, the San Ysidro Valley, and the low, arid area south of Chacra Mesa.

Cynthia Irwin-Williams (1977-1978) has surveyed extensively in the areas north, west and east of Mesa Prieta. Washburn (1972) and Pippin (1978) have attempted to assess the paleocology and spatial aspects concerning the P-I through P-III occupation near the village of Guadalupe. Peckham (1971) and Snow (1972) have surveyed large portions of the Bernabe Montoya Land Grant, locating sites that range from Archaic to historic Navajo. Investigations by Bice and Sundt at Mesa Prieta, under the direction of Cynthia Irwin-Williams (1972), add knowledge to the P-III period. At the northwest margin of Mesa Prieta, Davis and Winkler (1958) excavated six rooms of a late Mesa Verde site.

Irwin-Williams has developed a culture descriptive framework based on extensive survey, testing, and site excavation. She has termed Picosa, materials dating to the late three millennia B.C. (Irwin-Williams 1967, 1968). These materials are reported to occur on ridges between drainages and in caves and rockshelters from Early Basketmaker, dated at 1600 B.C. (Irwin-Williams 1968) through Pueblo occupations related to Chaco, Mesa Verde, and later, Rio Grande populations (Irwin-Williams 1972, 1978).

Data indicates the Basketmaker/P-I sites are located not only in caves and rockshelters, but on mesa points and dune areas along major drainages and tributaries (Irwin-Williams 1978). These sites are not particularly large, but quite often yield appreciable cultural materials. The P-III and P-IV sites are usually found near a major drainage adjacent to arable land (Pippin 1978). These sites are often quite large and spectacular, some with as many as 300 rooms and are rich in material culture items. Examples for this time period include such sites as Guadalupe Ruin, Prieta Vista, and other ruins north of Mesa Prieta. A Late Mesa Verdean site, excavated by Davis and Winkler (1958) southeast of the village of Guadalupe, is cited as evidence for a movement south by the Mesa Verdean people. Keur (1941) discusses historic Navajo architecture and cultural adaptations in his study of Big Bead Mesa, while Hester (1963) evaluates early Navajo migrations and acculturation with data primarily from archaeology, history, and ethnology. In addition, the Gila Apaches occupied this region for several hundred years and their camps are often found superimposed on previously occupied archaeological sites.

Archaeological surveys for which this search found records indicate that approximately 4% of this area has been covered by variously intense surveys.

THE LOWER RIO PUERCO DRAINAGE

The northern boundary of this area is the confluence of the Rio Puerco and Rio San Jose. The slopes of the eastern side of the Sierra Lucero and the northern slopes of the Sierra Ladrones form the western and southern boundaries, while the Rio Grande Valley forms the eastern margin.

Mera (1940) mentions several sites located south of the village of Rio Puerco, along the Puerco River. One site, LA 416, known as Pottery Mound, is the most extensively researched. However, published excavation data concerning this site is limited to the ceramic analyses by Voll (1961), summary statements by Hibben (1955, 1960, 1966), and reviews of kiva art by Brody (1964). The ceramic analysis concludes that the site is of the P-IV period and that earlier occupations at this location have not been detected. One other site, LA 415 (Mera 1940) appears to date to the Early Glaze period. It is located on the top of Hidden Mountain and appears to be a large defensive site with an estimated 150 rooms. Surface distributions of cultural materials are scant.

Additional investigation includes work done by Wendorf (1956), Laumbach (1978), and Klager (1979). Wendorf's pipeline survey discovered two sites, LA 2567 and 2569, located in the vicinity of Hidden Mountain. Excavation of the first site, LA 2567, consisting of four low mounds, indicates it is of the early P-II through late P-III period. He suggests the architectural features were probably constructed early in the history of the site since they all contain early sherds, but they were reused, or perhaps rebuilt periodically. Subsequent excavation of LA 2569 indicates that it was occupied during the late P-II, early P-III period. The site consists of five large mounds in three separate roomblocks, joined by a common plaza. Architectural remains suggest jacal and adobe, and rarely stone masonry.

Little is known archaeologically of the lands west to Sierra Lucero and south to the northern and western slopes of the Sierra Ladrones.

Archaeological surveys for which this search found records indicate that approximately 2% of this area has been covered by variously intense surveys.

THE RIO SAN JOSE

This region is defined by lands which occur between the southeastern slopes of the San Mateo Mountains and the Laguna Indian Reservation, and from the confluence of the Rios San Jose and Puerco west to the headwater of the Rio San Jose. Also included is the Grants Lava Flow and the western slope of the Cebolleta Mesa.

The southeastern slope of the San Mateo Mountains, the side drainages near the headwaters of the Rio San Jose, and the southern slope of San Mateo Mesa are very rich, archaeologically. These areas have been subject to extensive archaeological investigation due to prolific material resource exploration and development since 1974.

Large, areal surveys for this region have been conducted by the Laboratory of Anthropology, Public Service Company of New Mexico, Mobile Oil, Anaconda, Kerr-McGee, the School of American Research, ARKLA, Keradamex, Office of Contract Archeology, and others.

Sizable masonry house groupings attributed to Chacoan culture area and period are located at the heads of side drainages within the valley of the Rio San Jose. Casamero, a site typical of the communities, consists of approximately twenty ground floor rooms and a single kiva. Five additional masonry bin-like structures are also present. It is probable that the entire west room row were two-story constructions, as mound elevations in this area were substantial. An estimated nine second-story rooms plus twenty ground-floor units, suggest a room count of approximately twenty-nine units altogether (Marshall, et al. 1979). A plaza area enclosed by a low, masonry wall is believed to exist east of the main house structure. It is estimated that the enclosed area is approximately 11m E-W by 18 m N-S. There is a slight depression in the plaza area, suggesting that a subterranean kiva exists within the enclosure. Additional Anasazi sites are known in the Casamero district, such as a substantial complex of at least four houses and associated kivas (excavated in part by Dr. W.M. Harrison) and those described in the East Casamero district drainage area defined in the GASCO survey. There are five other similar communities of this type known. These are the San Mateo site, Kin Nizhoni, the Andrews Community, the Haystack Community, and Coyote Sings Here, which are described in PNM's study, *Anasazi Communities of the San Juan Basin* (Marshall, et al. 1979).

Reports indicate a concentration of Chacoan period sites in the vicinity of San Mateo Mesa (Peckham, personal communication). It is his opinion that late Chacoan period sites extend as far south as the southern slope of the San Mateo Mountains near the present Laguna Pueblo. Lands in the higher elevations of the San Mateo Mountains are relatively unexplored.

The Grants Lava Flow area is also rich, archaeologically. The work of Dittert and Ruppe (1949) along the western margin of Cebolleta Mesa and the subsequent work of Wiseman (1974) and Beal and Witter (1974) proved the region to contain an extensive complex of Cebolletan Puebloan sites. These sites are quite often large and spectacular. G. Frisbie (1973) has presented data concerning the Newton site, located approximately fifty miles southeast of Grants. The site consists of a complex of approximately 100 adjoining rooms and a single great kiva (Anderson 1968). The cultural affiliation is Anasazi and/or Mogollon and data (Breternitz 1966) suggests the time of occupation at about A.D. 1200 to about A.D. 1325, based on ceramic analysis. Areal survey near the York Ranch indicates that this extensive complex of puebloan sites extends to the lower margin of the northwest Datil range.

Within the lava flow, archaeological exploration is very limited. The density of sites is low compared with the Cebolleta margins, however, it is possible that numerous sites occur near sinks in the flow which contain water and soil (Wiseman 1974).

Archaeological surveys for which this search found records indicate that approximately 9% of this area has been covered by variously intense surveys.

THE UPPER RIO SALADO DRAINAGE

This area concerns the lands which occur along the upper Rio Salado drainage west of the Sevilleta Land Grant and in the northern river tributaries along the western slope of the Sierra Ladrones. Also included are the eastern slopes of Cebolleta Mesa and the northern slopes of the Gallinas Mountains.

Archaeological investigations undertaken in this area are limited to the surveys of H.P. Mera (1940), Davis and Winkler (1961), and by K. Laumbach (1978). Most archaeological investigations have been concerned with river margins or the Gallinas Mountains. Lands north of the Gallinas Mountains to the southern margin of the Laguna Indian Reservation are virtually unexplored.

Archaeological remains that have been reported from this region are largely Puebloan. The data indicate that a rather substantial Late Basketmaker/Pueblo I occupation was established along the upper Rio Salado and Gallinas Mountain area. This occupation continued through the Pueblo II period. P-III materials are reported in the Gallinas Mountains, but not along the central or lower drainage area of the Salado. Rio Grande Glaze period villages (P-IV to early Historic) were established at several locations in the central drainage area. Known Glaze A sites are at Indian Hill and La Jara. Glaze D sites are known both on the Rio Grande River and in small villages along the central drainage areas. The area was apparently abandoned by pueblo populations sometime after 1680 at which time the Apache, and later the Navajo people, inhabited the area to Anglo-American contact. After the reduction of the Apache threat, a group of colonists from Socorro established the village of Santa Rita (now Riley).

Numerous pueblo site locations are known in the region of the upper Rio Salado, but the recorded data for these sites is at best incomplete. It is likely that many small pueblo village sites occur on lands adjacent to the Rio Salado and within the major tributaries. The region beyond the river, especially on the southwest slope of the Sierra Ladrones range, is archaeologically unexplored. It is possible that rock shelters and caves occur in the Ladrone canyons containing Archaic, Basketmaker, and early Puebloan materials.

Archaeological surveys for which this search found records indicate that approximately 1% of this area has been covered by variously intense surveys.

THE LOWER RIO SALADO DRAINAGE

The Seybolleta Land Grant forms the western boundary of the lower Rio Salado drainage. The southeastern slope of the Sierra Ladrones forms the northern boundary.

The northern slopes of the Polvadera Mountains forms the southern boundary, while the eastern boundary is the Rio Grande Valley.

The areas adjacent to the Rio Salado and near the confluence of the Rio Salado and Rio Grande contain many small and several large Puebloan sites. A large Glaze period puebio is known to exist at Indian Hill, just east of the village of Alamillo. The dune formation in the Loma Blanca is also very rich in sites, mostly nonstructural lithic and ceramic scatters. Archaeological records for the lower Rio Salado are limited to incomplete site descriptions by Yeo (1939) and Mera (1940). In addition, several limited unit surveys were conducted by Laumbach (1978).

Archaeological surveys for which this search found records indicate that approximately 1% of this area has been covered by variously intense surveys.

Table 50

EVALUATION OF PREVIOUS RESEARCH PROJECT DATA IN THE AREA OF THE RIO PUERCO–RIO SALADO DRAINAGES, N.M.

Reference	Area	Survey	Excavation	Research Problem	Clearance Project	Architecture Descript.	Lithic Data by Site	Lithic Data by Project Area	Ceramic Data by Site	Ceramic Data by Project Area	Sites Difficult to Relocate	Sites Easily Relocated	Project Area Difficult to Relocate	Project Area Easily Relocated
Acklen 1977 1 site	UP	x			x		x	x				x		x
Alexander & Benham 1962 (LA 6554)	LP	x			x		x				x		x	
Allan-TVA 1975 2 sites	UP	x			x	x	x		x			x		x
Allan-TVA 1975 Neg.	SJ	x			x									x
Allan-Keradamex 1976, 128 sites	SJ	x		x		x	x	x	x	x		x		x
Anderson 1972 "Stock-drive"	US	x										x		x
Anschuetz 1979 8 sites	SJ	x			x	x	x		x			x		x
Anschuetz 1979 5 sites	SJ	x			x	x	x		x			x		x
Beal 1976 17 sites	SJ	x			x	x	x		x		x			x
Beal 1978 5 sites	UP	x			x	x	x		x			x		x
Beal 1979 19 sites	SJ	x			x	x	x		x			x		x
Beal & Witter 1976 134 comp.	SJ	x			x	x			x		x			x
Betancourt 1978 1 site	SJ	x			x	x	x		x			x		x
Broilo 1977 19 sites	SJ	x			x	x	x	x	x			x		x
Broster 1976 2 sites	SJ	x		x	x	x	x		x			x		x

Table 50 (Continued)

Evaluation of Previous Research Project Data in the Area of the Rio Puerco-Rio Salado Drainages, N.M.

Reference	Area	Survey	Excavation	Research Problem	Clearance Project	Architecture Descript.	Lithic Data by Site	Lithic Data by Project Area	Ceramic Data by Site	Ceramic Data by Project Area	Sites Difficult to Relocate	Sites Easily Relocated	Project Area Difficult to Relocate	Project Area Easily Relocated
Bussey 1966 1 site excav.	SJ		x		x	x	x		x		x			x
Bussey 1974 5 sites	SJ	x			x		x		x		x		x	
Burns, B. 1978	UP	x	x	x		x		-	x	x		x		x
Caraveo 1977 Neg.	UP	x			x									x
Carroll 1976 3 sites	SJ	x			x	x	x		x			x		x
Carroll 1979 218 sites	SJ			x		x	x	x	x	x		x		x
Carroll, et al. 1977a 10 sites	SJ	x			x	x						x		x
Carroll, et al. 1977b 10 sites	SJ	x			x	x	x		x			x		x
Cattle, et al. 1977 4 sites	SJ	x		x		x	x		x			x		x
Cleveland 1978 Neg.	SJ	x			x									x
Davis & Winkler 1961 36 sites	US	x		x		x	x	x	x	x	x			x
LA 1176	US	x		x		x			x		x		x	
LA 1178	US	x		x		x			x		x		x	
LA 1179	US	x		x		x			x		x		x	
LA 1180	US	x		x		x			x		x		x	
LA 5978	US	x		x		x			x		x		x	
LA 5979	US	x		x		x			x		x		x	
LA 5980	US	x		x		x			x		x		x	
LA 5981	US	x		x		x			x		x		x	
LA 5982	US	x		x		x			x		x		x	
LA 5988	US	x		x		x			x		x		x	
LA 5989	US	x		x		x			x		x		x	
LA 5994	US	x		x		x			x		x		x	
LA 5995	US	x		x		x			x		x		x	
LA 5996	US	x		x		x			x		x		x	
Dittert 1949 63 sites	SJ	x		x		x			x	x	x			x
Gauthier & Lent 1978 11 sites	JP	x			x	x	x		x		x			x
Geery 1979 1 site	LS	x			x		x					x		x
Grigg 1977 Neg.	SJ	x			x									x

Table 50 (Continued)
Evaluation of Previous Research Project Data in the Area of the Rio Puerco-Rio Salado Drainages, N.M.

Reference	Area	Survey	Excavation	Research Problem	Clearance Project	Architecture Descript.	Lithic Data by Site	Lithic Data by Project Area	Ceramic Data by Site	Ceramic Data by Project Area	Sites Difficult to Relocate	Sites Easily Relocated	Project Area Difficult to Relocate	Project Area Easily Relocated
Grigg 1976														
7 sites	SJ	x			x	x	x		x			x		x
Grigg et al. 1977														
9 sites	SJ	x			x	x	x		x			x		x
Hammack 1964														
3 sites	US	x			x		x					x		x
Hurt & McKnigh 1949														
2 sites	US	x		x			x				x		x	
Irwin-Williams 1972														
12 sites	UP		x	x			x		x			x		x
Irwin-Williams 1977	UP	x		x		x	x		x			x		x
Judge 1973														
59 sites	UP	x		x			x	x				x		x
Kayser 1971														
85 sites	SJ	x			x	x	x		x			x		x
Klager 1979														
5 sites	LP	x			x		x					x		x
Koczan 1976														
62 sites	SJ	x			x	x	x		x			x		x
Koczan 1978														
77 sites	SJ	x			x	x	x		x			x		x
Lang, n.d.														
1 site	SJ	x			x	x			x			x		x
Laumbach 1978														
(102) 3 sites	LS	x			x	x	x		x			x		x
(103) 2 sites	US	x			x		x		x			x		x
(104) 1 site	LS	x			x		x		x			x		x
(105) 2 sites	US	x			x	x	x		x			x		x
(113) 27 sites	LS	x			x	x	x		x			x		x
(115) neg.	LS	x			x									x
(116) 1 site	LS	x			x		x		x			x		x
(125) 1 site	LP	x			x		x		x			x		x
(126) neg.	LP	x			x									x
(127) neg.	LP	x			x									x
Lent 1978														
2 sites	UP	x			x		x					x		x
neg.	SJ	x			x									x
Lent & Harlan 1978														
neg.	SJ	x			x									x
Marshall (in press)														
"Newton Site"	SJ	x		x		x	x	x	x	x		x		x

Table 50 (Continued)
Evaluation of Previous Research Project Data in the Area of the Rio Puerco-Rio Salado Drainages, N.M.

