Chaco Landscapes: Data, Theory and Management

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CONTENTS

User's Guide

This paper, informally termed the "White Paper," presents current anthropological theory, methods, and research on Chacoan landscapes at several scales. The paper consists of 17 pages of text which summarize anthropological and management issues, supported by 45 pages of Appendices and a list of References cited. A condensed set of "Management Considerations" is presented in Section VIII of the text.

The Chaco Landscape

The Colorado Plateau is a land of long horizons punctuated by dramatic buttes, mesas, and mountain ranges. The rich cultural heritage and natural beauty of this region hold meaning for the millions of tourists who visit each year to experience this iconic landscape. Many of these same places on the Plateau are still considered central to indigenous religious practices, histories, and oral traditions of descendent communities in the region. This landscape is also defined by the complex connections and histories of diverse resident communities. Ancient communities of the Plateau are the focus of ongoing major anthropological investigations into such issues as Neolithic demography and agriculture, emergent sociopolitical complexity, and human impact on the environment. In short, Chacoan archaeology has many stakeholders.

Chaco Canyon is a UNESCO World Heritage Site, important not only for contemporary indigenous peoples and archaeologists but for all of humanity. It preserves a unique aspect of the human experience and draws over 40,000 visitors yearly to witness its grandeur and Native history. The confounding aspect of this cultural chapter is precisely its scope and formal expression across such a vast landscape. It was not until the 1970s that archaeologists fully grasped the extent of the ancient Chacoan roadways and thus the scope of the Chaco world. Forty years later, we are still struggling to understand this spatial and temporal complexity, trying to determine the connections and human experiences of those who built and traversed these roads, great houses, shrines, and kivas.

Chaco was not a single locality, nor was it merely a series of discrete localities or elements; management decisions that reduce this landscape to dots on a map threaten to destroy the most compelling, least-understood, and perhaps most significant aspect of this phenomenon. A century of research has shown that Chaco was comprised of relationships and shared symbols. Our ability to resolve many of the remaining research issues outlined above depends upon the protection of this landscape in a way that honors both what is known and what we still have to learn.

The goal of this paper is to provide an academic overview regarding the Chaco landscape: what it is, what we know about it, how we know what we know, and what we still have to learn. The purpose is to provide a comprehensive tool that can be used for management purposes. The text provides a summary road map while appendices to this document contain supporting information and broader discussions. The paper is divided into 7 sections: (1) introduction to Chaco in time and space; (2) management history and considerations; (3) landscape theory; (4) defining the Chaco landscape, part one – the material elements; (5) research issues; (6) defining the Chaco landscape, part two – the experiential elements; and (7); concluding arguments. In the main body of this paper we lay out our primary points; supporting data and additional discussion for each section is found in corresponding appendices.

I. Introduction: Chaco in Time & Space

Chaco Canyon, in the center of the San Juan Basin in northwest New Mexico, is well-known as the location of one of the most complex sociopolitical phenomena in the ancient American Southwest. Chaco chronology is divided into Early Bonito (AD 850-1040), Classic Bonito (AD 1040-1090) and Late Bonito (AD 1090-1140) phases (Lekson 2006:7). During its heyday between AD 1000-1140, builders erected monumental architecture in Chaco Canyon in the form of great houses, great kivas (large, circular communal and religious structure), and associated features (Lekson 1986; Lekson ed. 2006; Lekson ed. 2007; Vivian 1990).

At the heart of Chaco Canyon lie two dozen great houses. Pueblo Bonito is one of the earliest and best-known of these (Judd 1964; Neitzel 2003; Windes and Ford 1992, 1996). Chaco great houses are characterized by a set of unique attributes termed Bonito-style architecture: core-and-veneer sandstone masonry, planned layouts, large rooms, multiple stories, and enclosed kivas (Gladwin 1945; Vivian 1990:270-286). Chacoans crafted these buildings at an exaggerated scale, with formal symmetry, according to specific designs (Fritz 1978; Marshall 1997; Sofaer 1997; Stein and Lekson 1992). The monumental buildings coexist with small, domestic pueblos that form clusters of low mounds predominately along the south side of Chaco Canyon. Over time, the landscape of Chaco Canyon became increasingly formalized with the construction of shrines, staircases, mounds, ramps, and road segments (Hayes and Windes 1975; Kincaid 1983; Vivian 1997a, 1997b; Wills 2001; Windes 1978).

Chaco Canyon was a focal point for people in settlements across the San Juan Basin (see for example Cameron and Toll 2001; Judge 1989; Kantner 1996; Lekson 1999, 2009; Lekson ed. 2006; Renfrew 2001; Sebastian 1992). We know this because we find numerous aspects of the architectural and artefactual canon formalized in Chaco Canyon replicated by communities scattered across the San Juan Basin – indeed, from Grand Gulch in southeastern Utah to the hills north of Magdalena, New Mexico, a span of 280 miles. The entire area of the region has been estimated between 30,000 to 60,000 square miles (about the size of Alabama). These characteristics (discussed in greater detail in Sections 4 and 6) defined the broader Chacoan world. Chaco Canyon was surrounded by approximately 230 "outlier" settlements found across northwest New Mexico and adjacent areas (Fowler et al. 1987; Kantner 2003; Kantner and Mahoney 2000; Marshall et al. 1979; Marshall and Sofaer 1988; Powers et al. 1983).

The term "outlier" requires clarification. Apparently it originally referred to outlying, detached units of (then) Chaco Canyon National Monument: Kin Ya'a, Kin Bineola, and Pueblo Pintado. The outlying unit of Kin Ya'a is almost 30 miles south of the present park. Other outlying units were much closer: Kin Bineola is less than 5 miles from the park boundary. From a quasi-administrative term, "outlier" later came to signify any great houses outside the monument and later park boundaries. The Bis sa'ani "outlier" on Escavada Wash (the drainage immediately north of Chaco) is less than 5 miles from Chaco Canyon. Outlier great houses in southeastern Utah are over 150 miles away from Chaco. While some archaeologists prefer to call these sites "great houses" rather than "outliers," we use both terms. "Great house" has been discussed above. We also use "outlier," for two reasons: First, "great house" has been applied to Pueblo III and IV sites, long after Chaco's peak; and second, "outlier" connects the site and its landscape to Chaco Canyon, and aids in understanding landscapes at the largest scale.

The Chaco-era great house is a well-established and readily recognized empirical pattern. The number of great houses, however, is a moving target. An early (remarkably comprehensive) listing by Andrew Fowler and John Stein (1992) included just under 275 "great houses." A significant number of those sites, however, were late Pueblo III and Pueblo IV in time, and probably not relevant to the Pueblo II-early Pueblo III Chacoan landscape. Moreover, new Chaco era outlier great houses have been and continue to be discovered; for example, three in the last several years in southeastern Utah. At present, our GIS data bases list about 230 relevant Chaco-era outlier great houses. This database can be considered reasonably definitive for *known* great houses. However, we are confident that more will be discovered, in the less-thoroughly researched areas of the Chaco region (for example, the southern third of the region).

In the end, the term "outlier" is most useful for relating distant sites (such as Far View House at Mesa Verde) to the center of the greater Chacoan landscape at Chaco Canyon. Several schemes have been suggested for sites at various distances from the canyon. For example, "downtown" Chaco is the core area around Pueblo Bonito, Chetro Ketl and Pueblo Alto. The "Chaco Halo" recognizes a high density of sites (and great houses) immediately surrounding the canyon; for example those on Escavada Wash. The "San Juan Basin" is a geologic term used (and modified) by archaeology for the area between the Chuska Mountains on the west, the Nacimiento Moutains on the east, Mount Tayor-Lobo Mesa on the south, and the San Juan River valley and its tributaries on the north. But outlier great houses are found far beyond that area, up to 150 miles away to the north and south. Lekson (2009) has suggested three zones or distance limits: the central "downtown Chaco;" an "inner circle" up to 150 km from downtown Chaco (the distance within which a bulk good economy could theoretically operate, and roughly congruent with the San Juan Basin as defined above) and an "outer periphery" or limit at about 250 km (empirically, the outermost great house sites).

Some of these "outlier" settlements were founded in the Classic Bonito phase, but others have occupations extending back into the 800s (e.g., Doyel et al. 1984; Van Dyke 2000; Windes 2015). Most outlier great houses were a central focus for a surrounding community of small sites or hamlets. Some outliers clearly represent Chacoan colonies (e.g., Reed 2008; Todd and Lekson 2011), while others are argued to be local developments whose inhabitants emulated Chaco (e.g., Hurst 2000; Van Dyke 1999a). Inhabitants may have made periodic trips to Chaco Canyon, contributed resources and labor to large-scale events, participated in religious ceremonies, and defined themselves as members of the Chacoan rituality. Various lines of material culture evidence (discussed below) continue to help archaeologists better understand the complex relationships that existed within and between specific Chacoan communities.

A number of models have been developed to explain the rather dramatic and geographically expansive appearance of Bonito style architecture across an arid, agriculturally marginal landscape during the Pueblo II period **(Appendix I)**. Early explanations focused on the canyon. More recent work has recognized that relationships between Chaco Canyon and outlying great house communities (outliers) must have been an important part of the *raison d'être* of Bonito style architecture in both areas. How and why were great houses built in outlier communities? What does the appearance of great house architecture tell us about the nature and meaning of this broader Chaco phenomenon? Our ability to unravel this complex chapter of human history thus hinges on the long-term protection of these cultural resources, and the continuing yet constructive non-destructive research.

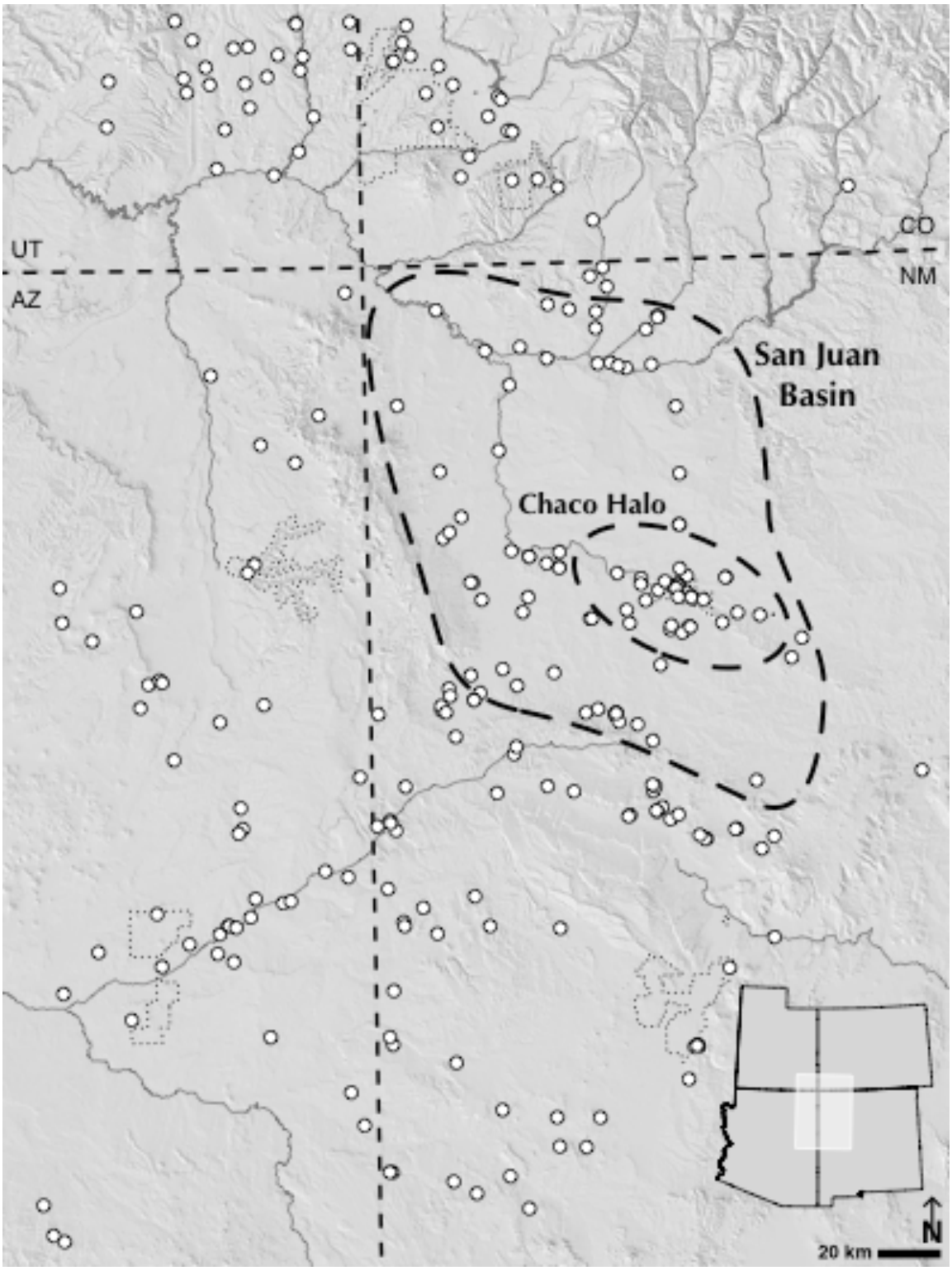

Figure I.1. The Greater Chacoan Landscape. This 60,000 sq mi area includes the core "Chaco Halo," the San Juan Basin, and outliers beyond the Basin. White circles are great houses; dashed areas are National Parks and Monuments. Figure drafted by Kyle Bocinsky.

II. Management History

On March 11, 1907 Chaco Canyon was named a National Monument, with several "outlier" units including Pueblo Pintado, Kin Bineola, and Kin Ya'a. Chaco Culture National Historical Park was created in December 19, 1980 (PL 96-550 Title V). This legislation also included "Thirty three outlying sites … hereby designated 'Chaco Culture Archaeological Protection Sites'" (Sec 502b), recognizing "…the potential for conflicts between resource preservation and energy development" (JMP 1983:1). (Pueblo Pintado, Kin Bineola and Kin Ya'a were already protected as part of the national park and therefore were not included as Protection Sites.) The Protection Sites are jointly administered under a Joint Management Plan (hereafter, JMP) by Federal and State agencies and the Navajo Nation (JMP 1983, amended 1990). On December 8, 1987 Chaco was accepted and inscribed on UNESCO's World Heritage List. The World Heritage listing acknowledged the geographic scale of ancient Chacoan society by including a number of Protection Sites: Aztec Ruins, Kin Bineola, Kin Ya'a, Pueblo Pintado, Casamero, Kin Nizhoni, Pierre's, Twin Angels, and Halfway House (the latter three related to the ancient "North Road"). Both the JMP and the World Heritage listing noted the potential for future conflicts between energy development and site protection. See **Appendix II**.

For 40 years, the NPS and other agencies, Tribes, and industry have attempted to address potential conflicts between energy development and the expanding understanding of the Chaco world and landscape, in and beyond the energy-rich San Juan Basin. Indeed, one of the first comprehensive "outlier" surveys was sponsored by the Public Service Company of New Mexico in cooperation with the New Mexico Historic Preservation Division (Marshall, Stein, Loose and Novotny 1979), to identify outlier great houses for future management of energy development. Another early extensive "outlier" survey was sponsored by the National Park Service (Powers, Gillespie and Lekson 1983). One of the few comprehensive excavations of an "outlier" in modern times was at Bis sa'ani, in advance of a coal mine that was never developed (Breternitz, Doyel, and Marshall 1982). In the following decades, numerous studies in the San Juan Basin have addressed the impacts of energy development on Chacoan archaeology, but never on the scale of the landscape studies of the 1980s. Given (1) the significant growth of knowledge about the Chaco world since the 1980s, (2) the increasing sophistication in both archaeology and historic preservation regarding landscapes, and (3) the renewed interest in energy development in the Chaco region, a new management philosophies seems warranted.

III. Landscape: Theoretical Background

Over the past two decades, landscape has emerged as a unifying concept for the archaeological study of place and social reality (e.g., Ashmore and Knapp 1999). Prior to 1980 (when Chaco was made a National Park) the term was seldom used in American archaeology. Indeed, Chaco and its region was one of the first places southwestern archaeology seriously considered landscape (Stein and Lekson 1992); and since that time, southwestern archaeology has lead the field in developing new methods and concepts, which now form a recognized "southwestern school" of landscape studies (Fowles 2010). We now have a broad range of concepts, theories, methods and tools which were unavailable in 1980s and 1990s. Many current areas of archaeological and anthropological interest, including identity, ethnicity, ritual, power, and ideology intersect at the nexus of landscape. In the Southwest U.S., the term *landscape* is invoked by archaeologists straddling a wide range of epistemological positions. Some equate landscape with settlement patterns, examining the changing and variable distributions of people and resources across space. GIS analyses have figured prominently for these researchers. Some

anthropologists explore "cultural landscapes," investigating the links – which may involve oral traditions and traditional cultural properties (TCPs) as well as archaeology – that connect indigenous groups with specific places. Still others view spatial experiences as reflexively constructed over time, and landscape as a window through which to investigate less tangible aspects of ancient life such as meaning and ideology. This latter group uses interpretive methods such as phenomenology. While each of these approaches has different roots, they can be, and are, employed in a complementary fashion on the Colorado Plateau. **Appendix III** unpacks each of these three bodies of theory; see also **Appendix V**. We contend that this larger body of landscape theory should continue to drive large-scale research programs in order to significantly advance our understanding of the greater Chacoan world. The benefit of this approach will provide management strategies that can address long-term management and preservation goals that are important to the many stakeholders who live in and visit the Chaco world heritage sites and cultural and physical landscape.

IV. Defining the Chaco Landscape: Part I – Material Expressions

Archaeologists have long recognized that Chaco reaches well beyond the confines of Chaco Canyon (Gladwin 1945; Martin 1936; Morris 1939; Roberts 1932). Canyon great houses provide the archetype through which outlier great houses have been identified. Until the 1970s, these "outliers" were investigated in a piecemeal fashion. Oil and gas developments in the 1970s and 80s led to the first major attempts to locate and record outliers and associated features across the Chaco World (Marshall et al. 1979). During this period, the Chaco Project and the BLM sponsored large-scale, landscape-level investigations (Fowler et al. 1987; Kincaid 1983; Nials et al. 1987; Powers et al. 1983). The application of large-scale pedestrian surveys and aerial reconnaissance in the 1970s revealed the existence of ancient roads associated with Chacoan structures. At least eight road segments, three of them major, extend into the San Juan Basin from Chaco Canyon. More recent uses of aerial thermography, Unmanned Aerial Vehicles (UAVs), Light Detection and Ranging (LiDAR) and other geophysical methods continue to reveal additional sites and features but have, as yet, only been applied to relatively small areas of the Chaco landscape. Marshall and Sofaer (1988) continued to investigate outliers with a focus on road-related features, shrines, and archaeoastronomy. In 1983-84, Powers directed a full-coverage survey of new lands around Kin Bineola, Kin Klizhin, Chacra Mesa, Upper Kin Klizhin, and the South Addition (Powers and Van Dyke 2015). Most of the information compiled by these authors is located in government documents or grey literature (exceptions include Doyel 1992; Kantner and Mahoney 2000, Chaco Project survey data, and Additional Lands survey data). Kantner (2003; Kantner and Kintigh 2006) collated a "Chaco World" database of known outliers for the Chaco Synthesis (Lekson ed. 2006). These data are available through the Chaco Research Archive (chacoarchive.org). In recent years, the Chaco World database has been updated and expanded by Van Dyke et al. (2016) and Matt Peeples, working with Archaeology Southwest. Efforts are currently underway as part of the current Chaco Landscapes project to reconcile the three disparate geospatial datasets and share those data with land managers and researchers. The process of reconciling these three data sources has also brought to light some of the major gaps in our knowledge about many of these great house communities. Our understanding has evolved dramatically in recent decades—bringing to light new dimensions of the Chaco landscape and locations for further study. Features and attributes of the greater Chaco landscape have been catalogued in different ways by researchers. A short list of material signatures found on the Chaco landscape includes the following: (1) monumental architecture

(great houses, great kivas); (2) roads and related features (staircases, earthworks); (3) outlier communities; (4) patterned distributions of surface artifacts corresponding to landscape features; (5) shrines and related features (stone circles, crescents, cairns); and (6) rock art.

Despite the obvious importance of Chaco outliers to our understanding of the system as a whole (see **Part V**), only about one-eighth of a total of a documented 230 outliers has been the focus of extended fieldwork in the form of survey or excavation projects (see for example Cameron 2009; Duff 2005; authors in Kantner and Mahoney 2000; Kearns 1996; Martin 1936; Morris 1918,1928; Reed 2008; Todd and Lekson 2010; Van Dyke 1999a; Warburton and Graves 1992) **Appendix IVA**). Research at outliers in the post-NAGPRA era has tended to minimize excavation in deference to Indigenous concerns. Much can be learned from non-destructive investigations into architecture and artifacts on the ground surface using some of the techniques mentioned above (LiDAR, aerial thermography, etc). The tremendous promise of these techniques (e.g., Casana et al. 2014) has yet to be realized. The sheer scale of the undertaking, with over two hundred outliers scattered across tribal, state, federal, and private lands, means that we still have very far to go.