Reference	Area	Survey	Excavation	Research Problem	Clearance Project	Architecture Descript.	Lithic Data by Site	Lithic Data by Project Area	Ceramic Data by Site	Ceramic Data by Project Area	Sites Difficult to Relocate	Sites Easily Relocated	Project Area Difficult to Relocate	Project Area Easily Relocated
Marshall & Stein (in press)														
"San Mateo Site"	SJ	x		x		x	x	x	x	x		x		x
"Kin Nizhoni"	SJ	x		x		x	x	x	x	x		x		x
"Andrews Comm."	SJ	x		x		x	x	x	x	x		x		x
"Casamero Comm."	SJ	x		x		x	x	x	x	x		x		x
"Haystack"	SJ	x		x		x	x	x	x	x		x		x
"Coyote Sings Here"	SJ	x		x		x	x	x	x	x		x		x
Mera 1940														
Pop. Changes	US/LS/LP	x		x		x	x	x	x	x		x		x
LA 414	LP	x		x					x			x		x
LA 415	LP	x		x		x			x			x		x
LA 416	LP	x		x		x			x	x				x
LA 284	LS	x		x		x			x	x				x
LA 285	LS	x		x		x			x	x				x
LA 286	LS	x		x		x			x	x				x
LA 287	LS	x		x		x			x	x				x
LA 786	LS	x		x		x			x	x				x
Peckham 1967														
9 sites	SJ	x			x	x	x		x		x			x
Peckham 1971														
210 sites	UP	x	x		x	x	x	x	x	x		x		x
Pippin 1978	UP			x		x						x		x
Reher 1975														
3 sites	SJ	x			x	x	x		x			x		x
Schaafsma 1977														
130 sites	UP	x			x	x	x		x			x		x
Schaafsma 1978														
10 sites	SJ	x			x	x	x		x			x		x
Sciscenti 1962														
2 sites	SJ	x			x	x	x		x			x		x
Seaman 1977														
16 sites	UP	x			x	x	x		x			x		x
Shiner 1954														
2 sites					x						x			x
Stein 1975														
neg.	UP	x			x									x
Vincent 1973														
4 sites	LS	x				x	x		x		x			x
Vincent 1974														
2 sites	LS	x				x	x		x		x			x
Wase 1977														
1 site	UP	x			x		x					x		x
Washburn 1972														
241 sites	UP	x		x		x	x	x	x	x		x		x

Table 50 (Continued)
Evaluation of Previous Research Project Data in the Area of the Rio Puerco-Rio Salado Drainages, N.M.

Reference	Area	Survey	Excavation	Research Problem	Clearance Project	Architecture Descript.	Lithic Data by Site	Lithic Data by Project Area	Ceramic Data by Site	Ceramic Data by Project Area	Sites Difficult to Relocate	Sites Easily Relocated	Project Area Difficult to Relocate	Project Area Easily Relocated
Wendorf 1954														
2 sites					x	x	x		x		x			x
Wendorf 1956														
37 sites	LP	x			x	x	x	x	x	x	x			x
LA 2549	LP	x			x		x		x			x		x
LA 2550	LP	x			x		x		x			x		x
LA 2551	LP	x			x	x	x		x			x		x
LA 2552	LP	x			x		x		x			x		x
LA 2553	LP	x			x		x					x		x
LA 2554	LP	x			x		x		x		x			x
LA 2556	LP	x			x		x		x		x			x
LA 2557	LP	x			x	x	x		x		x			x
LA 2559	LP	x			x				x		x			x
LA 2560	LP	x			x		x		x		x			x
LA 2561	LP	x			x		x		x		x			x
Whitmore 1977														
7 sites	UP	x			x	x	x		x			x		x
Wilson 1971														
19 sites	LS	x			x	x	x		x			x		x
Winkler 1958														
1 site	UP		x	x		x	x		x		x			x
Wiseman 1974														
163 sites	SJ	x		x		x	x	x	x	x		x		x
Wiseman 1976														
3 sites	UP		x	x			x		x			x		x
Yeo 1936														
LA 1999				x		x	x		x			x		x
Yeo 1939														
3 sites	LS	x				x			x		x			x

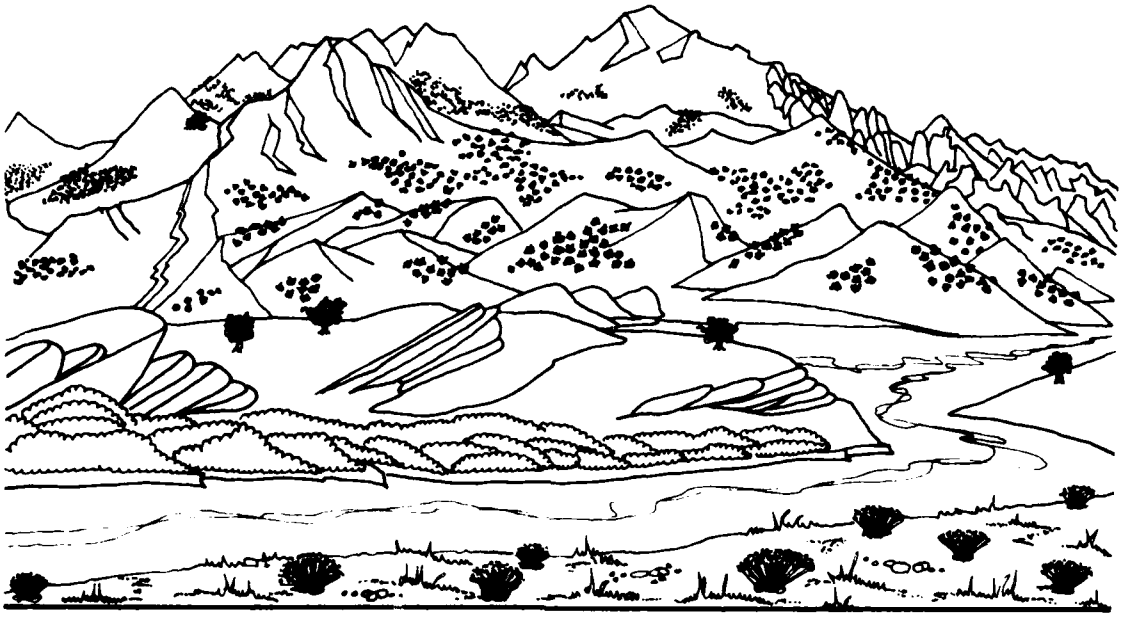
UP = Upper Rio Puerco
LP = Lower Rio Puerco
US = Upper Rio Salado
LS = Lower Rio Salado
SJ = Rio San Jose

CHAPTER VI

SUMMARY, SIGNIFICANCE AND RECOMMENDATIONS

To weave this fabric . . . . to 'reconstruct' the history of man . . . . will require the services not only of historians and anthropologists, but also of psychologists, biologists, meteorologists, geologists, chemists, and a host of other specialists in more or less autonomous disciplines . . . . The organic foundations upon which human culture has been developed and the influence of the natural environment are factors which cannot be ignored . . . .

[Taylor 1948:26]



Looking north towards Sierra Ladrones from L-6 (LA 20953).
[E. Shearin]

SUMMARY AND SIGNIFICANCE OF CULTURAL RESOURCES IN THE PUERCO-SALADO STUDY AREA

RELATIONSHIP TO THE REGION: POTENTIAL RESEARCH QUESTIONS

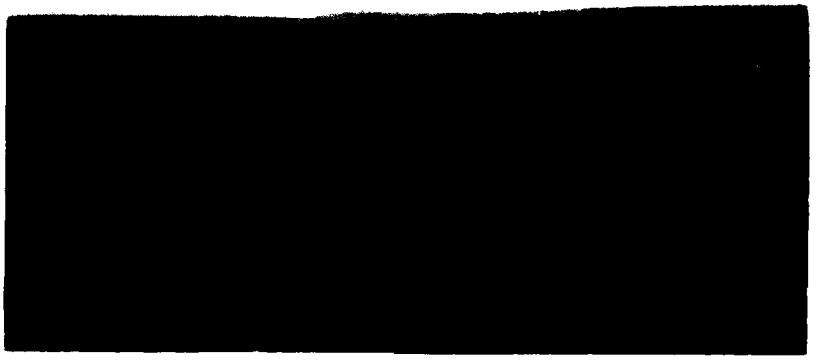
Irwin-Williams (1967) has presented a model of indigenous development from an Archaic, hunter-gatherer base through historic pueblos. Although her model is designed for application to the upper Puerco, it is probably generally relevant for the Southwestern region. In fact, most authors offering summary statements of the culture history of separate areas have generally suggested similar models to Irwin-Williams' summary, although they are somewhat more conservative in the contentions of direct cultural affiliations. In summary, the present model of regional cultural development is one of increasing sedentism with correlated adaptations to environmental variability, which itself is a trend toward more arid conditions. The factor that is as yet totally unclear to archaeologists working in this region, is the scale of sociocultural interactions. The whole problem of interpreting the cultural correlates of brownware-based ceramics versus grayware-based ceramics has, since about 1930, become increasingly more complex (Wheat 1954: 576). The formulation by Bennett (1948) of the area co-tradition concept has led to a miriad of area, project, and author based speculations concerning the affiliations (culture?) of individual sites and broad areas. At the outset, it appears that entirely too much weight has been credited to ceramic wares as a reflection of cultural affiliation. Speculative lines drawn on maps to demark *archaeological culture areas* have become accepted basis for assigning cultural interpretations, even to the point that field data demonstrating great variability from the original hypothesis are ignored in order to conform with accepted typologies. Dittert's study in Eddy (1966:382) has demonstrated the predominance of brownware ceramics in the earliest ceramic period sites of the Navajo Reservoir district in northwestern New Mexico, 200 miles north of the border defined as the northern boundary of the brownware tradition. In fact, brownware is commonly found in ceramic assemblages throughout the Southwest. Our point here is not that brownware-area (Mogollon) influence is widespread, but rather that oxidation-fired ceramics are not unusual. Therefore, although basic differences in ceramic materials from plateau or northern latitude settings and Basin-Range or lower latitude locations are marked in the later ceramic periods, use of ceramic ware distinction to distinguish traditions (or cultures or language groups) in the earlier periods is unreliable at best.

The idea that after 2,000 years ago dependence upon agricultural products began to gradually increase is common to Southwestern archaeologists. The correlate effects this had on the range normally exploited by particular population groups are practically unexplored. Archaeologists have recognized that many of the earlier period (and some middle and late period) Ceramic era architectural sites may have been occupied only seasonally or for short periods, after which time the population moved on to other locations. The area over which these movements took place is totally unknown. Ethnographically, marginally agricultural peoples are known to move villages (the people) over distances of several hundred kilometers every few years when land fertility becomes a problem (Wagley 1969). We assume that climatic, socioeconomic, and sociocultural variability might have similar effects. However, as yet no method for identifying single units of archaeological populations has enabled an analysis of range used by such groups. Until such time, it must at least be recognized that many sites have been occupied

for only short periods and may be the result of only a portion of a population's economic activities.

Schoenwetter and Dittert (1968) and Washburn (1974) have noted a correlation between relative location of agricultural village locations and climatic variability in the immediate region of the study area. Using pollen records and arroyo entrenchment events, they have indicated the possibility that during the ceramic periods, location, organization, and size of populations may directly reflect cultural adaptations to meet changes in the length and seasonality of precipitation. The historical section of this paper has reviewed evidence for the most recent entrenchment of the Rio Puerco. Various historic evidence seems to indicate that the arroyo present in the Rio Puerco valley today is an artifact of the past 100 years. This in no way precludes previous occurrences of similar events. In fact, every evidence is that like most of the drainages in the Southwest, the Puerco has undergone numerous such events. Further, it is unlikely that a low energy, heavily silted valley such as the Puerco would ever be entirely free of erosional cutting. On many occasions in the past, human populations in the Puerco-Salado drainage have probably been faced with the need to adjust themselves to this situation.

It is safe to assume that biotic conditions along the prehistoric Puerco and Salado drainages were substantially more productive than the present. Late Pleistocene conditions are not well understood in the particular of the lower Puerco-Salado drainages, although models for the general region are extant. All indications are that the present biota, with the exception of recent entrants such as tamarisk and Russian thistle (and a few other annuals and imported animals) has remained pretty much the same over the past 4,000 years.



In the Puerco drainage, the problem of shifting positions in the main drainage channel has not been approached either by this study or any other of record. Aerial photographs show many instances in which old meander courses have been cut off and several in which substantial lengths of the drainage have been displaced in the geologically recent past. It is very likely that substantial amounts of the older archaeological remains associated with the Rio Puerco have been covered with silt.

Photo 75

It is certain, however, that the ground cover, percentage relationship of plants and animals, and even community formations have changed radically in that length of time. (See Cully, this volume, for a discussion of changes in the ten years since the formation of the Sevilleta Wildlife Refuge.)

The direct actions of human populations have undoubtedly taken a substantial role in these changes. In the changing of the land, the people have also changed. Through the early periods of prehistory, the population density of the area was probably low. Until approximately A.D. 1000, population appears to have been sparse and dispersed, albiet clustered near the water sources. During the following two hundred years, traits listed from excavated sites suggest relationships with the populations of the northern and western Plateau margins. After about A.D. 1200, locally (middle Rio Grande) developed material culture appears to attain predominance (i.e., brownware ceramics and adobe architecture). Mera (1940) has recorded a number of site locations of what he terms the Rio Grande Glaze period. Dating from ap proximately A.D. 1300 to the historic eras, the period in the general region is characterized by the production of mineral glaze painted pottery. Markedly unusual sites are dated to the early years of the Glaze period. These sites are on high isolated mesa positions which suggest a *"defensive orientation"* (Mera 1940).

In the Salado drainage at La Jara Butte, on the Rio Grande near San Acacia just down from the Salado confluence at Indian Hill, and on the Puerco at Hidden Mountain, are three examples directly related to the study area. The sites are sizeable, more than 150 rooms, reasonably well constructed of locally available masonry elements, and appear to contain limited amounts of cultural materials. The ceramic type in association, Rio Grande Glaze A, although poorly dated, is believed to have been short-lived (less than 75 years).

Following the Glaze A period, sites are generally larger, located in less defensible positions, and longer lived. The reason for the defensive location of the Glaze A sites is, to date, totally unknown. The problem has not been examined. Middle and late Glaze period sites are situated in more conventional drainage associated positions. One such site was recorded in the Salado study area (there are undoubtedly others), and Pottery Mound is the most substantial example on the Puerco. With an estimated 500 rooms and a population of 1,000 people or more, the occupation of Pottery Mound undoubtedly substantially effected environmental conditions on the lower Puerco.

At about the time of earliest Spanish contact, it appears that populations occupying the Puerco and Salado moved to several major villages in the middle Rio Grande. Continual Athapascan incursions originating from or passing through the two drainages are reported by the Spanish throughout the Colonial period. Spanish livestock was apparently grazed on the two drainages but no attempt was made to establish a settlement until almost one hundred years after the 1680 Revolt which succeeded in ousting the Spanish colony for ten years.

Eighty years after the establishment of Los Quelites in 1761, near the confluence of the Rio San Jose and Rio Puerco, the Anglo-American era began in New Mexico. The early American occupations apparently attempted to follow the old Spanish patterns, but within a few decades federal adjudication of the land grant system opened vast tracts of land to homesteading. The transcontinental railroad arrived on its way west and Americans flooded into the sparsely populated areas of the region. The muddy Puerco and the intermittent Salado did not lend themselves easily to farming so open range grazing by large herds of sheep, goats and cattle became the established land-use pattern for both drainages. The Salado, being in places marginally suited to agriculture, attracted more homesteaders. The greater portion of the lower Puerco became the property of the Huning family and remains today a grazing land.

APPLICATION OF NEW INFORMATION TO THE INTERPRETIVE HYPOTHESIS

Prior to survey fieldwork, HSR examined Ford, Schroeder and Peckham's (1972) reconstruction of puebloan prehistory within the general region of the study area (HSR 1979, and reviewed this volume). Three hypotheses concerning prehistoric occupation of the lower Puerco and Rio Salado were advanced, which can be directly tested against the results of this survey.

1. A basic ceramic tradition, identified by its decorated wares, developed locally in the Puerco and lower Salado, at least by A.D. 900, possibly earlier.

This survey of the lower Puerco and Rio Salado located sites clearly associated with the Basketmaker III period. During this period, sites on the lower Puerco exhibit a preponderance of Cibola Gray Ware, with only trace amounts of Brownware. On the Salado, however, the situation is substantially different. Cibola Gray Ware and Brownware are represented in almost equal proportions on sites of the BM-III period. Although this distinction may be the result of sampling error (in both areas ware frequencies vary widely from site to site and ceramic assemblage is small), it suggests that two ceramic traditions were developed simultaneously, especially in the Rio Salado. In fact, the strong association between these two wares on Salado sites throughout a continuous occupation from BM-III through late Pueblo II, strongly suggests that these wares *do not* represent distinct sociocultural groups.

Thus, while the Rio Puerco data accord well with Ford, Schroeder and Peckham's hypothesis, data from the Salado present a somewhat anomalous result. Here, the ceramic traditions appear to be intermediate in character just as the Salado region appears to be intermediate in space, between the Anasazi to the north and the Mogollon to the south. Moreover, this *mixed* ceramic tradition persists in the study area through the Pueblo II period.

In the original statement of this hypothesis, the *basic ceramic tradition* was considered to be *identified by its decorated wares.* Some clarification of this point is necessary. If *decorated wares* is interpreted to mean painted wares only, then the cultural affiliation of the Salado materials would probably be assigned to the Anasazi. However, if *decorated* includes both painted and plastic treatments, then the strongly Mogollon aspect of these ceramics becomes apparent, and the assemblage can be viewed as intermediate or *mixed* (see Fig. 16).

Although none of the lower Puerco or Rio Salado sites have been directly dated, and clearly intrusive *horizon marker* types are absent, the general ceramic assemblage strongly suggests a date earlier than A.D. 900 for the occupation of these early ceramic sites.

1a. During its early stages, this ceramic tradition was associated with major drainages of the Puerco . . .and lower Salado . . .

The single Basketmaker III site in the Puerco study area is associated with the *confluence* of a major tributary and the Puerco. A similar situation appears to pertain along the Rio Salado. Five Basketmaker III sites are associated with the confluence of a major tributary and the main channel; one occurs along a major tributary two miles from confluence with the main channel, and one is located along the main channel itself and distant from any tributaries.

During the following period, identified as Pueblo I, association of sites with the main channel itself becomes predominant. This evidence then tends to confirm the hypothesis in part, while amplifying the nature of the specific locale.

> During its early stages (BM-III), this ceramic tradition was associated with the confluence of major tributaries and the main drainages of the lower Puerco and Rio Salado.

Moreover, sites from this period along the

Salado are not restricted to lower portions of the drainage (below the Box), but occur at various points along the drainage throughout the study area.

1b. During middle period stages, this tradition became associated with minor tributaries and upland areas associated with these larger drainages.

Since this survey did not include more than the lower portions of tributary streams, this hypothesis is difficult to evaluate. However, sites from the Pueblo II period do have a tendency to be at a distance from the drainage channel, and to be located on elevated ground, commonly on the major bench overlooking the channel, as well as on isolated hills and small mesa tops. Whether additional sites are located further up the tributaries is not known.

2. By about A.D. 1050 to 1250, two additional ceramic traditions were represented in the immediate vicinity of the Puerco Salado. A Chacoan tradition appeared immediately northwest of the study area, and a Mogollon ceramic tradition bordered the area to the south.

This hypothesis is difficult to evaluate for two reasons: 1) very little survey has been carried out in areas adjacent to the study areas, and much of what has been done is of very uneven quality; and 2) very few sites from this period, Pueblo III, were located during survey within the study areas. In fact, sites dating early in the P-III period are absent except in the northern portion of the Puerco study area. Nonetheless, some general discussion of the hypothesis is possible. Evidence from pipeline survey immediately north of the Puerco survey area indicates a substantial clustering of sites occupied during this period in the vicinity of Hidden Mountain and the confluence of the San Jose and Rio Puerco. The sites located during this survey are not far distant, and appear to be associated with this cluster. In a similar fashion, occupation during P-III on the Rio Salado appears to be associated with headward river locations and major upland tributaries. At least in some cases, these P-III settlements are substantial in size, exceeding 500 rooms (Tainter, personal communication), indicating a noteworthy degree of population concentration.

The identification of these sites with newly arrived ceramic traditions appears to be inappropriate, however. The purported incursion of a Chacoan or Keresan ceramic tradition into the lower Rio Puerco-Rio Salado region is poorly substantiated. Related ceramic types were already present (see Ceramics report) and appear to be indigenous. Furthermore, examination of site descriptions which form the basis for postulating an incoming Mesa Verdean population along the upper Salado, fails to justify that contention. Davis and Winkler (1961) report only five sites with evidence of Mesa Verde Black-on-White. Only two of these have pottery collections of reasonable size, and only one reports a *controlled sample*. This controlled sample fails to report any Mesa Verde Black-on-White. In fact, this sample reports almost all Brownware. A second sample from this site substantiates this result, although it contains a noticeable amount of western redwares. A third sample is essentially similar, except for one Mesa Verde sherd representing less than 3% of that sample. The second site with a somewhat smaller ceramic collection reports thirteen Mesa Verde Black-on-White sherds, representing 16% of the sample, with Brownwares again predominant. At best then, evidence is conflicting and no strong case is apparent.

A gradual Mogollon movement from the south into the Puerco-Salado vicinity has been postulated for the P-III to P-IV period, and actual Mogollon occupation is proposed by A.D. 1350. This survey demonstrates a strongly Mogollon character in ceramics from the earliest ceramic period. In fact, this Brownware component is the only ware consistently represented during all periods including the P-IV Glaze periods. This would suggest that Mogollon influences proposed by this hypothesis, in fact, were operable during all periods and thus would substantially predate

A.D. 1050, as contended by Ford, Schroeder and Peckham.

3. After A.D. 1350, earlier ceramic traditions were no longer represented in most of the study area, and appear to have been replaced by the Mogollon tradition represented immediately south.

In light of ceramic ware frequencies, a Mogollon ceramic tradition was substantially represented well prior to this postulated replacement. In fact, this hypothesis concerns the affiliation of southern Rio Grande Glaze sites themselves. Although few Glaze sites were investigated during this survey, continuity in the general character of the ceramic assemblage from earlier periods through Glaze A and into Glaze C-D-E would suggest that Glaze A populations, like those in residence at site L-10 (Indian Hill Pueblo), actually represented native groups which had returned from Pueblo III period sites at the Salado headwaters to the confluence of the Salado and the Rio Grande. This would indicate that historic Piro populations were the descendants of original, earlier populations rather than migrants from the south. At this time, however, such a contention must be regarded as highly speculative. Clearly, additional work centered on the detailed description of ceramic wares represented at these Piro glaze sites is a critical priority.

SIGNIFICANCE

Federal and state environmental and historic preservation legislation requires evaluation of cultural resource significance for all land modifying projects. The National Register of Historic Places has presented criteria for the evaluation of significance in 36 CFR:60.6:

> *The quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:*
>
> *a) that are associated with events that have made a significant contribution to the broad patterns of our history; or*
>
> *b) that are associated with the lives of persons significant in our past; or*
>
> *c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or*
>
> *d) that have yielded, or may be likely to yield, information important in prehistory or history.*

It is this final criterion which is most commonly applied to archaeological materials. However, it should be pointed out that not only is the information value of these resources important to science, but also to the public in general. During an *Evaluation of Archaeological Reports Submitted to the Area Archaeologist, BIA* (Wimberly and Eidenbach 1978), we have specifically considered these two aspects of the significance question:

1. Research Significance: Cultural resources represent finite examples of past cultural systems and should be directly assessed in terms of both their unique and common characteristics within a regional archaeological perspective. Few recognizable archaeological sites are devoid of future research potential, and on-site inspection during inventory survey should directly identify and discuss particularly promising research categories to the greatest extent possible.

2. Educational or Public Significance: The preservation of our rapidly diminishing and non-renewable cultural resources depends directly upon the

full cooperation of the land users who commission inventory survey. It is clear that many of the individuals involved in the proposed land use already have an interest in the preservation of cultural resources, and expect reports of such materials to direct attention to the significance of identified resources from a nonprofessional, popular perspective as well. Adequate treatment within this context can only result in increasing understanding and cooperation, and thus, will greatly assist in preservation of cultural resources -- the primary goal of archaeological inventory procedures.

EVALUATION OF SIGNIFICANCE

Although the archaeological profession has recognized the need for formal methods for evaluation of significance for a number of years, such methods have seldom been applied to preliminary judgements. Undoubtedly, a judgement of significance is both difficult and speculative in areas which are relatively unknown, and involves substantially different considerations than the judgements possible for historic buildings, well known archaeological sites, and districts. In many cases, such judgements are required in the absence of accurate comparative information, and all too commonly have the appearance of being arbitrary, or at best, hasty.

To meet the needs of National Register evaluation, HSR has developed an experimental method for weighing the relative value and potential contribution of each site within any population of archaeological sites. One particular advantage of this method lies in its potential expansion, allowing the inclusion of additional sites resulting from future survey, and a revised significance judgement.

This framework for evaluation of significance considers all reported sites as a representative sample of the full site distribution, and scores each site on seven practical criteria:

1. Density of cultural materials;
2. Preservation of the resource;
3. Potential stratigraphic preservation;
4. Rarity of the resource, by period or site type;
5. Aesthetic value of the resource;
6. Potential for restoration;
7. Continuing scientific and educational potential.

Score values range from zero to four points for each criterion, and represent individual judgements for each criterion as follows:

0 -- none
1 — below average
2 -- average
3 -- above average
4 -- exceptional

Explicit justification for each score can be consulted in individual site reports (see Chapter IV).

Thus, any particular criterion, if scored at the highest value, can weight the overall score for a site, even if other values score at an average level.

Total scores for all sites are then viewed as a distribution of significance value. Sites represented at the high end of this distribution are considered as most significant, and those on the lower end as least significant. Potential impact has been noted according to the following categories.

TYPES OF POTENTIAL IMPACTS ON CULTURAL RESOURCES RIO PUERCO-RIO SALADO

Impact Code	Impact Type	Impact Description
D-1	Direct	Destruction resulting from dam construction, access roads, etc.
D-2	Direct	Degradation resulting from flooding of maximum flood pool
D-3	Direct	Endangered by proximity to flood pool margin (here defined as within 400 meters of maximum flood pool margin)
I-1	Indirect	Potential degradation of

		the resource due to increased human activity in flood pool vicinity (here defined as greater than 400 meters and less than 1,000 meters from flood pool margin)	roads, and potential rights of-way (here defined as within 100 meters of an existing roadway) Height of maximum flood pool, used as basis for impact judgement: La Jencia — 5400 feet Loma Blanca — 5000 feet Rio Puerco — 4950 feet
I-2	Indirect	Potential degradation due to proximity to existing	

Table 51
SUMMARY TABLE – SIGNIFICANCE SCORES

Site Number	Density	Preservation	Stratigraphy	Rarity	Aesthetics	Restoration	Education	TOTAL SCORE	Impact Code
				RIO PUERCO					
P-1	0	2	2	1	0	2	1	8	I-2
P-2	3	2	1	2	0	0	0	8	I-2
P-3	2	1	2	3	0	0	2	10	D-2
P-4	3	1	1	2	2	1	2	12	I-2
P-5	1	3	2	3	1	0	3	13	D-2
P-6	2	2	1	2	0	0	2	9	D-2
P-7	2	2	2	3	0	0	2	11	D-1
P-8	4	2	2	2	0	0	2	12	D-1
P-9	0	1	0	2	0	0	2	5	D-2
P-10	0	0	0	2	0	0	2	4	D-2
P-11	0	0	0	4	0	0	4	8	I-1
P-12	1	0	1	2	0	0	2	6	D-2
P-13	0	2	1	2	0	0	2	7	D-2
P-14	2	2	1	2	0	0	2	9	D-2
P-15	2	3	2	3	0	1	3	14*	D-2
P-16	1	2	2	3	1	2	3	14*	D-2
P-17	1	3	2	3	0	1	3	13*	D-2
P-18	0	3	2	3	0	2	3	13*	I-1
P-19	2	3	3	2	0	0	4	14*	I-1
P-20	1	0	1	3	0	0	2	7	I-2
				(mean score: 12.45 — standard deviation: 12.70)					
				LA JENCIA					
S-1	0	2	0	1	0	0	1	4	—
S-2	4	2	2	3	3	1	2	17*	D-3
S-3	0	2	1	2	2	3	3	13	D-3
S-4	0	2	1	2	2	2	2	11	D-3
S-5	0	2	3	2	0	2	3	12	D-3
S-6	3	2	2	2	0	2	3	14	D-3
S-7	2	2	2	2	1	2	3	14	D-3
S-8	0	2	3	4	0	2	3	14	D-3
S-9	2	1	0	1	0	0	2	6	D-3
S-10	0	2	2	3	0	2	1	10	D-3
S-11	0	2	2	2	0	2	2	10	D-3
S-12	2	2	2	2	0	2	2	12	D-3
S-13	0	1	0	2	0	0	2	5	D-2
S-14	0	0	0	2	0	0	0	2	D-2
S-15	0	1	1	2	0	0	0	4	D-2
S-16	2	3	3	2	0	2	3	16*	D-2
S-17	3	2	3	2	0	2	2	14	D-2
S-18	1	2	3	4	3	4	4	21*	D-3
S-19	0	2	2	2	0	1	2	9	D-2
S-20	0	2	0	1	0	0	1	4	D-3

Table 51 (Continued)
Summary Table - Significance Scores

Site Number	Density	Preservation	Stratigraphy	Rarity	Aesthetics	Restoration	Education	TOTAL SCORE	Impact Code
La Jencia (Continued)									
S-21	2	2	3	2	0	2	2	13	D-1
S-22	0	1	3	3	0	0	2	9	D-3
S-23	2	2	2	3	0	2	2	13	D-1
S-24	0	4	2	3	0	0	4	13	D-2
S-25	1	3	2	4	0	0	4	14	D-2
S-26	1	3	3	3	3	2	4	19*	D-2
S-27	1	2	2	4	4	3	4	20*	D-3
(mean score: 11.59 — standard deviation: 5.03)									
LOMA BLANCA									
L-1	1	1	2	2	0	0	2	8	D-1
L-2	1	2	2	2	0	2	2	11	I-1
L-3	1	1	2	2	0	0	2	8	I-1
L-4	1	1	2	2	0	0	2	8	D-2
L-5	2	1	1	2	0	0	2	8	D-1
L-6	0	2	2	2	0	1	2	9	I-2
L-7	1	3	2	3	2	2	3	16*	I-1
L-8	1	2	2	3	0	1	2	11	I-1
L-9	1	2	3	3	2	1	3	15*	I-1
L-10	4	3	3	4	4	4	4	26*	--
(mean score: 16.8 — standard deviation: 21.14)									

*Highly significant sites

EXTENT OF EXPECTED IMPACT ON CULTURAL RESOURCES

The comparative extent of expected impact on archaeological and historic sites in the three study areas can be directly assessed by a consideration of two factors: the predicted density of sites in each study area, and the general level of significance of the sample of sites located during this 10% survey.