For many outliers, Bonito-style architecture of the great house itself is well-described, but information for surrounding small sites is incomplete or nonexistent. Research to date has demonstrated the tremendous variability in how these communities were laid out. In **Appendix IVB**, we demonstrate this variability through the following examples: Peach Springs (a textbook outlier); Skunk Springs (a sprawling community with a deep history); Andrews & Casamero (ancestral and scion communities); Escalon (Bonito-style architecture without a community); and Section 8 (a "black box"). The tendency for land managers to delimit a one-size-fits-all expedient circular boundary around known great house locations cannot and will not adequately identify or protect these landscapes, because Chaco outliers are highly variable in form and extent (e.g., Van Dyke 1999b, 2003). Detailed, comparative studies of outlier communities are imperative to allow us to address the research issues delineated in Appendix V, as outliers are found in microenvironments ranging from the Red Mesa Valley and the Chuskan slopes to the Middle San Juan drainage and the Basin floor.

Chaco roads are often difficult to identify. These engineered linear features are best visible from the air when light angles are low; researchers have recently had much success tracking Chaco roads with LiDAR (Friedman n.d.). At least eight major road segments extend outward from Chaco Canyon (Vivian 1997b, and many additional short segments are known (Roney 1992). See **Appendix IVC** for more information.

Shrines exist in a wide range of forms and purposes across the Southwest landscape. Chaco scholars have described the following shrines or shrine-like features: J or box-shaped "communication" shrines (Hayes and Windes 1975); stone crescents (Marshall and Sofaer 1988); stone circles (Windes 1978); herraduras, or horseshoe-shaped features associated with Chacoan roads (Kincaid 1983; Nials et al. 1987); and cairns, or simple piles of stacked rock. We provide further descriptions in **Appendix IVD**; see also **Appendix VA (Visibility).**

Chacoan rock art is relevant for addressing the research questions detailed below in **Part V**. Some Pueblo oral traditions, for example, consider spirals to represent migrations. Chacoan rock art remains infamously under-recorded and understudied, despite the high-profile example of the Sun Dagger atop Fajada Butte (Sinclair et al. 1987; Sofaer and Sinclair 1987; Sofaer 1997, 2007; Sofaer et al. 1979, 1982). The most intensive efforts towards remedying this situation have been conducted in Chaco Canyon by Jane Kolber and a team of volunteers; Kolber, Kelly Hayes-Gilpin and Donna Yoder have plans to eventually publish a synthetic description of this

research. Outside Chaco Canyon, across the Basin landscape, rock art is likely to be under-reported. This is illustrated by the fact that in the Chaco Additions comprehensive survey of Kin Bineola, Kin Klizhin, and parts of Chacra Mesa, Powers and Van Dyke (2015) tallied 76 discrete rock art elements. Comprehensive and systemic work is needed, in conjunction with indigenous collaborators, to record and interpret the rock art on the greater Chaco landscape.

V. Anthropological Research Issues on the Chacoan Landscape

Chaco has been an active area of research for archaeologists and anthropologists for over a century because its archaeology and dynamic cultural history offers a fascinating and perplexing case study which intersects with a host of current research issues – issues of local, national and international significance. The purpose of this section is to briefly review the major anthropological research issues around Chaco and highlight the ways in which the greater Chaco landscape is crucial to our ability to address them.

A. Chaco's Boundaries in Time and Space

Archaeologists agree that Chaco was centered in the canyon during the "golden century" between AD 1040-1140, but we are much less clear about how Chaco came into being, how it declined, and how and where these processes connect with the larger narratives about the ancient Southwest. Chaco's origins lie in the preceding Pueblo I period (A.D. 700-850) on the Colorado Plateau, but events are not neatly bounded by the Chaco Culture NHP, or by the San Juan Basin. Windes (2015; Windes and Van Dyke 2012); Wilshusen (Wilshusen and Van Dyke 2006) and Van Dyke (2007, 2008) have posited that late Pueblo I inhabitants from the northern San Juan moved south to establish early great house communities during the late A.D. 800s; however, these processes are understudied and remain poorly understood. Many of the relevant outlier communities are on Navajo Nation lands between Chaco Canyon and the Chuska Mountains; they form part of a planned study by Van Dyke and Navajo Nation archaeologists. Vivian (1989,1990) and Throgmorton (2012) have posited that southern San Juan peoples also played a role in established ninth century Chaco – again, studies are ongoing and incomplete. The Pueblo I communities across the northern and southern San Juan Basin thus should reasonably be included in any conception of Chaco landscape

By the mid-late eleventh century, formal outliers appeared across northwest New Mexico as well as portions of northeast Arizona, southeast Utah, and southwest Colorado. Chaco seems to have been expanding (see discussion of sociopolitical issues below). The nature of the relationships between these various outlier communities and Chaco Canyon is a topic of ongoing research (see for example Cameron 2009; Kantner and Mahoney 2000; Lekson 1999; Reed 2008; Todd and Lekson 2010; Van Dyke 1999a, 1999b, 2003). This research is focused on scales that range from (1) the classic "outlier" communities themselves, which vary but form a recognizable pattern(s); (2) larger-than-community designed landscapes; (3) sub-regions, such as the Chuska Valley or the Totah; and (4) the entire Chaco world as represented by outliers and potential outliers extending from southern Colorado to southern New Mexico, central New Mexico to central Arizona. Outliers are bound to one another and to Chaco Canyon not just by architectural similarities but also by landscape features such as roads (Kincaid 1983; Nials et al. 1987), lines of sight (Freeman et al. 2007; Hayes and Windes 1975) and viewsheds (Van Dyke et al. 2016). With clear landscape references and physical connections to each other and ultimately to Chaco Canyon, it is parsimonious to posit that Classic and Late Bonito Chaco "diffused" from center.

The nature of that diffusion is a key question for the history and heritage of ancient North America. To a large extent answers to that question will be found in the Chaco landscape.

Boundaries of the Chaco region appear to shift or change at the later end of its history. To the south, Bonito style elements such as enclosed kivas, core-and-veneer masonry, multiple stories, planned layouts, and associated great kivas proliferate at major settlements that extend through the Cibola area during the 13th century and beyond (e.g., Duff 2005; Fowler et al. 1987; Fowler and Stein 1992; Reed 2013; Roberts 1932). To the west, Chaco may have contributed to events at Wupatki and Ridge Ruin (Gruner 2012). To the north, Chaco clearly gave rise to Aztec Ruins National Monument (Lekson 1999; Reed 2008) and influenced architectural and social developments for generations (Bradley 1996; Glowacki 2015; Van Dyke 2009). Lekson (1999) posits that Chaco ultimately stretched south along the Chaco Meridian as far as Paquime in northern Mexico. It should be clear from this brief overview that the boundaries of Chaco in time and space are not only far from settled, but are part and parcel of the larger sets of ongoing research issues detailed below. The Chaco landscape should at minimum encompass all sites in the San Juan Basin that date between AD 850-1150 – the Early, Classic, and Late Bonito phases. Failure to protect this landscape will forfeit our ability to understand what Chaco was.

Chaco and its landscape are inherently important, as part of Native, national and world heritage. But beyond the intrinsic historical significance, Chaco can be used to address wider issues of general interest (Lekson in prep.). Chaco offers a remarkably detailed record of a non-Western, pre-industrial society responding to environmental challenges, and to local and regional imbalances between populations and resources (e.g. famously and controversially, in Jared Diamond's 2005 *Collapse*; see also Stewart 2000). Chaco provides a case study in the need – real or perceived – for some degree of central governance (that is, the invention or avoidance of government; the origins and consequences of aggregation into towns and cities; and the interaction of a periphery or frontier societies with larger, older, more developed core civilizations (that is, Chaco and Mesoamerica) and the role of ideology and ritual in social change. Broad questions such as these can only be answered with landscape-scale data, ranging from the core "downtown" to the ecologically "contained" San Juan Basin to the largest expressions of Chaco. Chaco is truly an example of how archaeological heritage can help the human species understand our past to better plan for our future.

B. Sociopolitical Organization / Complexity

The question of Chaco's boundaries is inextricably bound up with the more fundamental anthropological issue of what Chaco actually was, in a social and political sense, and how this entity changed over time. Chaco holds fascination for anthropologists across the globe – and of course scholars in other disciplines, not to mention a large and deeply engaged public – because it seems to occupy a unique, or at least an unusual, place in our greater understanding of human sociopolitical organization. The Chacoan landscape is integral to this issue and yet much landscape-level work remains to be done.

Chaco was not an isolated canyon or small population of isolated, though major villages, scattered across the San Juan basin. It was a major regional political "event," a complex interaction and landscape phenomenon for over 300 years. But what was the nature of that event?

A key debate surrounds the nature and degree of Chacoan sociopolitical complexity. Scholars see great houses as part of the establishment and legitimation of political authority (Lekson 1999; Sebastian 1992; Van Dyke 2007; Wilcox 1993), places of worship, interaction, and education

(Judge 1989; Renfrew 2001; Toll 1984, 1985), with similarities to modern Pueblo villages (Heitman 2011, 2015; Vivian 1990; Wills 2012). Scholars agree that planned, massive Bonito style structures required a substantial investment of labor and design. But opinions differ as to whether or not there were institutionalized leaders in Chaco Canyon, what the nature of those leaders' power may have been, and to what extent those leaders controlled other people across the Chacoan world. The Chaco landscape is central to these debates.

Judge (1979, 1989; Judge et al. 1981) and other Chaco Center archaeologists (e.g., Powers 1984; Powers et al. 1983; Schelberg 1984) originally considered the canyon as the center of a redistribution network for subsistence goods; the system protected members in the system against crop shortfalls caused by rainfall fluctuations. Judge (1989) later modified this model to envision a "pilgrimage fair" at Chaco, in which materials were redistributed congruent with gatherings for ceremonial activities. Most proponents of the Chaco Center model envisioned outliers were linked to the canyon in a relationship that was primarily economic. Scholars expected critical resources such as corn, construction timbers, lithic material, turquoise, pottery, firewood, and wild game to move throughout the system. Thus, it became critical to identify sources for these materials and to be able to follow them across the landscape, into Chaco Canyon, and potentially back out after redistribution. These studies have been able to disprove the redistribution model, but it is clear that many goods moved into Chaco Canyon and that relationships with outliers were variable and complex (More on this under exchange and interaction, below).

Many current explanations for Chaco revolve around the idea of the canyon as a central place for ritual gatherings, with leaders' power legitimated through exclusive access to ritual knowledge (Judge 1989; Kantner 1996; Saitta 1997; Sebastian 1992; Toll 1985; Wills 2000; Yoffee 2001**)**, perhaps stemming from their antecedent, ancestral connections to the canyon itself (Heitman 2007; Plog and Heitman 2010). The Chacoan landscape, with its formally constructed, carefully situated architectural features, is charged with symbolism (Fritz 1978; Heitman 2011, 2015; Marshall 1997; Stein and Lekson 1992). Van Dyke (2007) posits that the carefully constructed, formalized Chacoan or Bonito style landscape, consisting of great houses, great kivas, berms, road segments, and visual connections, are key to understanding Chacoan politics. Outlier residents came to Chaco to participate in ceremonies, and their physical experiences in Chaco emphasized the canyon as the center of the world – the correct and balanced place in which to perform rituals – thus legitimizing social and political power of canyon ritual leaders. By understanding the nature and distribution of the Bonito style landscape elements in outlier communities, we can start to see which communities or subregions were closely involved with Chaco, and which were perhaps more loosely confederated. Outlier architecture looms large in the background of all these questions – were the great houses, great kivas, roads and earthworks all stages for ritual events?