Study Area	Average Density of Sites/mi^2 in Occupied Zones
RIO PUERCO	6
Lower Hidden Mountain	
RIO SALADO	
La Jencia	21
Loma Blanca	9

From the standpoint of density alone, the Puerco or Loma Blanca options are likely to have less impact on cultural resources since on the order of half as many sites are to be expected per square mile, as compared to the La Jencia option. Although the difference in density between the Puerco and Loma Blanca areas should not be considered statistically significant, it should be noted that exposed sites in the Loma Blanca area are superior in preservation, and might require more extensive mitigation. However, it should be recognized that the occurrence of buried sites along the Puerco is quite likely.

Mean values of significance for each area are instructive, but of little management value since this means value has a negative correlation to the numbers of sites recorded. Thus, Loma Blanca, with the fewest sites, scores the highest on the mean, while La Jencia, with the greatest number of sites, scores lowest. This is not surprising since, as more sites are recorded, judgements of significance, using methods described here, become more discriminating. Perhaps of more importance are the numbers of significant sites and the maximum significance value.

From the standpoint of numbers of

highly significant sites which would probably require additional mitigation and partial or complete excavation, the Loma Blanca would probably be the least costly of the three.

Study Area	Mean Score Significance	Maximum Score Significance	No. of Highly Signif. Sites
RIO PUERCO			
Lower Hidden Mountain	12	14	5
RIO SALADO			
La Jencia	12	21	5
Loma Blanca	17	16*	3

*Note: Site L-10 in the Loma Blanca study lies outside the affected area, and has been excluded here, although it scored 26 significance value)

Photo 76: Glaze A, Pueblo-IV period site near the confluence of Rio Salado with the Rio Grande suggests need for "defensive" positions during the ca. A.D. 1350 era.

RESEARCH AND MANAGEMENT RECOMMENDATIONS

A formal 10% sample structured as a reconnaissance study of three potential dam locations has been conducted. Perceived stratifications of the environmental setting of each have been preliminarily examined by using standard ecological inventory techniques, and the results have suggested modification of the perceived units. Analysis of archaeological data collected by the sample has indicated problems for future research. A first level review of previous archaeological research in the entire drainage basins of the Rio Puerco and Rio Salado has been compiled and summarized. Following is a set of procedural recommendations based on this information.

PROPOSED DAM LOCATIONS: COORDINATION OF ARCHAEOLOGICAL PROGRAM WITH THE CORPS PROJECT SCHEDULE

The Corps proceeds on all projects in a stepwise or phase program. The involvement of cultural resource evaluation at an early stage insures that cultural resource management programs have ample opportunity to proceed in a similar fashion. In this manner, concern for the conservation of cultural resources takes an active role in the planning process. If cultural resource management proceeds in a logical, problem oriented, and adaptive program, requirements of scheduling mitigative actions and priorities of research can be coordinated.

INVENTORY SURVEY

Prior to commencement of any one or all of the land modifying activities presently being proposed, an archaeological inventory of all cultural resources which might potentially be affected must be assembled and systematic judgements concerning significance must be reached. Significance judgements on the basis of present information should be considered preliminary. It is possible to build on the present information a basis for future significance judgements as they become necessary. As Corps planning proceeds, archaeological inventory should continue. Proceeding inductively through one giant step to complete the inventory of all resources will potentially waste both time and funds. Such a strategy could produce tremendous problems in analysis, interpretation, and judgement of significance. Instead, it is recommended that the inventory proceed in formal, problem-oriented sampling stages. Coupled with a structured formal sample based on the present report, and limited testing with cost of dating appropriate materials included, significance judgements can be based on reliable, locally derived information. Thus, any mitigative actions to clear the projects can be done immediately. Mitigation will contribute substantially to future research as the inventory proceeds.

INVENTORY SAMPLE STEP II

Zones of highest site density generally coincide with the immediate margins of the main drainage and major tributaries, and consequently the dam site flood pool. These high impact/high density locations are generally restricted to within one-half kilometer of the active channel. All of the land within the area of potential direct impact will eventulaly be inventoried but this should be accomplished in problem-oriented steps. It is here suggested that the next step in the event that Corps planning proceeds is to conduct a formally structured, noniterative sample of an additional 20% (bring the total to approximately 30%) of the area within 500 meters either side of the drainage bottom.

Low site density zones outside the

potential direct impact-flood pool areas will receive indirect or no impact from project activities. It is here suggested that an additional 10% sample of these areas be conducted at this time, and that the step should include limited problem-oriented testing.

Step II Problem Orientation:

1. Site Distribution
2. Chronology
3. Ceramics
4. Lithics
5. Remote Sensing
6. Environment

SITE DISTRIBUTION

Archaeological sites are differentially distributed across the landscape. Although not by any means the full explanation, access to water and associated high-productivity, alluvial soils is an excellent predictor of site location. However, through time for various environmental and social reasons even within the high density areas, sites appear to cluster at given locations. It is believed that a 30% sample (present 10% plus 20% in Step II) of lands falling within the high density area will predict the location of the majority of these clusters. In the off drainage, low site density areas, few archaeological remains were found in the 10% sample. It is here suggested that another similarly structured (but noniterate) sample of the same magnitude be conducted in this area. This would bring the total coverage to 20% and result in two identically conducted samples, allowing a statistical test of validity. Depending upon the results of this sample, it may be possible to present a valid case for acceptance of this or only a slightly larger sample as adequate inventory of indirect impact.

CHRONOLOGY

The development of an adequate and accurate chronology is key to an understanding of both major anthropological research questions and proper management goals for cultural materials in this area. This requires the direct dating of prehistoric materials extracted from a known context of other more general informational value. This may include the dating of fossil packrat midden materials (to reconstruct paleoecology), noncultural charcoal in alluvial context (to date occasions of arroyo entrenchment/agradation), or cultural context (to date the presence/absence of particular pottery types or architectural styles). Absolute dates from prehistoric materials of this age are presently available through four different techniques: radiocarbon, dendrochronology, archeomagnetic, and obsidian hydration (all are comparatively inexpensive, ranging from $15.00 to $150.00 per sample). The type of dating method used should depend upon the particular circumstance (i.e., ceramic dates should generally be derived from dendrochronological or archeomagnetic sources since ceramic types are often short-lived and the plus/minus factor is commonly broader than the full period of a ceramic type). A carefully considered research design should present justifications for the type and number of such samples needed for each research question.

CERAMICS

Current ceramic taxonomy suffers from bias which essentially gives precedence to those regions first explored and described. The traditional assumption that ceramic types and traditions are coextensive with functional cultural units has in the past been used to simplify inventory and classification of ceramic sites. In those regions, a *type site* and its characteristic ceramics have been defined and institutionalized in the formal taxonomy. In many cases those regions which were among the first explored contained spectacular or accessible ruins, and the resulting research work served as the basis for the broad cultural historic classification which rests on the formal description of ceramic types, wares and traditions. Areas which have remained somewhat unexplored, like the lower Puerco-Salado, are assumed to be directly affiliated with described core regions, or less often to be intermediate between two such regions. Thus, the dotted lines between previously recognized *traditions* are generally placed across the less spectacular as well as the least explored. In these supposed *intermediate* areas, the standard ceramic taxonomy is less useful, and interpreta-

tion of cultural affiliation via ceramics often leads to unrealistic, if not nonsensical conclusions. In these areas, assumptions are best left aside, and a detailed ceramic investigation pursued on its own merits. In fact, the Puerco-Salado study area offers an opportunity to test the existing taxonomy and interpretations.

A thorough review of comparative collections collected during HSR survey, type descriptions in the literature, and collections from adjacent areas, on file at the Laboratory of Anthropology, will be necessary prior to fieldwork. Consultation with other ceramics specialists will greatly assist this task.

The analysis reported here points out a series of specific taxonomic and descriptive problems which will require petrographic analysis for clarification. These studies will identify the distinctive local clays and tempering materials and will allow location of source areas during actual field survey. These sources will be of significant value in the interpretation of relationships between the survey area and adjacent regions, by allowing the definition of intrusive versus indigenous ceramic materials.

Samples of clay and mineral sources identified during prior analysis and located in the field should be subjected to firing under variable temperatures and atmosphere for comparison with ceramic type collections. In addition, ceramic type samples should be collected from important sites adjacent to the study area in order to provide a broad regional perspective for typological studies.

LITHICS

On-site lithic analysis during the present sample was quite successful in identifying at least four consistent patterns of variability in lithic assemblages. Of particular interest were patterns associated with architectural sites, and with one surface quarry. Continued implementation of the analysis carried out thus far should verify and expand this information and furnish sufficient cases to allow multivariant statistical confirmation of these patterns. An expanded understanding of lithic variability in the study area will contribute to our knowledge of subsistence economies and changes in patterns of environmental exploitation.

In addition, identification of preferred sources for lithic materials should result from additional field survey, and may shed substantial light on energy relationships among local populations.

The geologist whose primary concern is discussed under environmental problems should also consult during fieldwork with the cultural lithics consultant in examination of potential raw materials sources. Further, a comparatively inexpensive petrographic analysis of lithic source and site materials will clearly document any correlations made.

Methods of lithic analysis comparable to those described should be used throughout additional survey and should be sufficient for resolution of these and other problems discussed in the lithics report.

REMOTE SENSING

Available aerial photography proved invaluable during survey for location description and interpretation of sites and land form. This imagery will be a basic requirement of further survey. In addition, preliminary analysis of a sample of these photos by the remote sensing specialist prior to this survey revealed several linear surface features suggestive of prehistoric roads and/or water control systems (Camilli 1979). These features failed to appear in ground sampling during this project and were not directly investigated. Prior, during and after additional survey, complete analysis of the aerial photo coverage should be conducted and at least a representative sample of such features should be directly investigated.

ENVIRONMENT

Three aspects of environmental studies are appropriate to pursue at this time. First, the modern ecological evaluation program begun on the present survey should continue, refining with the archaeologists the concepts

now expressed as perceived environmental units. Second, a study of fossil packrat middens observed in the Salado study area (probably also can be found on the north side of Ladron and in the outcropping sandstone and basalt mesas just north of the Puerco study area) should be undertaken. This study will provide very exact measures of environmental segments over an estimated ten thousand year period (known examples in the region extend to fifty thousand years ago and commonly produce results dating from two to ten thousand years). Finally, the assistance of a competent late Pleistocene geologist should be sought for a study of the substantial environmental record available through examination of the alluvial history of streams in the study area. In this manner, a fairly complete picture of both the biotic and physical aspects of the environment during the periods of human occupation can be built along with a basic chronology and statistically reliable sample of the locations of human occupation.

EVALUATION PROGRAM FOR THE PUERCO-SALADO WATERSHED

In addition to the reconnaissance study of three locations on the lower Puerco-Salado drainages, HSR was also asked to preliminarily evaluate the scale of potential cultural resource impact if a large scale program to control erosion in the full watershed was undertaken. The scale of the study area involved is immense — potentially over 8,500 square miles. However, it is realized that even a most extensive erosion control program would directly impact only a small portion of the total area of the watershed. At this early date, no specific plan as to location or character of such control facilities has been formulated.

At this time, cultural resource recommendations must proceed under the most general assumptions. If ACE moves to actual planning of such a program, the recommended first step for cultural resource evaluation is the formulation of a high level, general research design. The literature and background overview that HSR has completed (Bill Gossett, this report) has shown that only about 3% of the watershed has received even minimal attention from the archaeological profession. Approximately 3,000 archaeological sites have been reported in some manner, and it is conservatively estimated that at least 30,000 such locations are present in the watershed. HSR suggests that the known sites fall into at least five major physiographic units of the watershed. Production of a general research design could begin with the present groupings and proceed with appropriate environmental and/or cultural subdivisions as necessary.

Beginning with the information and maps compiled for this report, a first step in the production of a regional research design should produce an exhaustive review of previous research. In addition, collections records and samples of the actual materials should be reviewed. General environmental literature and inventories should be reviewed. This information should be applied to a large scale map constructed by stratifying ERTS imagery into perceived ground cover and physiographic units. Existing archaeological information should be summarized in terms of these units. Finally, sample field visits to known clusters of archaeological resources should be undertaken. In this manner, all available information can be summarized, supported by details, and serve as background for both problem orientation in the general research design and significance judgements which will be required as further evaluation proceeds.

SUMMARY OF RECOMMENDATIONS FOR FUTURE RESEARCH

Phase of Study	Method/Technique	Objective	Type of Personnel
Inventory Archaeological Survey	formal sample 20% high density areas 10% low density areas final sample conditional	verify & refine predictive model locate & describe sites	field survey party
Ethnohistoric Studies	archival research	develop detailed history of local relationship between colonial and native pueblo and Athapaskan populations	consultant with travel and field time
Remote Sensing Studies	detailed analysis of available photo coverage	locate and recommend ground truth tests for interpretations of large scale cultural features	consultant
Test Excavations	formal sample of located sites	recover and process in situ ceramic, lithic & chronological samples	field test party
Comparative Ceramic Studies	consultation of comparative collections & with experts	identify ceramic problems for study area	consultant with travel time
Petrographic Studies	samples of lithic & ceramic source areas	comparative firing studies petrographic descriptions	consultants with field time
Paleoecological Studies	pollen studies packrat midden studies dendrochronological studies	develop model of environmental change during the periods of occupation	consultants with field time
Alluviation Studies	geological & historical studies of stream alluviation	document history of drainage changes	consultant with field time
Archival Research for Watersheds	consultation of site records & manuscripts, etc.	document known sites in watershed	archaeologist with travel time
Watershed Site Evaluation	formal sample of recorded site communities for revisitation	develop comparable descriptions & evaluations of sites within the watershed	field evaluation party

View from S-7 (LA 20927) looking south across Rio Salado towards S-2 (LA 20922). [E. Shearin]

REFERENCES CITED

FOOTNOTED REFERENCES

1. Leopold, L.B., M.G. Wolman, and J.P. Miller (1964:241), *Fluvial Processes in Geomorphology*. W.H. Freeman and Co., San Francisco.

2. Cooke, R.U. and R.W. Reeves (1976), *Arroyos and Environmental Change in the American Southwest*. Clarendon Press, Oxford.

3. Hastings, J.R. (1959), Vegetation change and arroyo cutting in southeastern Arizona. *Journal of the Arizona Academy of Science* 1:60-67.

4. Leopold, L.B. (1959), Vegetation of southwestern watersheds in the nineteenth century. *The Geographical Review* 41:295-316.

5. Thornthwaite, C.W., C.F.S. Sharpe, and E.F. Dosch (1942), Climate and accelerated erosion in the arid and semi-arid southwest, with special reference to the Polaca Wash Drainage Basin, Arizona. *U.S. Department of Agriculture Technical Bulletin* 808.

6. See Cooke and Reeves (1976) for summary of the various theories.

7. Bryan, Kirk (1927:17), Channel erosion of the Rio Salado, Socorro County, New Mexico. *U.S.G.S. Bulletin* 790:15-19.

8. Ibid.

9. Bryan, Kirk (1928), Historic evidence on changes in the channel of Rio Puerco, a tributary of the Rio Grande in New Mexico. *Journal of Geology* 36:265-82.

10. Bryan (1927) op.cit.

11. Martin B. Hays vs. the United States, U.S. Court of Private Land Claims No. 37, Transcript of Proceedings, March 16 to Nov., 1893, Filed Feb. 23, 1894. University of New Mexico Library, Coronado Room, Catron Papers (UNM, Catron Papers).