C. Exchange & Interaction

Exchange and interaction across the regional landscape are key to evaluating Chacoan sociopolitical models. In the 1980s, ceramic and lithic studies discredited the redistribution model by demonstrating that although many goods travel into Chaco Canyon, they do *not* appear to have been redistributed across the basin (Cameron 1984; Toll 1985; Jacobson 1984). Material movements indicate that the residents of Chaco Canyon had particularly strong relationships with people living in outliers along the slopes of the Chuska Mountains, 75 km west of Chaco Canyon. Chuskan materials found in Chaco Canyon include trachyte-tempered ceramics (Mills et al. 1997; V. King 2003; Shepard 1954; Stoltman 1999; Toll 1981, 1984, 1985; Toll et al. 1980;

Windes 1977:299-328) and Narbona Pass chert (Cameron 1984, 1997; Jacobson 1984; Warren 1967, 1977). Some maize moved from the Chuskan slopes into Chaco (Benson et al. 2003; Cordell et al. 2001, 2008; Grimstead et al. 2015). Strontium isotope analysis indicates that the Ponderosa pine timbers used in canyon great house roofs were obtained primarily from trees which grew in the Zuni Mountains and later from the Chuska Mountains (Durand et al. 1999; English et al. 2001; Guiterman, Swetnam, and Dean 2016; Windes and McKenna 2001). Deer and antelope would have likely been hunted in the mountains (Vivian 2000:5; Vivian et al. 2006:19), and isotopic studies indicate the Chuska Mountains were a major source for artiodactyl fauna (Grimstead 2011).

Researchers discuss two general processes to account for the movement of Chuskan material to Chaco (Cameron 2001; Renfrew 2001; Toll 2001). The first of these involves simple exchange between residents of the two areas. The second process involves movement of the materials during visits made to Chaco Canyon by Chuskan residents (Renfrew 2001). Chuskans may have brought pottery for use while visiting Chaco Canyon, or they may have brought something to Chaco in the pots. Cameron (2001) suggests Narbona Pass chert may have been valued for color symbolism and may have been deposited in Chaco for votive purposes. Van Dyke (2008) has suggested that Chaco-Chuska relationships figured prominently in the rise of Chaco as a locus for elite power and regional ritual gatherings. Clearly, there was intensive movement of materials between Chaco Canyon and the Chuskan slopes, but we know remarkably little about the archaeology of the area between the two. Relative frequencies of Chuskan ceramics and Narbona Pass chert within outlier communities between the two areas are needed to test hypotheses about Chaco-Chuskan interaction.

Much of the archaeology done in the San Juan Basin has been directly or indirectly related to oil and gas development (e.g., Bradley and Sullivan 1994; Dykeman 2003; Hovezak and Sesler 2002, 2009; Kearns 1991, 1996; Plog and Wait 1982; Reher 1977; Wendorf et al. 1956). This work has been limited in areal scope. Although there are good data from some communities, sample sizes are small, and previous researchers did not always differentiate between Early and Classic Bonito contexts (Hensler 1997; Marshall and Sofaer 1988:60-61; Peckham 1969; Powers et al. 1983:342; Toll 1985:435-451; Ward 2004). Ongoing research projects in the area include Windes' work on Basketmaker III and Pueblo I communities to the west and south of Chaco (Windes 2015), and Marshall and colleagues' (Marshall et al. 1979; Marshall and Sofaer 1988) reconnaissance surveys. In a herculean effort, Barbara Mills and Matt Peeples currently are addressing the issue of outlier interaction by collating all existing artifact data from across the Chaco world to be used in Social Networks Analysis. Clearly much work remains to be done, and landscape-level pedestrian survey along with aerial reconnaissance in outlier communities would be the best way to gather data to begin to address these issues.

D. Indigenous Relationships to the Chacoan Landscape

Landscapes and identities are strongly connected in the indigenous Southwest, where past and present places are integral to religious practices, histories, and ethics (e.g., Anschuetz et al. 2001; Anschuetz 2007; Basso 1996; Ferguson and Colwell-Chanthaphonh 2006; Ferguson and Hart 1985; Kelley and Francis 1994; T. King 2003; Koyiyumptewa and Colwell-Chanthaphonh 2011; Linford 2000; McPherson 1992; S. Ortiz 2002; Snead 2008; Snead and Preucel 1999). We briefly review the role of landscape for historic and contemporary Pueblo and Navajo peoples in **Appendix IIIB**. Prominent peaks, springs, lakes, mesas, buttes, canyons, volcanic plugs, and other landscape features are key to indigenous histories and identities.

Chaco Canyon is itself an important place of pilgrimage for Pueblo peoples (Ellis and Hammack 1968:32). Pueblo oral traditions suggest there are strong relationships between Chaco and Hopi, Zuni, Acoma, Laguna, and the eastern Pueblos. Hopi, Zuni, and Eastern Pueblo oral traditions tell of an ancestral place called White House, where a series of seminal events transpired that relate to the development of Pueblo ceremonialism (Lekson and Cameron 1995:194-195; Lekson 1999:145-150; Stirling 1942:83; White 1942:145). For the Hopi, Chaco Canyon is Yupköyvi, a place where the Parrot, Katsina, Eagle, Sparrowhawk, Tobacco, Cottontail, Rabbitbrush and Bamboo clans gathered and shared their ceremonial knowledge before proceeding on their migrations to Tuuwanasavi (Kuwanwisima 2004). Many Hopi consider archaeological sites as tangible, intentional markers that ancestors left to connect the present with the past, and to indicate ongoing Hopi land stewardship (Colwell-Chanthaphonh and Ferguson 2006:156). Chaco also figures prominently in Navajo stories and ceremonies, including traditions surrounding the origins of the Kin yaa' áanii (Towering House Clan), the Tl'ízílání (Many Goats Clan), Ánaasází Táchii'nii (Red Running into Water Clan), and Tséńjíkiní (Cliff Dwelling Clan) (Begay 2004; Warburton and Begay 2005). Navajo stories tell about a Great Gambler, or Noqoilpi, who lived at Chaco and enslaved all the people before he was overthrown (Judd 1954:351-354; Matthews 1897; McPherson 1992:87-93).

The greater Chaco landscape is no less important to contemporary indigenous identities and oral traditions. For example, Chimney Rock and Companion Rock, twin spires on the Piedra River in southwest Colorado, are a shrine to the Twin War Gods of Taos Pueblo. Cabezon Peak, a volcanic plug in northern New Mexico near the outlier of Guadalupe, is the head of a slain giant in Diné stories. Mount Taylor, a prominent volcanic cone on Chaco's southern horizon, is Tzoodzil for the Navajo, home of Turquoise Boy and Yellow Corn Girl, decorated with turquoise, dark mist, and female rain. The same peak is Tsipaya for the Hopi, a home of katsinas, Kaweshtima for the Acoma, home of the rainmaker of the north, and Dewankwin K'yaba:chu Yalanne for the Zuni, locus of ceremonial activities and plants associated with the medicine and Big Fire societies.

Today, Navajo occupy much of the Chaco landscape, and many prominent places on the Chaco landscape are important for Navajo oral histories (see also **Appendix IIIB**). In addition to the places mentioned above, major peaks include: Hosta Butte ('Ak'iih Nást'ání); Shiprock (Tsé Bit' a'í), and Huerfano Mountain (Dzilth Ná'oodithlii) (Kelley and Francis 1994; Linford 2000; McPherson 1992, 2001); many additional locations remain unstudied. Navajo peoples have long lived in close proximity to Chaco outliers, and they have a range of beliefs and oral traditions about them. Dennis Fransted's (Fransted and Werner 1974; Fransted 1979) collections of Diné stories and place-names for Chacoan places remain unpublished. Although his work is a good start, the process is far from complete. Gilpin (2013, 2014) has been collecting Navajo oral histories as part of the Navajo-Gallup project. There is currently intense Navajo interest in landscape histories and the Chacoan past (Warburton and Begay 2005). This is potentially a very important contemporary focus for Chaco landscape studies, given intense Navajo interest in landscape histories and the Chacoan past (e.g., Kloor 2009).

Archaeologists post-NAGRPA have intensified collaborations with indigenous groups, and there is much good work happening with respect to landscape studies (see for example Begay 2004; Duff et al. 2008; Ferguson et al. 2009; Koyiyumptewa and Colwell-Chanthaphonh 2001; Kuwanwisisma 2004; Swentzell 1992) Any effort to think about the Chaco landscape should incorporate what people living on that landscape have to say about it. This is potentially

important for addressing research issues that encompass indigenous origins, identity, and place attachment.

E. "Dwelling in Places": the Ancient Experience of Chacoan Landscapes

Just as contemporary indigenous peoples are connected to landscape, researchers also seek to understand how ancient Chacoans interacted with landscape. As reviewed in **Appendix III**, people live and move not in a vacuum, but in places. This was no less true in the past than in the present. Julian Thomas exhorts us to strive to understand how past peoples "made themselves at home in their worlds" (Thomas 2006:22).

What aspects of landscape were important for Chacoans? For ancient farmers, critical resources obviously included water, arable land, and raw materials for technology. These aspects of the Chaco landscape are relatively well-studied (see for example Cully and M. Toll 2015; Force et al. 2002; Sebastian 1992; Vivian et al. 2006). But there were also meaningful, emotional and symbolic relationships between Chacoans and the world around them, just as the Navajo, for example, consider their home place to be bounded by four sacred mountains. For all Pueblo peoples, the idea of a center place, where directions and levels intersect, is an extremely powerful trope that connects identity with landscape. At Chaco, there are clear archaeological indicators that similar worldviews were present (Swentzell 1992). The Chacoan landscape can be understood as the large-scale spatial representation of a worldview, or way of dwelling in the world, shared by ancient inhabitants, builders, and visitors. Van Dyke (2007) has argued that this worldview revolved around landscape themes that are omnipresent at Chaco: balanced dualisms, directionality, visibility, and center place. When people moved through the buildings and across the modified landscape of Chaco Canyon, the experience re-affirmed their beliefs about the nature of the world and their place in it. It seemed inevitable and desirable to travel to Chaco for periodic ritual events, and to contribute labor and resources towards the ceremonies necessary for the continuation of the Puebloan way of life.

We are starting to get a clearer picture of how this worked in Chaco Canyon, but we have barely scratched the surface in terms of understanding the formal landscapes within outlier communities. Stein and Lekson's (1992) work have given us a good starting point. Kin Hoch'oi in the Puerco valley, for example, contains a formal berm breached by road segments that seem designed to facilitate processions, and a "road through time" connects Chacoan structures from late and early time periods (Fowler et al. 1987; Fowler and Stein 1992). It is likely that similar relationships are present in many outlier communities, but this has not been a primary focus of study. Mike Marshall and Phillip Tuwaletstiwa are working towards an understanding of processionways and formal avenues for movement in the western San Juan Basin, but their work is not complete. Anna Sofaer (1997, 2007) has demonstrated the relevance of astronomical alignments to Chacoans, but her work has focused in Chaco Canyon and the central San Juan Basin. Further study is needed to understand the occurrence of alignments within and between outlier communities.

Viewsheds and lines of sight are critically significant for understanding the Chacoans relationship to landscape. For Chacoans, as for all Southwest peoples, highly visible landforms would have been one way to establish emotional, cognitive, and symbolic connections to homelands, relatives, past events, oral traditions, and each other (Bernardini and Peeples 2015; Van Dyke 2011). Chacoans positioned great houses, tower kivas, shrines, stone circles, and other features to maximize line-of-sight connections across the landscape. These lines of sight would have anchored identities across time and space in multiple, overlapping ways. They also

could have been for communication and/or surveillance. Hayes and Windes (1975) demonstrated that shrines in Chaco Canyon created an intervisible signaling network. A local high school student (Freeman et al. 1997) used mirrors for a science fair project to demonstrate that Huerfano Mesa links the Chaco Canyon great house of Pueblo Alto to the outlier great house of Chimney Rock, 130 km to the northeast. Van Dyke and colleagues have recently completed an initial GIS-based viewshed and line-of-sight analysis of great houses, shrines, and related features across the greater Chacoan landscape (see **Appendix VIA**). We conclude that Chacoans clearly positioned shrines to facilitate intervisibility and signaling. Our study predicts places where archaeologists should logically expect to find shrines, but we have not yet looked. Van Dyke and colleagues have demonstrated the critical importance of viewsheds, but much work remains to be done identifying and documenting this significant element of Chacoan landscapes.

Viewsheds within outlier communities are another important and barely tapped focus of study. Where data are present, scholars have employed GIS line-of-sight and viewshed analyses in attempts to address these issues, with contradictory results (Dungan 2009; Ellenberger 2012; Kantner and Hobgood 2003; Robinson et al. 2007 – see expanded discussion in **Appendix VIA**.). Surveillance, communication, and a shared sense of identity are three possible reasons for local outlier great house visibility, and each has different implications for the nature of the Chacoan polity. At present we lack the high-resolution outlier community data that would be necessary to continue to evaluate these hypotheses.

VI. Defining the Chacoan Landscape: Part II - Experiences

Archaeology has made enormous strides in documenting Chaco landscapes. Of course, much remains to be done for basic discovery and documentation. But we have covered only part of the story. In **Part IV** (see particularly **Appendix IV**), we catalogued the material evidence needed to address the research issues outlined above. At minimum, these categories of evidence include (1) monumental architecture (great houses, great kivas); (2) roads and related features (staircases, earthworks); (3) outlier communities; (4) surface artifacts; (5) shrines and related features (stone circles, crescents, cairns); and (6) rock art. **In Part VI**, we address the experiential aspects of the Chaco landscape that we need to understand in order to address these research issues. If we want to understand landscape from an experiential perspective, one important collection of evidence should be indigenous oral traditions, stories, and histories, as discussed above in Section D. A minimal list of phenomenological evidence should include: (A) viewsheds; (B) day and night skies; and (C) soundscapes. We provide a brief summary below and refer the reader to **Appendix VI** for expanded discussion.

VIA. Viewsheds

On the Colorado Plateau, high places are visible and intervisible by virtue of the elevated topography and the clear and cloudless skies. Chacoans would have valued visibility over broad areas of landscape for reasons that included surveillance, communication, symbolism, and a shared sense of identity or history. Chacoans had the means as well as the motive to create a communication or signaling network involving great houses and shrines that drew together the greater Chacoan world. GIS databases and software are proving to be excellent tools for examining and modeling visible connections over large areas. Visibility studies based in GIS can determine potential and likely lines-of-sight (the reciprocal ability of people at two locations to see one another), viewsheds (the surrounding terrain and features that can be seen from a single location), and viewnets (networks of locations connected by lines-of-sight). Van Dyke et al.

(2016) have recently completed an initial GIS-based viewshed and line-of-sight study involving over 80 shrines and related features and over 230 great houses or related features. We determined that shrines do, in fact, facilitate intervisible connections. Importantly, our study predicts where we should look for unrecorded shrines across the Chaco landscape – work that has yet to be undertaken.

Viewsheds within outlier communities are another focus of interest. Many outlier great houses were situated on elevations above their associated community; that is, they were "the house on the hill." Great houses may have been intended to watch over, or to be seen by, the surrounding community. In four communities where fine-grained small site data are present, scholars have employed GIS line-of-sight and viewshed analyses in attempts to address these issues, with variable and contradictory results. Any energy development that negatively impacts air quality will directly affect our ability to see, study, and understand viewsheds on the Chaco landscape.

In addition to recognizing the cultural significance of viewsheds for ancient Chacoans, management should also consider the modern visitor experience at Chaco sites. Contemporary visitors come to Chaco for spiritual communion and aesthetic inspiration that depend on unimpeded access to the skies, vistas, and viewsheds. It is impossible to provide statistics that would purport to measure the aesthetic inspiration and spiritual solace visitors experience on the Chaco landscape, but some evidence of this is offered by the immense popularity of this landscape as a topic for black-and-white photography compendia. See for example David Noble's (2010) *In the Places of the Spirits*, Judy Tuwaletstiwa's (2007) *Mapping Water*, Jack Campbell's (2007) *The Great Houses of Chaco*, Mary Peck's (1994) *Chaco Canyon: A Center and Its World*, and Paul Logsdon's (1993) *Ancient Land, Ancestral Places*. Anecdotally, we can attest that visitors' experiences of the remote Pierre's site – a north road corridor and Chaco Protection Site – are negatively impacted by a well pad and clanking pump engine just outside the Protection Site boundary. We have visited Pierre's site repeatedly, with archaeological colleagues and with tour groups, and visitors have never failed to comment unfavorably on the viewshed and soundscape. "Wilderness values" are a management consideration at Chaco Culture National Historical Park, and should extend as a management concern throughout the Chaco region.

VIB: Day and Night Skies

It is not simply visibility that is an important component of the Chaco landscape experience – it is the sky itself. The directions and alignments so important to Pueblo cosmography derive some of their significance from the movements of celestial bodies, including the sun, the moon, and the stars. We have good evidence in the form of rock art and architectural alignments that Chacoans were concerned with all of these elements. That is, the dark skies were an integral element in the design and experience of Chacoan landscapes. Chaco Culture NHP is committed to protecting the quality of night skies inside the park; it recently was certified as an International Dark Sky Park by the International Dark-Sky Association (IDA). However, there has been virtually no research into celestial meanings, alignments, and associations at outliers on the Chaco landscape (with the exception of Chimney Rock, located NE of Chaco in Southern Colorado). Energy development creates a great deal of light pollution and thus would be potentially very harmful to Chaco's night skies, as well as daytime air quality.

VIC: Soundscapes

Sound is an understudied experiential aspect of the Chacoan landscape that begs for further attention. It is likely that Chacoan ritual involved songs, chants, drums, bells, flutes, and shell trumpets. Archaeologists and anthropologists have barely begun to undertake investigations into ancient soundscapes (see **Appendix VIC**). Experimental studies have focused on architectural spaces and natural places, but no work has been undertaken outside of the park. The Chaco soundscape, which is a major landscape feature and experience, is one of the most fragile aspects of this landscape to be threatened by energy development.

VII. Management Considerations

Chaco Culture National Historical Park was the center of a large region from A.D. 850 to 1150. Chaco's ancient history can only be understood in the context of that larger regional. Without knowledge of its region, Chaco would be like studying Washington D.C. without the rest of the USA.

Chaco's region, defined by approximately 230 "outlier" Great Houses and distinctive landscape features, covered 30,000-60,000 square miles in portions of New Mexico, Colorado, Utah and Arizona. Chaco's history played out over vast landscape scales.

Chacoan landscapes can be considered on three scales: Chaco Canyon itself, with its remarkable city-scape; individual "outlier" landscapes; and the larger regional landscape. The Canyon is protected as a National Park; a handful of "outlier" landscapes are protected as Chaco Protection sites; the larger regional landscape has not yet been considered for protection or management. All three scales were recognized in the original creation of the Monument and Chaco's later elevation to Park status; and in Chaco's inscription to the World Heritage List.

> The Canyon landscape is protected as a National Park and by proposed "buffer zones" for public land management. The management of non-Federal lands near Chaco, however, remains problematic.
>
> Outlier landscapes consist of material, physical elements and non-material elements. Material elements include Great Houses, Great Kivas, roads, berms, and multiple surrounding farmsteads. Non-material elements include internal viewsheds (Great House to farmsteads), external viewsheds (Great Houses to Great House and to significant peaks), night skies, soundscapes, and other experiential and oral historical elements. A relatively small number of outliers are protected and managed as part of the Park and as Chaco Protection Sites.
>
> The regional landscape has seldom been considered as a management unit, in part because it comprises multiple land statuses, multiple states, and multiple agency jurisdictions. Studies and documentation of its constitutent and contributing elements lag far behind the Canyon and outlier landscapes: roads, viewsheds, line-of-sight signaling systems, shrine networks, significant natural features.

A "resource" this diverse and wide-ranging demands a unified management approach, to Chaco itself, its outliers and region, and the natural environment that was integral to the Chacoan landscape, rather than the piece-meal approach by separate government entities. Such integrated

management can benefit from both the explosion of new data on Chaco and its world, and from recent substantive developments in how archaeology (and heritage management) view and understand landscapes.

Important new archaeological tools and methods for studying landscape have been developed in the Southwest since the 1990s. Many of these tools were not available prior to 2000 (Chaco Protection Sites Joint Management Plan 1983; BLM Farmington Resource Management Plan 2003).

A recognized Southwestern "school" of landscape archaeology developed from innovations and discoveries at Chaco landscapes on the canyon, outlier, and regional scales. Thus Chacoan landscapes are not only intrinsically significant, they are significant to the development of new scientific and humanistic knowledge in the past, present, and future.

Chacoan landscapes on all scales can be managed under existing historic preservation laws and regulations, if recognized as and afforded the National Register considerations of "historic planned landscapes" and "historic rural landscapes." By categorizing Chaco as prehistoric – that is, lacking history – these considerations are effectively foreclosed. It could be argued that such regulatory foreclosure reflects unfortunate colonial prejudices.

Appendices

Appendix I: Landscape in Canyon-Outlier Models

A number of models have been developed to explain the rather dramatic appearance of Bonito style architecture across an arid, agriculturally marginal landscape during the Pueblo II period. Early explanations focused on the canyon. More recent work has recognized that relationships between the Chaco Canyon and the outliers must have been an important part of the *raison d'être* of Bonito style architecture in both areas. However, Chaco scholars are still struggling to understand how and why great houses were built in outlier communities, and what this meant both for the communities themselves, and for their relationships with Chaco Canyon and with one another.