12. Survey platt of T1N, R3W, Leslie Otto (1902), General Land Office records on file at Bureau of Land Management, Santa Fe (GLO, BLM).

13. Hays vs. U.S. (op.cit.).

14. Official decree of Governor Tomas Velez Capuchin in relation to the Antonio Sedillo grant and the settlement of San Rafael de los Quelites, July, 1765, Archive 720, Records of the Surveyor General's Office (SGO) on microfilm at UNM, Coronado Room.

15. Official letter from Antonio Sedillo, original grantee, to Governor Capuchin dated July 10, 1765 (SGO, UNM, Microfilm, Coronado Room).

16. Bryan (1928) op.cit.

17. Westphall, Victor (1965), *The Public Domain in New Mexico 1854-1891*. The University of New Mexico Press, Albuquerque.

18. Abert, J.W. (1848:463), Examination of New Mexico in the years 1846-47. *30th Congress, 1st Session, House Ex. Doc.* 41:417-548.

19. Simpson, J.H. (1850:71-73), Journal of a military reconnaissance from Santa Fe, New Mexico, to the Navajo country . . . in 1849. *31st Congress, 1st Session, Senate Ex. Doc.* 64:55-168.

20. Bryan (1928:279), op.cit.

21. Morisawa, Marie (1968:101), *Streams: Their dynamics and morphology*. McGraw Hill Book Co., N.Y.

22. Schumm, S.A. and R.F. Hadley (1957), Arroyos and the semi-arid cycle of erosion. *American Journal of Science* 225:161-74.

Footnoted References (Continued)

23. Bryan (1928:277), op.cit.

24. Cunningham, D.R. (1881:82), Field notes of the original survey of T4N, R1W, May, 1881 (GLO, BLM).

25. Richards, W.H. (1912:448), Field notes of the resurvey of T3N, R1E, February, 1881 (GLO, BLM).

26. Chief of Engineers, Department of the Army (1978:xxviii), Rio Grande and tributaries, Rio Puerco and Rio Salado, New Mexico. *95th Congress, 2nd Session, Senate Doc.* 95-90.

27. Bolton, Herbert E. (1949), *Coronado, Knight of pueblos and plains.* University of New Mexico Press.

28. Hammond, George P. and Agapito Rey (1966:82), *The rediscovery of New Mexico 1580-1594.* University of New Mexico, Albuquerque.

29. Schroeder, Albert H. (1974:2), *A study of the Apache Indians: Part IV - The Mogollon, Copper Mine, Mimbres, Warm Spring and Chiricahua Apaches.* Garland Publishing Inc., New York and London.

30. Benavides, Alonso de (1954), *Benavides' Memorial of 1630.* Academy of American Franciscan History, Washington D.C.

31. Schroeder (1974:6), op.cit.

32. Bandelier, Adolph (1892:250), Final report of investigations among the Indians of the Southwestern United States, carried on mainly in the years from 1880 to 1885. *Papers of the Archaeological Institute of America, American Series,* 3 and 4, John Wilson and Son, Cambridge.

33. Espinosa, J. Manuel (1942), *Crusaders of the Rio Grande: The story of Don Diego de Vargas and the reconquest and refounding of New Mexico.* Institute of Jesuit History, Chicago.

34. Kessell, John L. (1979:303), *Kiva, Cross and Crown: The Pecos Indians and New Mexico 1540-1840.* National Park Service, U.S. Department of the Interior, Washington D.C.

35. Dyreson, Dilmar A. (1979), Settlement pattern changes and self-organizing systems in the central Rio Grande watershed of New Mexico, AD 1350-1968, PhD dissertation, University of Denver.

36. Greenleaf, Richard E. (1972:93), Land and water in Mexico and New Mexico 1700-1821. *New Mexico Historical Review* 47:85-112.

37. Harper, Allen G., Andrew Cordova, and Kalervo Olberg (1943:19), Man and resources in the middle Rio Grande Valley. *Inter Americana Studies II.* University of New Mexico Press, Albuquerque.

38. Navajo Tribe (n.d.:186), Prepared findings of fact in behalf of the Navajo Tribe of Indians in the area of the overall Navajo claim (Docket 229), Volume IV, Findings 18 and 19.

39. Nicolas Duran de Chaves Land Grant (UNM, PLC - reel 39: case 57) documents appended to petition filed 1-7-1893, Jose Chaves y Gallegos and Jose Prudencio Sanchez y Chaves vs. the United States.

40. UNM, SG: reel 13.

41. Harper, et al. (1943:120-121), op.cit.

42. Schroeder (1974:47), op.cit.

43. UNM, Catron Papers: Antonio Sedillo Grant.

44. Hammond, George P. and Agapito Rey (1953:129), *Don Juan de Onate, Colonizer of New Mexico 1595-1628.* Two volumes, University of New Mexico Press, Albuquerque.

45. UNM, Catron Papers: Antonio Sedillo Grant.

Footnoted References (Continued)

46. Espinosa (1942:187), op.cit.

47. Thomas, A.B. (1932), *Forgotten frontiers: A study of the Spanish Indian policy of Don Juan Bautista de Anza, Governor of New Mexico 1777-1787.* University of New Mexico Press, Albuquerque.

48. Jenkins, Myra E. and Ward A. Minge (1974:4), *Navajo Indians II: Navajo activities affecting the Acoma-Laguna area, 1746-1910.* Garland Publishing Co., New York and London.

49. Schroeder (1974:64), op.cit.

50. Jackson (1810:407), *The journals of Zebulon Montgomery Pike, with letters and related documents.* University of Oklahoma Press, Norman.

51. Spanish Archives of New Mexico (1:1281), *State of New Mexico Records Center, Santa Fe.*

52. UNM, Catron Papers: Sevilleta Grant.

53. Sanders, Alvin (1976:29), *Historical survey of the Socorro district.* Bureau of Land Management, Socorro.

54. Navajo Tribe (n.d. 206), op.cit.

55. UNM, Catron papers: Antonio Chavez Grant.

56. Jenkins and Minge (1974:6), op.cit.

57. Reeve, Frank (1974:17), Navajo Indians II: *The Navajo homeland 1848-1868.* Garland Publishing Inc., New York and London.

58. Jenkins and Minge (1974:58), op.cit.

59. Ibid:71.

60. Maltrotti, John (1949), Leads toward history of Alamo Navajos. Ms on file at Department of Anthropology, University of New Mexico, Albuquerque.

61. Jenkins and Minge (1974:80), op.cit.

62. Ibid.

63. Ibid:175.

64. Navajo Tribe (n.d.:62-64), op.cit.

65. Bancroft, Hubert H., *History of Arizona and New Mexico 1530-1888, Volume XVII* (1889:644). The History Company, Publishers, San Francisco.

66. Keleher, William A. (1929:356), Law of the New Mexico land grants. *New Mexico Historical Review* 4:350-71.

67. Schroeder (1974:137, 141), op.cit.

68. Reeve (1974:89), op.cit. Here Reeve is citing a letter from Lt. H.W. Freedley to Sykes, April 1859. Freedly was then stationed in Los Lunas.

69. Ibid.

70. Ibid.

Footnoted References (Continued)

71. McNitt, Frank (1972:387), *Navajo wars: Military campaigns, slave raids, and reprisals.* University of New Mexico Press, Albuquerque.

72. Navajo Tribe (n.d.:231), op.cit.

73. Noel, Theo (1961:43), *A campaign from Santa Fe to the Mississippi, being a history of the old Sibley Brigade.* Edited by Martin B. Hall and Edwin A. Davis, Stagecoach Press, Houston.

74. Colton, Ray C. (1959:92-93), *The Civil War in the western territories, Arizona, Colorado, New Mexico, and Utah.* University of Oklahoma Press, Norman.

75. Hall, Martin H. (1960:198), *Sibley's New Mexico campaign.* University of Texas Press, Austin.

76. Schroeder (1974:174), op.cit.

77. Ibid:183.

78. Carleton to Rigg, Santa Fe, August 4, 1863, *39th Congress, 2nd Session, Senate Report* 156:123.

79. Schroeder (1974:176), op.cit.

80. Ellis, Florence H. (1974:446), *Navajo Indians I - An anthropological study of the Navajo Indians.* Garland Publishing Inc., New York and London.

81. Navajo Tribe (n.d.:241), op.cit.

82. Westphall, Victor (1965:65), op.cit.

83. UNM, Catron Papers: The Antonio Chaves Grant.

84. UNM, PLC, reel 39: case 57, petition filed 1-7-1893, Jose Chaves y Gallegos and Jose Prudencio Sanchez y Chaves vs. the United States.

85. Widdinson, Jerold G. (1959:259), Historical geography of the middle Rio Puerco Valley, New Mexico. *New Mexico Historical Review* 34(4):248-84.

86. U.S. Census Reports, on file at New Mexico State Records Center, Santa Fe.

87. Christiansen, Paige W. (1974), The story of mining in New Mexico. *New Mexico Bureau of Mines and Mineral Resources,* Scenic Trips to the Geologic Past 12.

88. GLO, BLM 1882 survey of T2N, R4W by Daniel Curry, field survey notes.

89. Carroll, John M. (1971), *Buffalo Soldiers West.* Old Army Press, Ft. Collins, Colorado.

90. Christiansen (1974), op.cit.

91. Keleher (1929:359), op.cit.

92. Sherman, James and Barbara H. Sherman (1974:174), *Ghost towns and mining changes of New Mexico.* University of Oklahoma Press, Norman.

93. U.S. Census Reports (1900), New Mexico State Records Center, Santa Fe.

94. Bryan (1927:18), op.cit.

95. Sanders (1976:56), op.cit.

REFERENCES CITED

Acklen, John and Rory Gauthier
1977 *An archaeological survey in the Rio Puerco Valley (east).* The Public Service Co. of New Mexico, Marquez Line. Office of Contract Archeology, University of New Mexico, Albuquerque, Project No. 185-2.

Alexander, Robert K. and R. Benham
1962 *Highway cultural inventory project: Final report 1961-1964.* Published jointly by New Mexico State Highway Department and Museum of New Mexico, Santa Fe.

Allan, William C.
1975a *Archaeological survey of ten exploratory drilling holes and associated access roads, McKinley County, New Mexico, Tennessee Valley Authority, phase I.* Office of Contract Archeology, University of New Mexico, Albuquerque, Project No. 101-128.

1975b *Tennessee Valley Authority archaeological survey, phase II: Eleven mineral exploration drill holes on the Abe Pena ranch.* Office of Contract Archeology, University of New Mexico, Albuquerque.

Allan, William, R. Gauthier, F. Broilo and R. Loose
1976 *An archaeological survey near San Mateo, New Mexico — The Kerdamex Incorporated lease.* Office of Contract Archeology, University of New Mexico, Albuquerque, Project No. 101-124.

Anderson, R.F.
1968 Magdalena stock drive. BLM Socorro, N.M.: National Register of Historic Places (unpublished).

Anschuetz, Kurt F.
1979a *An archaeological survey of approximately 400 acres near Cebolleta, N.M. for Nuclear Assurance Corporation.* Office of Contract Archeology, University of New Mexico, Albuquerque, Project No. 185-40.

1979b *An archaeological survey of approximately 640 acres near Ambrosia Lake, N.M. for Pioneer Nuclear, Inc.* Office of Contract Archeology, University of New Mexico, Albuquerque, Project No. 185-43.

Beal, John
1976 *Cultural resource evaluation of two proposed electrical generating stations in McKinley County.* School of American Research, Santa Fe.

1978 *Drill location survey and archaeological site density study in conjunction with the La Ventana Coal project.* School of American Research, Santa Fe.

1979 *Limited archaeological investigations in the area north of Hosta Butte.* School of American Research, Santa Fe.

Beal, John and D. Witter
1974 *Archaeological survey of the Malpais and recreational area.* School of American Research, Santa Fe.

Beck, Warren A. and Ynez D. Haase
1969 *Historical atlas of New Mexico.* University of Oklahoma Press, Norman.

Bennett, W.C.
1948 The Peruvian co-tradition. In A reappraisal of Peruvian archaeology. *Memoirs of the Society for American Archaeology* No. 4.

Betancourt, Julio
1978 *Archaeological survey of a proposed underground telephone cable to the Koppen Mine.* Office of Contract Archeology, University of New Mexico, Albuquerque, Project No. 185-2KK.

Breternitz, David A.
1966 *An appraisal of tree-ring dated pottery in the Southwest.* University of Arizona Press, Tucson.

References Cited (Continued)

Brody, J.J.
1964 *Design analysis of the Rio Grande glaze pottery of Pottery Mound, New Mexico.* Master's thesis, University of New Mexico, Albuquerque.

1979 Personal communication, meeting with HSR staff in Albuquerque, June 1979.

Broilo, Frank
1977 *An archaeological survey of the Anaconda Company's Bluewater Mill tailing pond expansion.* Office of Contract Archeology, University of New Mexico, Albuquerque, Project No. 101-170.

Broster, John B. and Rory Gauthier
1976 *Archaeological clearance survey of Mountain Bell underground cable right-of-way.* Office of Contract Archeology, University of New Mexico, Albuquerque, Project No. 101-103TT.

Bryan, Kirk and Franklin T. McCann
1943 Sand dunes and alluvium near Grants, New Mexico. *American Antiquity* 8(3):281-295.

Bryan, Kirk and Joseph H. Toulouse, Jr.
1943 The San Jose non-ceramic culture and its relation to a puebloan culture in New Mexico. *American Antiquity* 8(3):269-280.

Bureau of Land Management
1979 Draft environmental statement: Grazing report, lower Rio Puerco, Socorro district, Socorro, New Mexico.

Bussey, Stan
1966 The Mesita-Laguna highway salvage project excavations of LA 8679. Museum of New Mexico, *Laboratory of Anthropology Notes* No. 39, Santa Fe.

1974 *A final report on the archaeological survey of a portion of the southwest arm of the National Astronomy Observatory.* New Mexico State University, Las Cruces.

Burns, Bruce
1978 Tentative ceramic chronology for the middle Puerco valley and chronometric analysis. *Archaeological investigation in the area of the middle Puerco River valley, New Mexico: May 1-December 1, 1978.* Progress report to the BLM, Eastern New Mexico University, Portales, pp. 17-70.

Camilli, Eileen
1979 The sampling design and known cultural resource locations. In Preliminary report: Reconnaissance study of the archaeological and related resources of the lower Puerco and Salado drainages, central New Mexico. Human Systems Research, Inc. (unpublished).

Caraveo, Carlos and Randall Schalk
1977 *An archaeological survey of two lineal tracts on Kerr-McGee and BLM lands in the Rio Grande drainage.* Office of Contract Archeology, University of New Mexico, Albuquerque, Project No. 185-2J.

Carroll, Charles H.
1976 *An archaeological survey of ten Anaconda Company proposed exploratory drill sites.* Office of Contract Archeology, University of New Mexico, Albuquerque, Project No. 101-103W.

Carroll, Charles H., et al.
1979 *The Public Service Company of New Mexico: Seboyeta pumped storage archaeological study.* Public Service Company of New Mexico, Albuquerque.

Carroll, Charles H. and Jean Hooton
1977a *An archaeological survey of eight parcels of land within the Anaconda Company's Jackpile Mine, Paguate, N.M.* Office of Contract Archeology, University of New Mexico, Albuquerque, Project No. 101-154.

References Cited (Continued)

Carroll, C.H., J. Hooton and D.E. Stuart
1977b *An archaeological survey of the Anaconda Company's proposed P:15/P:17 Jackpile Mine, N.M.* Office of Contract Archeology, University of New Mexico, Albuquerque, Project No. 101-154.

Carroll, Charles H. and Michael P. Marshall
1979 *Archaeological investigations in the vicinity of Seboyeta, New Mexico.* The Public Service Company of New Mexico.