Lekson (1999) and Van Dyke (2007) have argued that landscape holds the key to understanding Chaco. Local Chacoan ritual and monumental landscapes in both the Canyon itself and at "outlier" communities have been recognized and documented by Fritz (1978), Stein and Lekson (1992), Fowler and Stein (1992), Sofaer (1997, 2007), Van Dyke (2004, 2007), and many others. At the largest scale, Chaco Canyon (ca. 850-1130) was directly followed in time by Aztec Ruins National Monument (ca. 1110-1280), a complex of monumental structures and landscape features comparable to (but half the size of) Chaco. Lekson (1999, 2015) suggested that Chaco in effect shifted due north, to a second, successor center. The meridian axis structured both the original landscape at Chaco and the "Great North Road" probably linking Chaco and Aztec. This meridian may have a deeper history, prior to Chaco as well as influenced the later foundation of subsequent regional centers. The importance of the meridian in Chaco Canyon's landscape has been studied by John Fritz, Ruth Van Dyke and others. The larger regional extension of the meridian is provisional, but largely accepted among archaeologists.

Van Dyke (2007) argues that the Chaco landscape embodies a worldview that emphasized dualism, cardinal and vertical directions (Marshall 1997; Stein and Lekson 1992). As outlier residents arrived for ceremonies at Chaco, their spatial experiences confirmed for them that the canyon was the center place – an appropriate location in which to conduct the rituals necessary to ensure agricultural success and to keep their lives – and the world – in balance. The North and South Roads at Chaco evoke, on a visceral, nonverbal level, a sense of the balance between the visible and the invisible, the celestial and the subterranean. Chaco Canyon is experienced as the fulcrum of this opposition – the place in which equilibrium can be maintained. Chaco Canyon is ideally situated to be a center place. The canyon itself represents a balanced dualism between vertical and subterranean, highly visible, and entirely hidden. The name Chaco Canyon suggests depth, but Fajada Butte and the mesas that form its walls are some of the highest points in the San Juan Basin. Chacra Mesa is intervisible with many locations across the San Juan Basin and with landforms along the Basin's edges, 50-100 km away. Places such as Huerfano Mountain and Hosta Butte may have represented particular directions or boundaries, or they may have been associated with particular myths or histories. Chacoans positioned some buildings and other features to create lines of sight with specific landforms, and they marked these high places with shrines.

Appendix II: Management Considerations

"Chaco Canyon National Park" was proposed in 1902, based on the report of GLO Agent Stephen Holsinger (Holsinger 1901). Holsinger had visited Chaco Canyon at the insistence of Edgar Hewett (Museum of New Mexico) to investigate the excavations and homestead claims of Richard Wetherill. Holsinger recommended that Chaco Canyon be protected from homesteading, and with it a sizable portion of the San Juan Basin – almost 750 square miles! He also listed several "outliers" that merited protection, beyond the limits of his expansive proposal. No action was taken until the passage of the Antiquities Act of 1906 (also promoted by Hewett). In March 11, 1907 Chaco Canyon was named a National Monument of about 32 square miles, but with several "outlier" units: Pueblo Pintado, Kin Bineola, Kin Ya'a, and the elusive Casa Morena (Holsinger never visited this site, and the land set aside for its protection contains no major ruins).

Importantly, the original evaluation of the ancient society centered at Chaco Canyon recognized its remarkable geographic scale. Management and preservation of Chaco archaeology required "thinking outside the box," far beyond the limits of Canyon. Holsinger's insights were affirmed in the 1920s and 1930s with excavations at several of Chacoan sites distant from Chaco Canyon: Aztec Ruins (50 miles N of Chaco), Lowry Ruin (110 miles NW), Chimney Rock (80 miles NE), and Village of the Great Kivas (85 miles SW).
Subsequent research has revealed at least 230 such Chacoan "outliers" at distances up to 150 miles from Chaco Canyon (Fowler et al. 1987; Kantner 2003; Kantner and Mahoney 2000; Marshall et al. 1979; Marshall and Sofaer 1988; Powers et al. 1983). Early research also revealed the existence of long, linear landscape features today called "roads;" subsequent research has confirmed the existence of "road" segments at many "outlier" sites, including the most distant in southeastern Utah. Research begun in the 1970s also documented an extensive line-of-sight communication system, linking distant "outliers" to each other and in some cases back into Chaco Canyon (Freeman et al. 2007; Hayes and Windes 1975).

Joint Management Plan -- 1983

The geographic scale of Chacoan society was recognized in the legislation that enlarged the old National Monument and created Chaco Culture National Park in December 19, 1980 (PL 96-550 Title V). This legislation also included "Thirty three outlying sites … hereby designated 'Chaco Culture Archaeological Protection Sites'" (Sec 502b), recognizing "…the potential for conflicts between resource preservation and energy development" (Joint Management Plan1983:1; hereafter JMP). The Protection Sites are jointly administered under a Joint Management Plan (JMP) by Federal and State agencies and the Navajo Nation (JMP 1983, amended 1990). The first of five goals of the Joint Management Plan was: "Identify, manage, protect, and interpret a representative sample of the prehistoric Chacoan cultural system" (JMP 1983:16); it is clear that "Chacoan cultural system" means archaeological sites and landscapes across the Chacon region. Four other goals included balancing energy development and site protection; resolving conflicts in protection and development; developing individual site management plans; and developing procedures for new discoveries (JMP 1983:16). While the original legislation named only "Protection Sites," we direct attention to the JMP's foresight in the protection of "the prehistoric Chacoan cultural system," to which we will return, below.

To select the "representative sample" of Protection Sites, the Chaco region was divided into six "pie slice" sub-regions with Chaco Canyon at center. These six sub-region represented

known or assumed "road system affiliation" – that is, "road" networks branching out from Chaco in each of the six defined directions. Within each "road system", sites were selected in reference to six criteria: "distance from Chaco", "vegetative context", "time period", "outlier type, "Chacoan structure size", and "unusual structural features" (JMP 1983:33-34). In light of these criteria, "a sample … [was] selected that will best represent the known diversity in the outlier system" (JMP 1983:33), listing thirty-three sites in parcels ranging in size from 10 to 1,565 acres. With one exception in Arizona, all Protection Sites are in northwestern New Mexico, with about two-thirds in the San Juan Basin. Most of the latter are in the southern San Juan Basin (that is, south of Chaco).

World Heritage -- 1987

This far-sighted legislative protection for "outliers" was followed on December 8, 1987 by Chaco's inscription on UNESCO's World Heritage List. The World Heritage listing acknowledged the geographic scale of ancient Chacoan society by including a small number of Protection Sites: Aztec Ruins, Kin Bineola, Kin Ya'a, Pueblo Pintado, Casamero, Kin Nizhoni, Pierre's, Twin Angels, and Halfway House (the latter three related to the ancient "North Road"). The World Heritage listing includes the following statement:

> "Further evidence of the Chacoan system, including road traces and outlier communities with 'great houses,' extends well beyond the property boundaries, but was not considered for inclusion at the time of inscription. There is no buffer zone. Since the property's inscription, efforts such as partial site reburial, fencing, and patrolling have dramatically slowed the rate of deterioration. However, threats to its integrity from adjacent development (including associated utilities and roads), energy exploration, extraction, as well as transportation projects and proposals have increased." (http://whc.unesco.org/en/list/353/, accessed Dec 22, 2015)

Chaco's World Heritage qualities were recently re-affirmed by the World Heritage Committee (2014), naming Chaco as a site of Outstanding Universal Value.

Only truly exceptional properties and landscapes make the list, with Chaco being one of only 10 World Heritage cultural listings in the US. It ranks with the Statue of Liberty, Independence Hall, Monticello, Cahokia, and Taos Pueblo. Chaco's significance, recognized in the World Heritage inscription, is unusual in that it is not a single property, but as a "network of sites" and a regional system. In some ways it is similar to the Hawaiian chain of islands and atolls called Papahānaumokuākea, which has deep ancestral/historic value for Native Hawaiians – a World Heritage listing encompasses an area of over 135,000 sq mi. Note that the World Heritage List recognizes the size and scale of the "Chacoan system" and allows for the inclusion of additional properties in the future as research develops and discoveries are made.

National Register Significance

National Register status is a key element of archaeological site management under NHPA Section 106 and other legislation and regulations. While National Register status is not addressed in detail in the text of Joint Management Plan, it is listed first in the table of Protection Site data (JMP 1983:31-32). As of 1983, sixteen of the 33 Protection Sites were listed, eight

were nominated, and the remainder were all deemed eligible. As a lynch-pin of cultural resource management, we review some aspects of National Register criteria and its tools, specifically Criterion D in relation to other Criteria; and District or Thematic multiple property nominations; and Register designation of "Cultural Landscape," with reference to "Traditional Cultural Properties."

Four criteria guide nomination and inclusion in the National Register (National Register Bulletin 15, 1997). The first three are historical or architectural: A. association with historic events; B. association with historically significant people; and C. important examples of architectural styles "that embody the distinctive characteristics of a type, period, or method of construction, that represent the work of a master, or that possess high artistic values." Criterion D is loosely inclusive for archaeology: "that have yielded or may be likely to yield, information important in history or prehistory." The first three generally represent the relatively recent Colonial and National past; the fourth, Criterion D, is a general criterion for prehistory and the least specific: "likely to yield information." Typically (but not exclusively) the potential for yielding information is equated with the presence of intact deposits, and thus is site-specific. If a site has or probably has intact sub-surface deposits, it is eligible for nomination to the National Register. It is "eligibility" that triggers Section 106 and its regulations, and subsequent management actions. In many ways, the bar is lower – or, rather, different – for archaeological sites than for places of conventional historical note, places associated with historically important people, or architectural masterpieces.

All known Chacoan Great Houses – which number between 200 and 230 –clearly are eligible for National Register Nomination under Criterion D. A strong case can also be made for nomination and inclusion under Criteria A, B, and C. As with Traditional Cultural Properties (Nat Reg Bull 38), this requires a more anthropological than conventional academic approach to "history."

Criterion A calls for association with events that contributed to broad patterns in history. It appears that Chaco Canyon and the Chaco cultural system (JMP 1983) was a watershed in Native history in the Southwest: what came before was very different than what came after. While there is debate about the exact nature of those changes, the fact of change – extraordinary historical change – is undeniable and accepted by most if not all archaeologists and historians. Native accounts also refer to Chaco as a place where both great and terrible things transpired, changing Pueblo life forever (accounts in Lekson 2009).

Criterion B requires association with persons significant in the past. A strong case can be made that Chaco Canyon and its outlying Great Houses were associated with rulers or leaders of considerable power. While the nature of that power is a matter for research – economic? political? military? ritual? all of the above? – the fact of power at Chaco is generally accepted. We may not know the names of all the individuals or families controlling this power, but the people of their times knew their names or titles. Indeed, from Navajo accounts, we have the name of Chaco's ruler: Noqoìlpi, "He-Who-Wins-You-Over" (often translated as "Great Gambler;"Judd 1954:351-354; Matthews 1897; McPherson 1992:87-93). Noqoìlpi lived at Pueblo Alto in Chaco Canyon and ultimately controlled the Chaco cultural system. He features in many Navajo traditional histories – some of which are significant to current Navajo policies and development (e.g., the development of casinos in the Navajo Nation came long after other regional tribes, in part due to the traumatic history surrounding the Great Gambler). Clearly, Chaco Canyon's Great Houses were associated with historically significant figures; the

associations of outlier Great Houses is less clear, but a strong argument can be made that they, too, were associated with persons of historical significance.

Criterion C focuses on architectural styles: "that embody the distinctive characteristics of a type, period, or method of construction, that represent the work of a master, or that possess high artistic values." Chaco landscapes are distinctive of a key era in the history of the ancient Southwest, and Chaco Great Houses are distinguished by their forms and methods of construction – beautifully detailed sandstone masonry that has inspired walls and veneers on modern structures. It could also be argued that Chaco Great Houses involved a creative role we would today call an architect, or architects: that is, an individual or small group which planned and designed the form of the buildings, cognizant of its exterior appearance, which were then built by others, and used (for centuries) by others. To quote National Register Bulletin 38: "A property identified in tradition or suggested by scholarship to be the work of a traditional master builder or artisan may be regarded as the work of a master, even though the precise identity of the master may not be known." We would add only that master may have been plural, that is a small group. But clearly one set of people designed Great Houses, while other people used them. And they designed them impressively: the "artistic values" of Chacoan Great Houses are routinely acknowledged in compendia of world architecture.

Chaco Canyon and archaeological properties associated with the "Chacoan cultural system" or region are clearly eligible under Criterion D. A strong case can be made for Criteria A, B and C as well. The Chaco cultural system, using the language of JMP 1983, was more than the aggregate of the central Canyon and outlier Great Houses. Clearly, the Chaco cultural system operated over long distances and large areas; those distances and areas are as critical to understanding, protecting, and managing the cultural system as are its nodes, the Great Houses and their communities (discussed below). Chaco and its outliers are obvious candidates for District or Thematic multiple property nomination to the National Register. The scale of such nominations is not limited, and can apply to "any geographical scale—local, regional, State or national." For example, the Zuni Salt Lake and Sanctuary District, a Traditional Cultural Property district in west-central New Mexico, is 182,000 acres in size. The Medicine Lake Highlands TCP district in northern California encompasses 73,000 acres of public land. Very recently, Mount Taylor in New Mexico was named a Traditional Cultural Property of over 400,000 acres, for its importance to Tribes today. Mount Taylor was almost certainly an element of the ancient Chacoan landscape.

Multiple property nominations can include transportation corridors (railroad rights-of-way, roads) as well as structures. They include provisions for future discoveries: "The geographical data define the limits of the area where properties included within the multiple property group exist or are likely to exist." Thus such a nomination would not be a limiting tool for successful management. The fact that Chaco "outliers" have not been nominated in a district or thematic nomination is, we think, simply a reflection of the amount of effort required for documentation.

"Cultural Landscapes" and Management

It has become increasingly clear that Chaco cultural system was not simply a series of isolated "sites" but rather a cohesive, inter-connected landscape. Thus the National Register categories of "Historic Landscape" and "Cultural Landscape" are almost certainly appropriate. The Chaco cultural system could be nominated under either or both of these categories; or landscapes at several scales could be part of a District or Thematic nomination.

"Cultural Landscapes" is a category for eligibility as defined by NPS, may be eligible for inclusion in the National Register, with or part of a District nomination. From an NPS on-line glossary:

> "Cultural landscape - a geographic area (including both cultural and natural resources and the wildlife or domestic animals therein), associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values. There are four general types of cultural landscapes, not mutually exclusive: historic sites, historic designed landscapes, historic vernacular landscapes, and ethnographic landscapes." (http://www.nps.gov/tps/standards/four-treatments/landscape-guidelines/index.htm, accessed Dec 22, 2015)

As with the four National Register criteria discussed above, "cultural landscapes" lean towards historic applications. The sub-category "Ethnographic landscapes" acknowledges Native American issues (although its application is not limited to Native Americans) but refers to landscapes in the present, not in ancient times. Therefore we look at "historic designed landscapes" and "historic vernacular landscapes." The latter refers to rural situations, and may be useful in mid-scale landscape situations, such as Chacoan communities (described below). As with the National Register interpretation of Traditional Cultural Properties (Parker and King 1998; hereafter, TCP), we believe it is useful to look at "historic designed landscapes" for application to the Chaco cultural system (Birnbaum 1995; Keller and Keller n.d.). Clearly, the designation was intended for gardens and estate grounds, but it is also applied to larger scales such as "city planning or civic design". "Cultural landscapes" are "features organized in space:"

> "Spatial Organization and Land Patterns refers to the three-dimensional organization and patterns of spaces in a landscape, like the arrangement of rooms in a house. Spatial organization is created by the landscape's cultural and natural features. Some form visual links or barriers (such as fences and hedgerows); others create spaces and visual connections in the landscape (such as topography and open water). The organization of such features defines and creates spaces in the landscape and often is closely related to land use. Both the functional and visual relationship between spaces is integral to the historic character of a property."

"Historic Landscapes" and Management

"Designed historic landscapes" specifically address "view and vistas into and out of the landscape" as well as "parkways, drives and trails", and "spatial relationships and orientations such as symmetry, asymmetry and axial alignment" – among other characteristics. Again, we acknowledge that this category was intended for historic landscapes in the European tradition. But the category also fits Native historical designed landscapes. Consider the remarkable 5th and 6th century Hopewell mound complexes, of huge geometric earthworks: Hopewell mound complexes were clearly designed with roads, orientations, symmetries; moreover, the landscape design carried over very broad geographic space.

We argue that the Chaco cultural system is eligible as both "Designed historic landscape" and "historic vernacular landscape," at different scales or levels. We offer examples that will be

further developed in the course of this project, at the levels of (1) Chaco Canyon, (2) Chaco Communities (of which there are over two hundred), and (3) the Chaco region.

Just as Chaco Great Houses were designed, so too the settlement in Chaco Canyon (hereafter, "Chaco Canyon"). Construction lasted several centuries. Clearly, however, there were designed "views and vistas into and out of the landscape" as well as "parkways, drives and trails", and – most importantly – "spatial relationships and orientations such as symmetry, asymmetry and axial alignment." North-south and east-west axes of design were first proposed John Fritz (1978), and dismissed by that era's archaeology as either coincidence or irrelevant. The north-south axis has since been confirmed (Lekson 1999; Van Dyke 2007) – and taken seriously. In the 1970s and 1980s, symbolism took a back seat to ecology: symbolism and design characters were not among the criteria for selection of the "representative sample" of the Chaco cultural system, but "vegetative context" was a deciding factor (quite properly, of course). We note that several of the archaeologists working on the Chaco Protection Site list were deeply engaged with symbolism and design (e.g., Stein and Lekson 1992) but it took the passage of several decades, the infusion of British landscape studies, and the passage of the American Indian Religious Freedom Act (1978) and NAGPRA (1990) for symbolism and design to rise in the consciousness of cultural resource management. Initially these ideas were incorporated in the management of TCPs of current Tribes, but increasingly management now acknowledges that ancient Natives also invested meaning into their buildings and landscapes. Thus, more recent researchers have demonstrated a range of plans and alignments for Chaco Canyon, reflecting cosmologies of lunar, solar, and cardinal alignments (Van Dyke 2007; Sofaer 2007). Indeed, the sky was a key element of the Chacoan Designed Historical Landscape; while treasured as a Dark Sky Park, the management of Chaco Canyon (and its region, discussed below) should also acknowledge that the night sky was fundamental aspect of Chaco's designed landscape. As noted above, alignments and design underlay the forms of Great House buildings and other elements comprising Chaco Canyon. It is widely accepted that the Canyon itself, at least in its central span of seven miles, was designed and planned with many characteristics of a "Historic Designed Landscape" – and should be eligible under that National Register category. The full civic plan would include the "halo" of buildings surrounding the present National Park (for example, on Escavada Wash) which may extend for some distance. A full analysis of the "Designed Historic Landscape" of Chaco has yet to be completed.

The level of "Chaco Community" represents both "Designed Historic" and "Historic Vernacular" landscapes. The notion of "Chaco community" is formal, not sociological (although a sociological community is sometimes implied): a repeated pattern of a small Chacoan Great House (often atop a rise or eminence) with attendant earthen monuments and "road" segments; one or more Great Kivas; and a scattering of much smaller homesteads, clustered around the Great House and typically intervisible with it (Marshall et al 1979; Lekson 1991; Kantner and Mahoney 2000). There are over two hundred known communities, and of course they exhibit a wide range of variation in both Great House form and community structure. No two Great Houses are exactly alike (not surprisingly); and some communities have a half-dozen small homesteads, while others have scores; some communities are tight and dense, others more scattered. Regardless of variation, the reality of the landscape pattern is widely accepted, even if its social correlates are matters of discussion and debate. The Community level best demonstrates the Native vernacular tradition by contrasting the homesteads – relatively simple, user-built, vernacular folk housing – versus the "polite" or "high style" architecture of Chaco Great Houses. Conventionally, non-European tradition architecture is automatically (and

dismissively?) termed "vernacular." The clear contrast between Great House and homestead architecture demonstrate that Chaco Great Houses (like Hopewell monuments) cannot properly be called "vernacular." They were designed by architects (or individuals filling the role of architects) and suffused with symbolism; they were built as monuments for the long term; and they expressed an easily comprehended architectural order that transmitted meaning and aesthetic quality to the observer. Thus, the Chaco Community as a landscape type includes both "Designed" and "Vernacular" themes. Civic planning of various Chaco Communities is a topic which has not had the study it deserves. For example, we suggest that the location of the Great Kiva – near or at the Great House versus out in the community of homesteads – was either planned or negotiated. The alignments of road segments, most evident near the Great House, continue through and perhaps structure the community of homesteads. These and other design possibilities can be suggested with some degree of confidence, and (although understudied) must be considered in management. Several of the Chaco Protection Sites include the surrounding community; we are uncertain how many, if any, of the Sites exclude the community.

At the very largest level is the Chacoan region. As defined by the distribution of "outlier" Great Houses, the region is very large, at least 30,000 square miles and up to 60,000 square miles. As might be expected, the Chacoan region has been a matter of contention and territorial dispute. Early efforts (in the 1970s) ran into political boundaries; "there are no Chaco Great Houses in Arizona," for example. The weight of the data has, over the years, put such issues largely to rest; however, the meaning of this broad distribution remains very much a matter of debate. We are not so concerned here with the ultimate answers to that question – beyond the simple fact that the resources to answer that question remain in and on the ground, and should be managed accordingly. For current management purposes, we noted above that the whole distribution of Great Houses constitutes an obvious, eligible District or Thematic nomination; but beyond that, we argue that the region may also constitute both "Designed Historic" and "Historic Vernacular" landscapes, perhaps nested and overlapping.