Cattle, D.J., C.H. Carroll and D.E. Stuart
1977 *An ethnographic and ethnohistorical investigation of eight historic Laguna archaeological sites within the Anaconda Company's P:15/P:17 and Dames & Moore acreages. The Jackpile Mine, Paguate, N.M.* Office of Contract Archeology, University of New Mexico, Albuquerque, Project No. 185-6.

Cleveland, Greg
1978 *An archaeological survey of nine proposed drill sites in the vicinity of Ambrosia Lake.* Office of Contract Archeology, University of New Mexico, Albuquerque, Project No. 185-2QQ.

Cooley, M.E. and J.P. Akers
1961 Ancient erosion cycles of the Little Colorado River, Arizona and New Mexico. In Short papers in the Geological and Hydrological Sciences. *U.S.G.S. Professional Papers* 424C:244-8.

Cordell, Linda S.
1979 Personal communication with HSR field crew at Pottery Mound, August 1979.

Cox, G.W.
1972 *Laboratory manual of general ecology.* W.C. Brown and Co., Dubuque, Iowa.

Danson, E.B.
1957 An archaeological survey of west central New Mexico and east central Arizona. *Papers of the Peabody Museum* XLIV(1).

Davis, Emma Lou and J.H. Winkler
1958 A late Mesa Verde site in the Rio Puerco valley. *El Palacio* 66(3):92-100.

1961 *Mesa Verde National Park survey.* Museum of New Mexico, Laboratory of Anthropology, Santa Fe.

Dawson, Jerry and W.J. Judge
1969 Paleo Indian sites and topography in the middle Rio Grande valley of New Mexico. *Plains Anthropologist* 14:149-163.

Dittert, Alfred D. and R.J. Ruppe, Jr.
1949 The prehistoric population and architecture of the Cebolleta Mesa region, central western New Mexico. Unpublished thesis, University of New Mexico, Albuquerque.

Eddy, Frank W.
1966 Prehistory in the Navajo Reservoir district, northwestern New Mexico. *Museum of New Mexico Papers in Anthropology* 15, Santa Fe.

Emlen, J.T.
1971 Population densities of birds derived from transect counts. *The Auk* 88:323-342.

Findley, J.S., A.H. Harris, D.E. Wilson and C. Jones
1975 *Mammals of New Mexico.* UNM Press, Albuquerque.

Ford, R.I., A.H. Schroeder and S.L. Peckham
1972 Three perspectives on puebloan prehistory. In *New perspectives on the pueblos.* Alfonso Ortiz, editor. School of American Research. UNM Press, Albuquerque.

References Cited (Continued)

Frisbie, Theodore R.
1973 Field report, the Newton site, Hickman, Catron County, New Mexico. *Awanyu* 1(4). Archeological Society of New Mexico.

Gauthier, R. and S. Lent
1978 *An archaeological survey of Conoco's Bernable Road modification and improvement.* Office of Contract Archeology, University of New Mexico, Albuquerque, Project No. 185-18.

Geery, Floyd
1979 *Riley Prospect No. 1.* Cultural Resources Management Division, New Mexico State University, Las Cruces.

Gladwin, H.S.
1945 The Chaco branch, excavations at White Mound and in the Red Mesa valley. *Medallion Papers* XXXIII. Gila Pueblo, Globe, Arizona.

Grigg, P.S., S.L. Fosberg and R.P. Gauthier
1977a *An archaeological survey of the Anaconda Company's Oak Canyon tract in the Jackpile Mine, Paguate, N.M.* Office of Contract Archeology, University of New Mexico, Albuquerque, Project No. 185-2D.

1977b *Tennessee Valley Authority archaeological survey, phase four: Twelve uranium exploration drill holes near Grandma's swimming pool, McKinley County, N.M.* Office of Contract Archeology, University of New Mexico, Albuquerque, Project No. 101-128A.

Grigg, P., J. Stein and D.E. Stuart
1976 *An archaeological survey of six housing sites on the Laguna Indian Reservation.* Office of Contract Archeology, University of New Mexico, Albuquerque, Project No. 101-103Y.

Hammack, Laurens C.
1964 Archaeology of the New Mexico section, the American Telephone and Telegraph communications cable. Museum of New Mexico, *Laboratory of Anthropology Notes* No. 25, Santa Fe.

Hammond, George P. and Agapito Rey
1966 *The rediscovery of New Mexico 1580-1594.* UNM Press, Albuquerque.

Haury, E.W.
1938 Some southwestern pottery types, series IV. *Medallion Papers* XIX, Globe, Arizona.

Hawley, Florence M.
1936 Field manual of prehistoric southwestern pottery types. *University of New Mexico Bulletin* 291.

Hernandez, J.W., W.A. Dick-Peddie and T.O. Boswell
1971 *A socioecological evaluation of the Sevilleta Grant.* New Mexico Environmental Institute, Las Cruces.

Hester, James J.
1963 Navajo migrations and acculturation in the southwest. *Museum of New Mexico Papers in Anthropology* 6. Museum of New Mexico, Santa Fe.

Hibben, Frank C.
1955 Excavations at Pottery Mound. *American Antiquity* 11(2):179-180.

1960 Prehispanic paintings at Pottery Mound. *Archaeology* 13(4):267-274.

1966 A possible pyramidal structure and other Mexican influences at Pottery Mound, N.M. *American Antiquity* 31(4):522-529.

1979 Personal communication with HSR field crew at Pottery Mound, July 1979.

References Cited (Continued)

Hurt, W.P. and D. McKnight
1949 Archaeology of the San Augustin Plains: A preliminary report. *American Anthropologist* 14(3).

Irwin-Williams, Cynthia
1967 Picosa: The elementary southwestern culture. *American Antiquity* 32(4):441-57.

1968 Archaic culture history in the southwestern United States. In Early man in western North America. *Contributions in Anthropology* 1(4). Eastern New Mexico University, Portales.

1972 (Editor) *Prieta Vista: A small Pueblo III ruin in north central New Mexico.* Albuquerque Archaeological Society, Albuquerque.

1977 Archaeological investigations in the area of the middle Puerco River, New Mexico. May 1 to December 31, 1977. Progress report to BLM. Eastern New Mexico University, Portales.

1978 Archaeological investigations in the area of the middle Puerco River valley, New Mexico. May 1 to December 31, 1978. Progress report to BLM. Eastern New Mexico University, Portales.

Jennings, J.D., E.K. Reed, et al.
1956 The American southwest: A problem in cultural isolation. Seminars in archaeology: 1955. *American Antiquity* XXII(2)2:59. The Society for American Archaeology, Salt Lake City.

Judge, W. James
1973 *Paleo Indian occupation of the Central Rio Grande Valley of New Mexico.* University of New Mexico Press, Albuquerque.

Kayser, David W.
1971 Mobile Oil Corporation uranium lease area, Laguna, New Mexico. Museum of New Mexico. *Laboratory of Anthropology Notes* No. 59, Santa Fe.

Kelley, Jane Holden
1966 The archaeology of the Sierra Blanca region of southeastern New Mexico. Unpublished Ph.D. dissertation, Harvard University, Cambridge.

Kerney, T.H. and P.H. Peebles
1964 *Arizona flora.* University of California Press, Berkeley.

Keur, D.L.
1941 Big Bead Mesa: An archaeological study in Navajo acculturation, 1745-1812. *Memoirs of the Society for American Archaeology* 1. Menasha.

Kidder, A.V.
1936 *The pottery of Pecos* II. Yale University Press, New Haven.

Klager, Karol J.
1979 *An archaeological survey of two proposed drill core hole sites on the Puerco and Salado rivers north of Socorro, New Mexico, for the Army Corps of Engineers.* Office of Contract Archeology, University of New Mexico, Albuquerque.

Koczan, Steve
1976 *An archaeological inventory of a five section tract northwest of San Mateo, New Mexico.* Kerr-McGee Project No. 64.15. Museum of New Mexico, Laboratory of Anthropology, Santa Fe.

1978 *A cultural resource inventory of a portion of the Kerr-McGee Roca Hondo uranium claims west of San Mateo, New Mexico.* Project No. 65.41. Museum of New Mexico, Laboratory of Anthropology, Santa Fe.

Lang, Richard W.
n.d. *An archaeological survey of the southern margin of San Mateo Mesa.* School of American Research, Santa Fe.

References Cited (Continued)

Laumbach, Karl W.
1978 Unpublished site forms for Unit 102. Cultural Resources Management Division, New Mexico State University, Las Cruces; for Bureau of Land Management, Socorro.

Lent, Stephen C.
1978 *An archaeological survey of two proposed drill sites in the Cibola National Forest for Frontier Mining.* Office of Contract Archeology, University of New Mexico, Albuquerque, Project No. 185-2S.

Lent, S. and M. Harlan
1978 *An archaeological survey of seven proposed drill sites in the Cibola National Park, Grants, New Mexico.* Office of Contract Archeology, University of New Mexico, Albuquerque.

Maker, H.J., L.W. Hacker and J.U. Anderson
1974 *Soil associations and land classification for irrigation, Valencia County.* New Mexico State University, Agricultural Experiment Station Report No. 267.

Manthey, G.T.
1976 The proposed Ladrone Mountain primitive area: A resource analysis. Western Interstate Commission for Higher Education, Boulder, Colorado.

1977 *A floristic analysis of the Sevilleta National Wildlife Refuge.* Master's thesis, Unviersity of New Mexico, Albuquerque.

Marshall, Michael
(in press) *The Newton site.* Museum of New Mexico, Laboratory of Anthropology, Santa Fe.

Marshall, M., J. Stein, R. Loose and J. Novotny
1979 Anasazi communities of the San Juan Basin. Ms., Public Service Company of New Mexico, Albuquerque.

Mera, H.P.
1931 Cnupadero black-on-white. *Laboratory of Anthropology Technical Series Bulletin* 1, Santa Fe.

1935 Ceramic clues to the prehistory of north central New Mexico. *Laboratory of Anthropology Technical Series Bulletin* 8, Santa Fe.

1940 Population changes in the Rio Grande glaze paint area. Archaeological survey. *Laboratory of Anthropology Technical Series Bulletin* 9, Santa Fe.

Morris, E.H.
1927 The beginnings of pottery making in the San Juan area: Unfired prototypes of the earliest ceramic period. *Anthropological Papers of the American Museum of Natural History* XXVIII, Part II:125-198. New York.

Museum of Northern Arizona
1965 Acoma-Zuni pottery types. The seventh southwestern ceramic seminar notes, September 1965. Research Center, Museum of Northern Arizona, Flagstaff.

1966 Rio Grande glaze types. The eighth southwestern ceramic seminar notes, September 1966. Research Center, Museum of Northern Arizona, Flagstaff.

New Mexico State University
1972 Soil associations and land classification for irrigation, Socorro County. *Agricultural Experiment Station Research Report* 234, Las Cruces.

1974 Soil associations and land classification for irrigation, Valencia County. *Agricultural Experiment Station Research Report* 267, Las Cruces.

Pease, D.S.
1975 *Soil survey of Valencia County, New Mexico, eastern part.* U.S.D.A., S.C.S.

References Cited (Continued)

Peckham, Stewart
1967 Archaeological salvage along Interstate 40 near Laguna Pueblo, New Mexico. Museum of New Mexico, *Laboratory of Anthropology Notes* No. 47, Santa Fe.

1971 Unpublished site forms at the Museum of New Mexico, Laboratory of Anthropology, Santa Fe, N.M.: Bernabe Montoya Land Grant.

1979 Personal communication with HSR staff at Laboratory of Anthropology, Santa Fe.

Peterson, Frederick
1962 Pochteca. In *Ancient Mexico* pp. 172-175. Capricorn Books.

Pielou, E.C.
1974 *Ecological diversity.* Wiley-Interscience Publications, New York.

1975 *Population and community ecology.* Gordon and Breach, New York.

Pippin, Lonnie C.
1978 *The archaeology and paleoecology of Guadalupe Ruin, Sandoval County, New Mexico.* Ph.D. dissertation, Washington State University, Pullman.

Reher, Charles
1975 *Archaeological clearance survey of sixteen Anaconda Corps. proposed exploration well sites.* Office of Contract Archeology, University of New Mexico, Albuquerque, Project No. 101-103J.

Robbins, C.S., B. Bruun, H.S. Zim, and A. Singer
1966 *Birds of North America.* Golden Press, New York.

Roberts, F.H.H.
1929 Shabik'eschee Village, a late Basketmaker site in Chaco Canyon, New Mexico. *Bureau of American Ethnology Bulletin* 92, Washington.

Schaafsma, Curtis F.
1977 *An archaeological survey adjacent to San Mateo Mesa, McKinley County, New Mexico.* School of American Research, Santa Fe.

1978 *A survey in the vicinity of Ambrosia Lake.* School of American Research, Santa Fe.

Schoenwetter, James and Alfred E. Dittert
1968 An ecological interpretation of Anasazi settlement patterns. In *Anthropological Archeology in the Americas* pp. 41-66. The Anthropological Society of Washington.

Sciscenti, James V.
1962 Laguna-Paguate highway salvage excavations on U.S. 50. Museum of New Mexico, *Laboratory of Anthropology Notes* No. 13, Santa Fe.

Scott, N.J., Jr.
1978 *Survey of the vertebrates of the Sierra Ladrones.* National Fish and Wildlife Laboratory, Museum of Southwestern Biology, University of New Mexico, Albuquerque.

Seaman, Tim
1977 *Cultural resource investigation for Exxon, L-Bar Ranch property.* Laboratory of Anthropology, Museum of New Mexico Project No. 66.24, Santa Fe.

Shiner, Joel and W.B. Lark
1954 *The archaeological survey of the Standard Pipe Line Company's products line between El Paso and Albuquerque.* Museum of New Mexico, Laboratory of Anthropology, Santa Fe.

Snow, David
1972 Unpublished laboratory notes in Museum of New Mexico, Santa Fe.

References Cited (Continued)

Stein, John
1975 *An archaeological survey of Anaconda Company drill sites on the Ojo del Espiritu Santo Grant, Sandoval County.* Office of Contract Archeology, University of New Mexico, Albuquerque.

Strong, C.W.
1966 An improved method of obtaining density from line transect data. *Ecology* 47:311-313.

Tainter, Joseph
1979 Personal communication, November 1979.

Tanner, J.T.
1978 *A guide to the study of animal populations.* University of Tennessee Press, Knoxville.

Taylor, Walter W.
1948 *A study of archaeology.* Southern Illinois Press, Carbondale.

Vincent, D.
1973 Sites BLM AR-02-169-1A and 1B, BLM Socorro, New Mexico (unpublished); also BLM sites BLM AR-02-2A and 2B 170 and 171 (unpublished).

Voll, Charles
1961 The glaze paint ceramics of Pottery Mound. Unpublished Master's thesis, University of New Mexico, Albuquerque.

Wagley, Charles
1969 Cultural influences on population: A comparison of two Tupi' tribes. In *Environmental and cultural behavior.* A.P. Vayda, editor. Natural History Press, New York.

Warren, A.H.
1978 The pottery of the Alamito Coal Lease survey, San Juan County, New Mexico.

Wase, C. and R. Schalk
1977 *An archaeological survey of several areal parcels on Kerr-McGee lands and BLM lands.* Office of Contract Archeology, University of New Mexico, Albuquerque, Project No. 185-2K.

Washburn, Dorothy K.
1972 An analysis of the spatial aspects of the site locations of P-I—III sites along the middle Rio Puerco, New Mexico. Unpublished Ph.D. dissertation, Columbia University.

1974 Nearest neighbor analysis of Pueblo I-III settlement patterns along the Rio Puerco of the east, New Mexico. *American Antiquity* 39(2):315-335.

Wendorf, Fred
1954 *The excavation of a small Pueblo III site near Gallup, New Mexico, Highway Salvage No. 1.* Museum of New Mexico, Laboratory of Anthropology, Santa Fe.

1956 The San Juan permian line. Pipeline archaeology for El Paso Natural Gas Co., El Paso, Texas.

Wheat, Joe Ben
1954 Southwestern cultural interrelationships and the question of area co-tradition. *American Anthropologist* 56(4):576-586.

Whitmore, Jane
1977 *An archaeological survey of a portion of Mesa Cocina, Sandoval County, New Mexico.* School of American Research, Santa Fe.

Wilson, John P.
1971 An archaeological survey of the Reserve Oil and Mineral Corp. uranium lease area on the Laguna Indian Reservation, Valencia County. Museum of New Mexico, *Laboratory of Anthropology Notes* No. 61, Santa Fe.

References Cited (Continued)

Wimberly, Mark and Peter L. Eidenbach

1978 Evaluation of archaeological reports submitted to the area archaeologist, Bureau of Indian Affairs, Albuquerque Area Office, 1975 to summer of 1978: Parts I and II. Unpublished report to the BIA. Human Systems Research, Tularosa.

1979 Preliminary report of reconnaissance study of the archaeological and related resources of the lower Puerco and Salado drainages, central New Mexico. Unpublished report submitted to the Army Corps of Engineers, Albuquerque. Human Systems Research, Tularosa.

Wimberly, Mark and Alan Rogers

1977 Archaeological survey in the Three Rivers drainage: Cultural succession, a case study. *The Artifact* 15. El Paso Archeological Society.

Winkler, James J. and Emma Lou Davis

1958 *A late Mesa Verde site in the Rio Puerco Valley.* University of New Mexico Press, Albuquerque.

Wiseman, Regge

1974 *The Malpais reconnaissance: An archaeological inventory and evaluation of some prehistoric sites in the El Malpais planning unit, Socorro District BLM.* Museum of New Mexico, Laboratory of Anthropology, Santa Fe.

1976 *Research design for archaeological excavations at LA 13669, southwestern Sandoval County, New Mexico.* Kerr-McGee Corporation. Museum of New Mexico, Laboratory of Anthropology, Santa Fe.

Wright, Herbert E.

1946 Tertiary and Quaternary geology of the lower Rio Puerco area, New Mexico. *Bulletin of the Geological Society of America* 57:383-456.

Yeo, H.H.

1936 Collection of isolated evidence. Museum of New Mexico, Laboratory of Anthropology, Santa Fe.

1939 Data on isolated evidence. Museum of New Mexico, Laboratory of Anthropology site cards, Santa Fe.

APPENDIX

HSR FIELD FORMS*

1. Sample Quad Form (graph paper on reverse)
2. Site Form (graph paper on reverse)
3. Lithic Analysis Form
4. Ceramic Analysis Form
5. Historic Materials Form

* for details and category definitions, see HSR 1973 *Technical Manual.*

Var.	GENERAL QUAD CHARACTERISTICS		Sample Quad No:
	Elevation (meters) High-Low		
	Slope	%	
	Aspect	deg.	
	Agric. Potential w/in km. diameter: % Total Area	%	
	Soil Type: Great Group		
	Soil Type: Series		
	Distance to Main Drainage Bottom		
	Distance to nearest Surface Water (w/in 5 km)		

	No. of Sites w/in Sample Area (list)	No.
	Site No.	Short Characterization, include Time Est.

HUMAN SYSTEMS RESEARCH
SAMPLE QUAD COVER SHEET

Sample Quad No:

Project No:

Date

Map Reference:

____¼ of ____¼ Sec. ____ T ____ R ____

Dev.	Meters
	Feet

UTM—NE Corner

Aerial Photo Reference:

Ownership: Federal/State/Private

Temporal Horizon Represented:
Paleo Indian / Archaic / Ceramic / Apache / Historic
(circle one or more and comment): No. Sites: _____

Description of Sample Area and Setting:

VEGETATION SPECIES IN ORDER OF DOMINANCE

Var.	GENERAL SITE CHARACTERISTICS		Sample Quad No: Site No:
	Elevation	ft	
	Slope	%	
	Aspect	deg.	
	Cultural Litter Density (x)	/m²	
	Maximum Length, Longest Axis	m	
	Orientation, Longest Axis	deg.	
	Maximum Width, Perpendicular Axis	m	
	Estimated Maximum Area	m²	
	Maximum Deposit Depth	m	
	Soil Type: Great Group		
	Estimated Lithic Density (x)	/m²	
	Estimated Ceramic Density (x)	/m²	
	No. Distinct Hearth Areas	#	
	No. Distinct Surface Structures	#	
	Maximum Structural Height	m	

DENSITY OF CULTURAL MATERIAL / UNIT SAMPLE

Material																		
Ceramic																		
Lithic																		
Ground Stone																		
Burn Rock																		
Metal																		
Plastic																		
Wood																		
Glass																		
Other																		
TOTAL																		

HUMAN SYSTEMS RESEARCH
SITE FORM

Sample Quad No:
Site No:
LA No:

Project No:

Date:

Site Name(s):

Elev. Meters / Feet

Previous Site No:

UTM

State:

County:

__ ¼ ____ ¼ of ____ ¼, Sec. ____, T ____ N/S, R ____ E/W

Ownership: Federal / State / Private

Temporal Horizon:

Description:

Physiography & Biota of Site Setting:

Site Condition — Register Comments:

Map and Aerial Photo No:

LITHIC DATA

Sample Unit Type	Sample Area	Site Area	Quad No: / Site No:

Var.	Artifact Category	Size	Material Code	Total #	Total %
	Unutilized Flake	1			
		2			
		3			
		4			
	Angular Fragment	1			
		2			
		3			
		4			
	Σ All Debitage				
	No. w/Cortex				
	Utilized Flake	1			
		2			
		3			
		4			
	Angular Utilized	1			
		2			
		3			
		4			
	Σ Total				
	No. w/Cortex				
	Retouch or Rejuv. Flake	1			
		2			
		3			
		4			
	Retouch or Rejuv. Flake Utilized	1			
		2			
		3			
		4			
	Total Ret. Flake				
	Core	1			
		2			
		3			
		4			
	Core Chopper	1			
		2			
		3			
		4			
	Core Hammer	1			
		2			
		3			
		4			
	Σ All Cores				
	Total Number of Core Tools				
	Total Number of Cores with Cortex				

Var.	Artifact Category	Size	Material Code	Total
	Retouched Flake Tools	1		
		2		
		3		
		4		
	Total			
	with Cortex			
Facially Chipped Tool	Bifacial	1		
		2		
		3		
		4		
	Total			
	Unifacial	1		
		2		
		3		
		4		
	Total			
	w/Cortex			
	Total Chipped Stone			
	Total Modified Chipped Stone Tools			
	Total Utilized Chipped Stone			
	Percent Utilized			
	Total Unutilized			
	Percent Unutilized			
	Total Chipped Stone with Cortex	%		
	Non-Chipped Stone Hammerstone	1		
		2		
		3		
		4		
	Total Number Non-Chipped Stone Hammers			
	Total Number Chipped and Non-Chipped Hammerstone			

Gr. Stone Material		Total
Metate	Slab	
	Basin	
	Trough	
Mano	1 Hand	
	2 Hand	
Mortar		
Pestle		
Other		
TOTAL GROUND STONE TOOLS WITHIN SITE		

DRAW ARTIFACTS | **Site No:**

NOTES | **Quad No:** **Site No:**

List Artifacts in descriptive terms:

Comments:

DATE: RECORDER:		LEVEL #: FEAT. #:	SAMPLE VOL: M^3

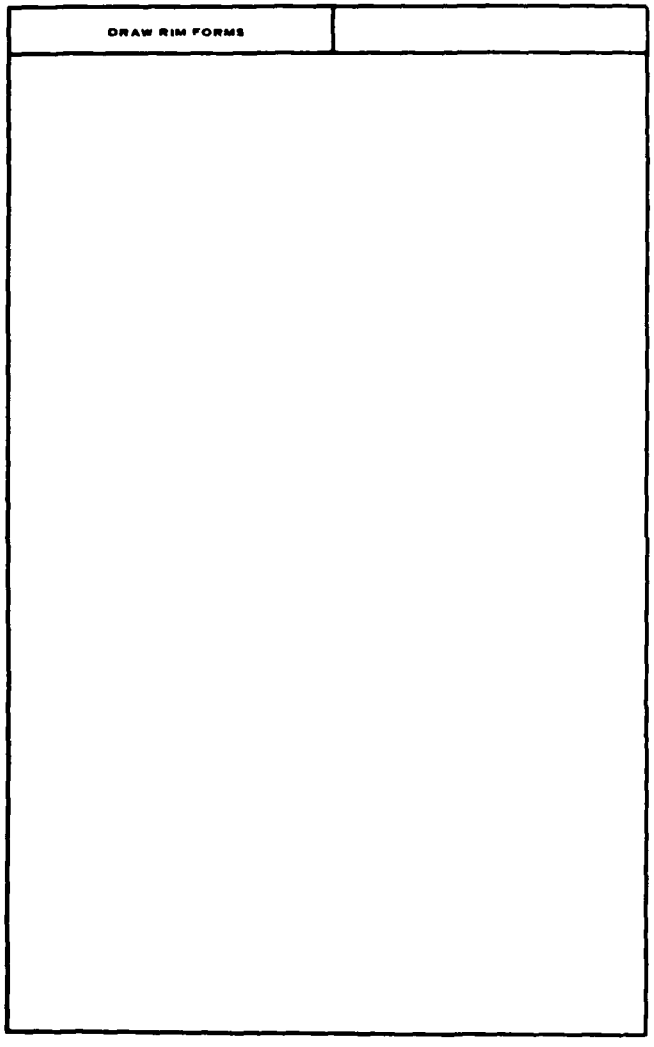
VAR #									

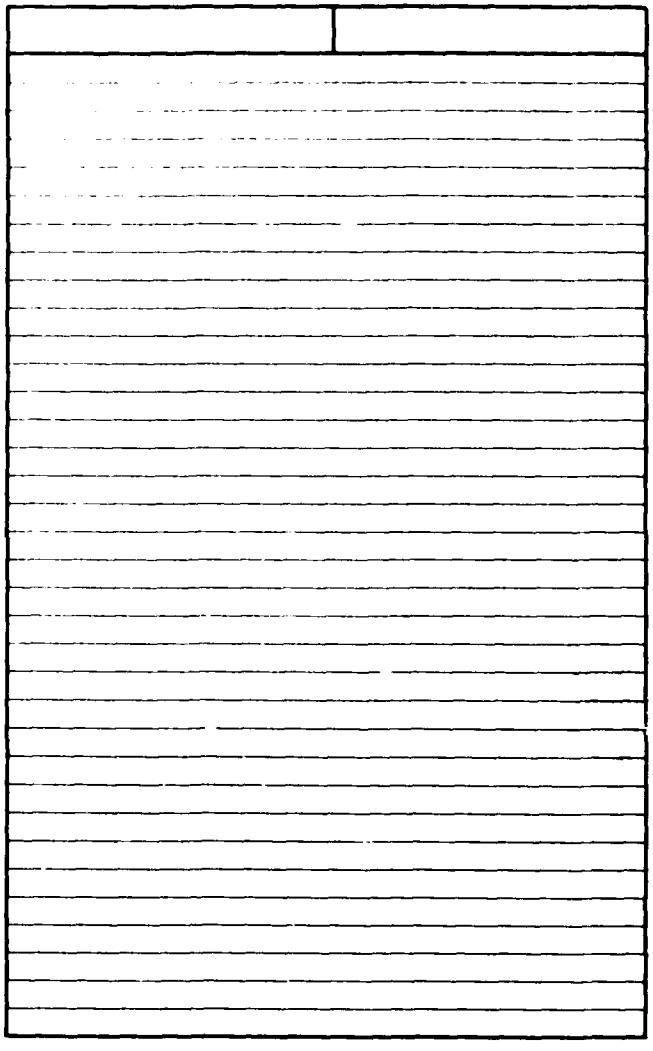
CERAMIC DATA

SITE #: LA-	SAMPLE UNIT TYPE:	PROVENIENCE: N E BELOW MAIN DATUM

VAR #	VARIABLE	# SHERDS	% SAMPLE	# RIMS	# WITH CARBON				
	PREHISTORIC								
	BROWNWARE								
	REDWARE								
	WHITEWARE								
	GLAZEWARE								
	APACHE WARE								
	SPANISH COLONIAL WARE								
	HISTORIC CERAMIC WARE								
	PREHIST. DECOR. SHERDS								
	UNDECORATED SHERDS								
	PAINTED SHERDS								
	TEXTURED SHERDS								
	TEXTURED & PAINTED SHDS.								
	BOWLS								
	JARS								
	UNDETERMINED								
	OTHER								
	TYPES								

DRAW RIM FORMS





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TOTAL																			

GLASS CONTAINERS	B/O	COLOR										TOTAL	LABEL			TOTAL
		AQUA	PURPLE	AMBER	BL	GR	PK	WT	BR	CLEAR			EMBS	PAPER	SILK SCRN	
SHARDS W/O SEAM																
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HISTORIC MATERIALS DATA

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HISTORIC MATERIALS DATA

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WINDOW GLASS

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SODA-LIME								
MODERN								
TOTAL								

ENAMELWARE

TYPE	FUNCTION	REMARKS

CARTRIDGES

CAL.	CF/RF	I.D.	REMARKS

WIRE (Plain and Barb)

TYPE	LENGTH	REMARKS

WOOD	STOCK SIZE	LENGTH	REMARKS
HAND HEWN			
HAND SAWN			
COMMERCIAL SAWN			

OTHER:

CANS

	REUSABLE																							
	LABEL TYPE																							
	BRAND NAME																							
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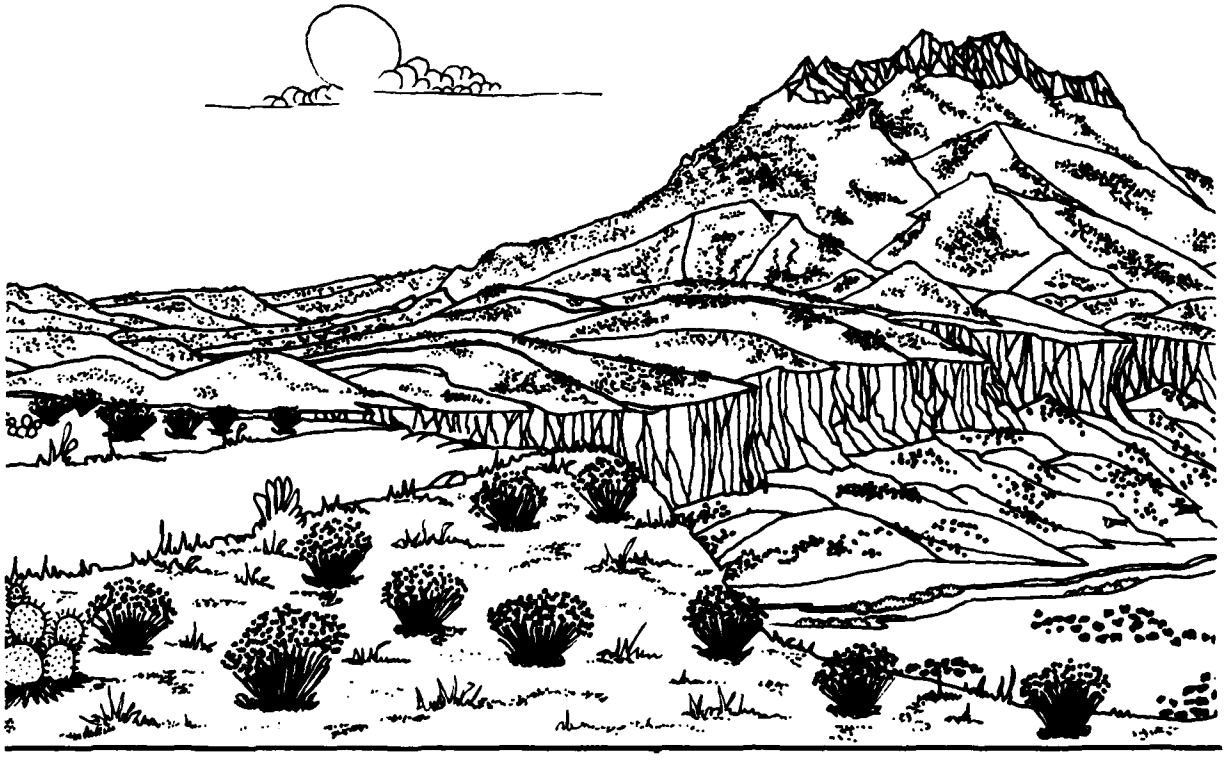
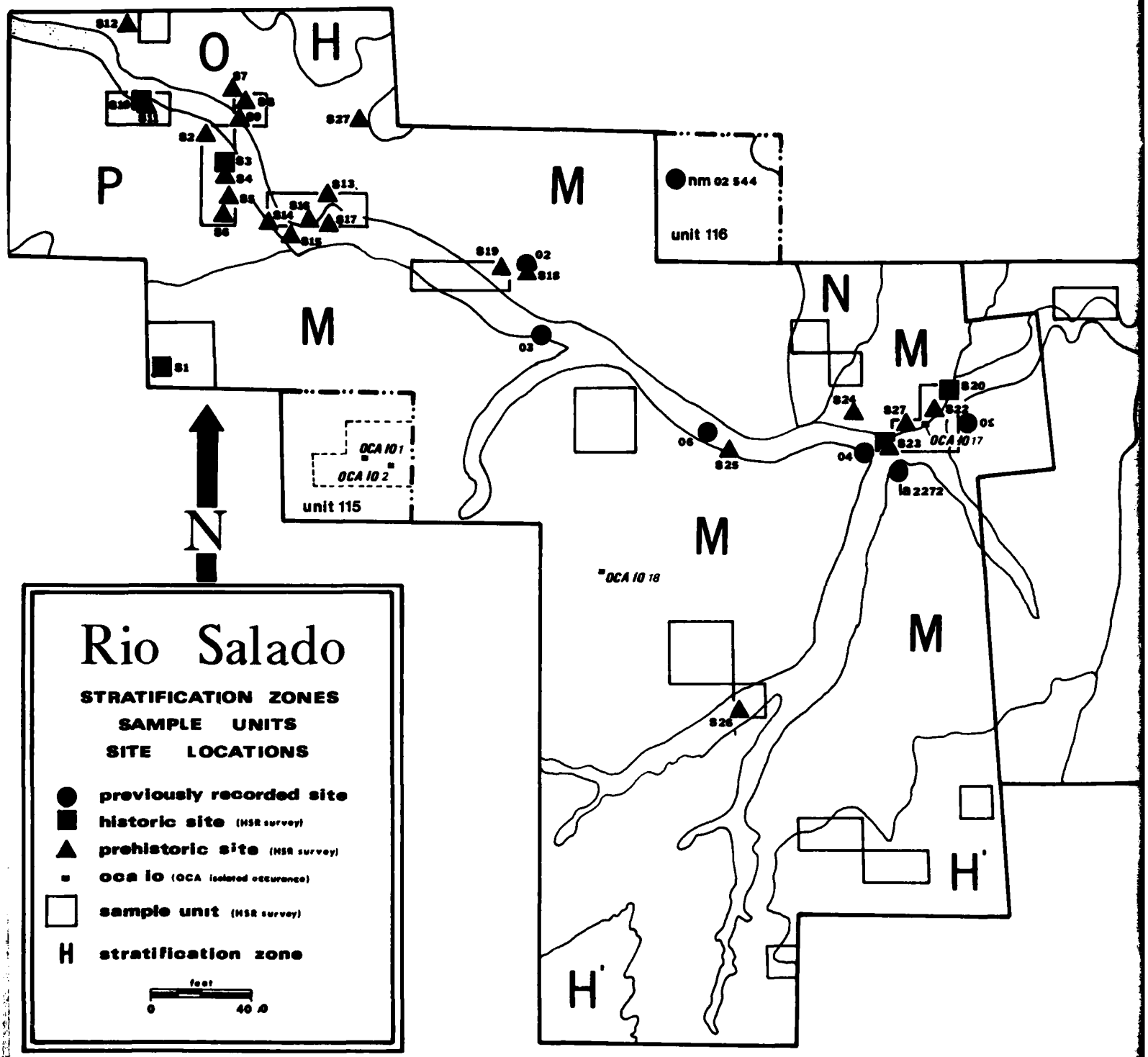


Sierra Ladrones looking north from the Salado.
[E. Shearin]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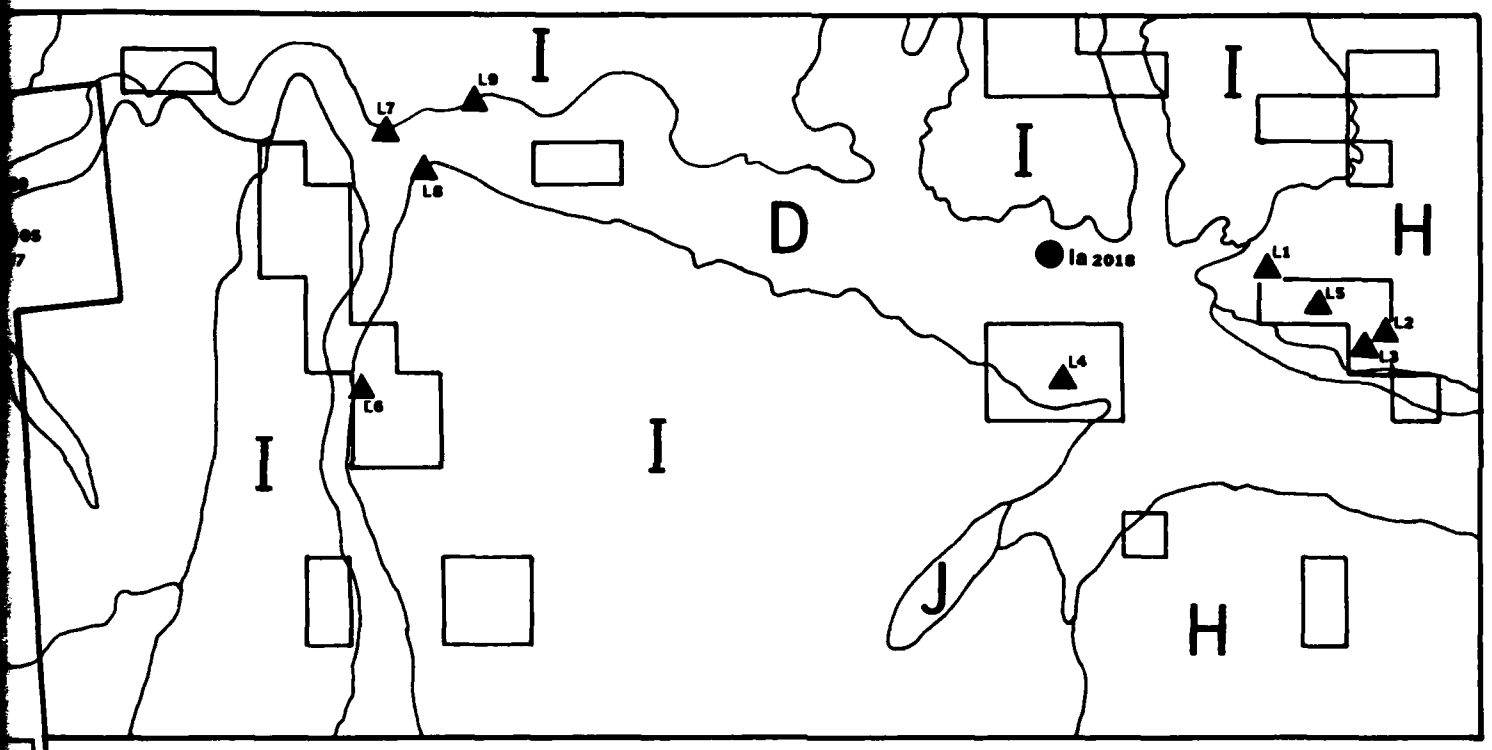
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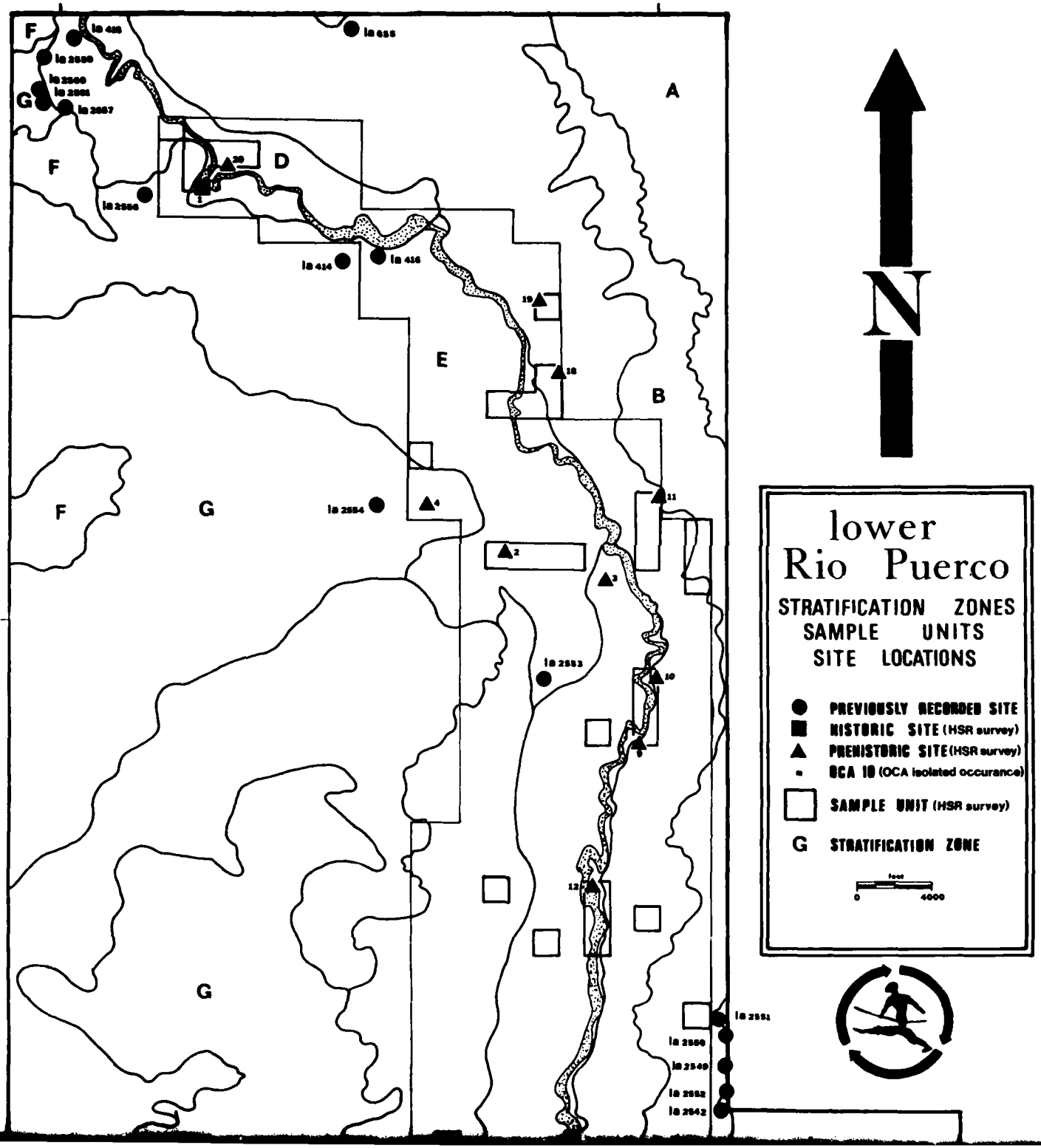
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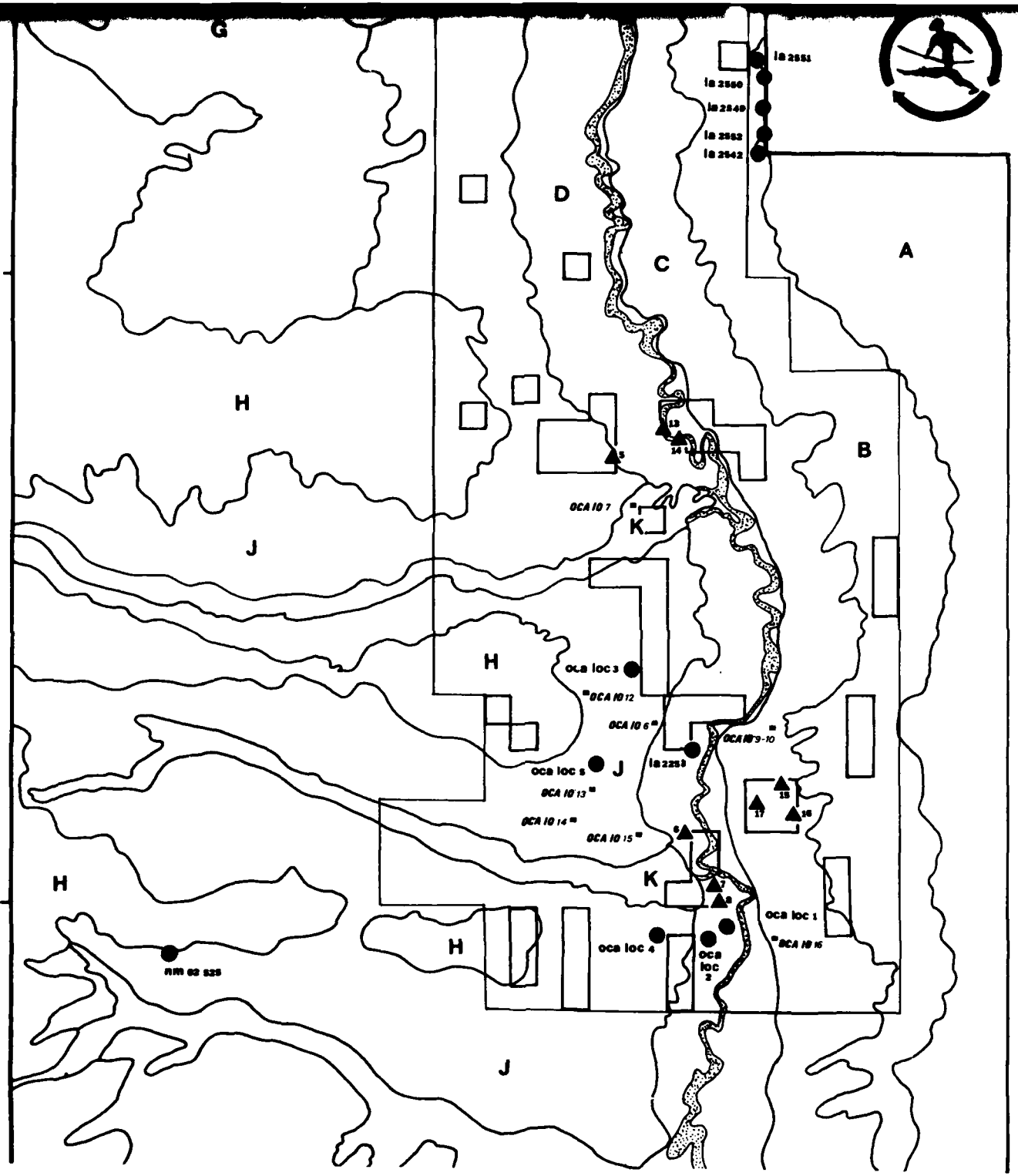
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