As the Chaco cultural system, the entire region is a Historic Vernacular landscape – although not as understood in European-tradition terms. Chacoan communities were not contiguous, but scattered and distributed over a large area to reflect the "patchy" occurrence of good farmlands. Northwest New Mexico is not Iowa; farmlands (absent modern irrigation) are seldom contiguous and continuous. A rural landscape in the European tradition is largely impossible in the Southwest, outside the irrigated river valleys of the Rio Grande, Salt River, Gila River and so forth. Modern and historic Navajo settlement reflected the same "patchiness" of resources, and indeed many Chaco Communities were located at places favored by Navajo farmers – or vice versa, perhaps. Thus the overall distribution of settlement was "Vernacular" in the widely understood sense of architecture reflecting or responding to local conditions, local needs, local materials and local traditions. Taken to landscape scales, the Chacoan region was thus a "Vernacular historic landscape."

This assessment could be dismissed, perhaps, as reading too much into an adaptive, ecologically-determined pattern of villages and settlements – were it not for a "Designed Historic landscape" overlying and literally overarching the "vernacular." This Designed Historic Landscape is evident in three realms: (1) Great Houses themselves; (2) architectures of distance – designs intended to link the region; and (3) the cosmology and history Chaco expressed as a monumental Designed Landscape.

First, of course, are the Great Houses at the core of most communities; the Great Houses vary in form, but share canons of Chaco's "high style" design. Architectures of distance were

developed to link the region: (1) viewsheds in which "outlier" Great Houses were often intervisible; (2) a sophisticated infrastructure for a line-of-sight communication system which linked "outlier" Great Houses with each other and with Chaco Canyon; and (3) the enigmatic Chacoan "roads."

Great Houses were placed (sited) with great attention to their view sheds, and intervisibilities with other Great Houses and with important landscape features (see **Appendix VIA**). While most "outlier" Great Houses today are reduced to mounds of a ten or twelve feet height, it is instructive to note that the Bluff Great House – in every way a "typical" low mound, originally stood at least three and perhaps four stories tall (Cameron 2009). Other "outlier" Great Houses may have similarly emphasized the vertical both as features designed to impress viewers and viewshed multipliers.

The Chacoan line-of-sight communication system is well documented in some areas; for example, Chimney Rock to Chaco via a "repeater" station at Huerfano Butte (Freeman and others 1997). That system linked Chimney Rock to Chaco. Other systems have been suggested for other parts of the Chaco region, but work on key aspects of the Designed Historic Landscape is only beginning. If the extent of the line-of-sight system was in fact regional – as we and others think likely – then it was a network connecting the far-flung elements of that landscape in ways not considered by historic European traditions of landscape architecture.

Chaco "roads" are at once the most evident but least obvious architecture of distance. Some "roads" continued, uninterrupted, for scores of miles (for example, the North Road). Others may be evident only near Great Houses. While it is possible that alignments evident on the current surface continued great distances, it is also possible that only the initial (or terminal) alignment was necessary to express in landscape architecture; the intervening distance was simply understood. For example, a highly visible road segment at the Bluff Great House pointed fairly accurately toward the Great House Community at Teec Nos Pos, some 35 miles toward the Southeast; continuing that alignment from Teec Nos Pos another 85 miles on the same bearing reaches, fairly accurately, Chaco Canyon. There is no evidence (yet) of a continuous road linking those three places, but "road" segments easily visible at Great Houses may have carried sufficient symbolism – with "outlier" Great Houses and the line-of-sight communication system – for an architecture of distance, a key element of Chaco's Designed Historic Landscape.

At an even higher (if perhaps spatially smaller) level, Designed Historic Landscapes structured and commemorated Chacoan cosmology and history. The best-known instance is the Chaco Meridian (Lekson 1999), controversial when first proposed but today widely accepted, at least in part: Chaco moved North to Aztec (a distance of 50 miles), and commemorated or structured that event with a major landscape monument, the "North Road." The full argument is far too long and complicated for presentation here, but the basic idea has been independently supported by artifact and other studies (Reed 2008) and landscape analysis (Van Dyke 2007). The scale of the Designed Historic Landscape represented by Chaco and Aztec is commensurate with other known Native landscapes; for example, the "Great Hopewell Road" links two major monumental centers at Newark and Chillicothe, over a distance of 60 miles. It seems clear that Chacoan Designed Historic Landscapes imposed a cardinal structure on the natural landscape, and that structure was profoundly important in Chacoan history.

Finally, the Chacoan Designed Historic Landscape incorporated prominent natural features (allowed in "Designed Historic Landscapes"). Field studies have demonstrated the alignments and viewsheds of the Chacoan landscape reference prominent peaks, buttes and the like (Van Dyke 2007).

Architect Dennis Doxtater (University of Arizona) has proposed and published (in peer-reviewed journals) his observations that axes defined between and among prominent mountain peaks played a role in the rise of Chaco at Chaco Canyon, and in its subsequent historical development (Doxtater 2002). This suggestion is congruent with Pueblo place-making, which typically references mountain peaks in four (or more) directions. Modern Pueblo practices may reflect an earlier, perhaps more precise "geomancy" (Heitman 2011). Doxtater suggests emplacement of Chaco in what we would today call a "natural" environment, but which for Pueblo people today is an active living landscape, and for Chacoan architects in ancient times the context or parameters for Designed Landscapes.

In summary, the individual "outlier" Great Houses and their communities are clearly eligible as a multiple property, District or Thematic nomination. But we argue that protection and management of the "Chacoan regional system" calls for more: a landscape management approach -- identifying, protecting, and managing the Vernacular and Designed Chacoan landscapes. Not just the constituent "sites" and the buildings, but the spaces, distances, viewsheds, alignments, and night skies that constituted ancient Chaco.

Appendix III: Landscape: Theoretical Background

Appendix III A. Settlement Pattern Studies & GIS

Settlement pattern studies have enjoyed a long run of popularity in cultural ecology and processual archaeology (Ashmore 2002). Horizontal and vertical measurements describe relationships between people and natural or cultural resources, and landforms provide raw materials or opportunities to engage in various kinds of subsistence behavior. Traditional settlement pattern studies tend to view space as a neutral container for action. Maps, aerial photographs, GIS databases, and other kinds of large-scale, top-down representations of space are important tools of the landscape scholar. GIS databases and software are proving to be excellent tools for examining and modeling visible connections over large areas (Bernardini et al. 2013; Bernardini and Peeples 2015; Connolly and Lake 2006; Exon et al. 2000; Fisher et al. 1997; Johnson 2003; Kay and Sly 2001; Kay and Witcher 2005; Lake 2007; Llobera 1996, 2003, 2007; Waldron and Abrams 1999; Wheatley 1995; Wheatley and Gillings 2002). Visibility studies based in GIS generally focus on determining lines-of-sight (the reciprocal ability of people at two locations to see one another), viewsheds (the surrounding terrain and features that can be seen from a single location), and viewnets (networks of locations connected by lines-of-sight).

Geographic Information Systems are the standard by which land management agencies and academics present and analyze geospatial data such as site locations. Despite the general fluency and ubiquity of these technologies, it became clear to the authors of this report that various management agencies (including the BLM Farmington Field Office) and different Chacoan research groups were using disparate geospatial data sets of variable quality. We are in the process of aggregating and reconciling existing datasets on great house community locations, but even the best available data are in many cases limited and imperfect. Efforts to improve and augment these data are ongoing. Without accurate site locations and the geographic extent of Chacoan landscape features, we cannot expect to adequately understand, much less protect the greater Chaco landscape.

Appendix III B. Cultural Landscapes

While maps of physical distances among populations and resources are important information, reducing landscape to material patterning leaves the meaningful and experiential aspects of place unexplored. People have reactions, perceptions, opinions, and experiences of their constructed and natural spatial surroundings. Maps do not show us the landscape as Chacoans would have seen it. "Distanced, geometrical, 'outsider's' approaches to space can claim no priority over the social and the experiential" (Thomas 1993: 27). During the 1980s and 90s, geographers, philosophers, and anthropologists began to think of landscapes as socially produced, relational fields vital to the construction of identity and society (e.g., Altman and Low 1992; Lefebvre 1991). Many past peoples have imbued features of the natural landscape, such as boulders, caves, springs, and mountain peaks, with meaning. Ethnographically, landforms tend to be ascribed special significance when they take unusual shapes, or are framed by other landforms, or dominate the horizon from a particular direction (Boivin 2004; Taçon 1999; Williams and Nash 2006). Examples worldwide include Mayan caves (Brady and Ashmore 1999), and the association of a temple complex with a distinctive mountain at My Son, Vietnam (Sharma 1992). Natural places become focal points for the construction of meaning when they are places of unusual drama, reminding people to step out for a moment from the ordinary, quotidian scale of life -- like ritual events, marked off as symbolically meaningful and separate from daily life, focusing peoples' attention and preparing them for emotionally powerful experiences (Cohen 1979:98; Geertz 1980).

The concept of "place" encompasses both the built environment and the natural world – indeed, recent critical perspectives point out that separation of the two is a relatively recent, post-Enlightment, Descartian construct (Thomas 2004). "Landscape" in archaeology provides an ontological framework for thinking about difficult and slippery issues such as memory, emotion, and meaning (Kus 1992; Tarlow 2000). Meaningful places are not only seen – they are felt, experienced, and remembered (Webmoor 2005; Witmore 2005). Stories, histories, and oral traditions create emotional connections and social memories, attaching peoples to places (Schachner 2011; Silko 1977). The theoretical roots of this perspective are found in Bourdieu's notion of habitus – a set of durable dispositions reflexively created through bodily movement within the physical world (Bourdieu 1977; see also Merleau-Ponty 1962).

Archaeologists working on monumental landscapes in Mesoamerica (Ashmore 1989), Roman Greece (Alcock 1993), and Neolithic Britain (Bradley 1998, 2000; see **Appendix V**) turned their attention to landscape as a way to think about ancient ideologies, worldviews, and power relationships. Landscapes comprise the spatial milieu within which bodies and the social and material worlds interact and intersect. Landscapes also constrain and order, as both the site and the stake of social struggle (Foucault 1977; Harvey 1989, 1996; Smith 2003). Archaeological sites can themselves become the loci of social memories and meanings that are continually constructed, obliterated, altered, and reconstructed over time (see authors in Van Dyke and Alcock 2003). Stonehenge (Bender 1993) is an excellent example of this.

Indigenous groups clearly have relationships with landscape that transcend Western ideas about resources or distances. Indigenous peoples of the Southwest use landscape features as metonyms to evoke stories and values (Basso 1996; Young 1988:4-9). By the 1990s, Southwest archaeologists began to focus on cultural landscapes as a way to integrate human perceptions and relationships into the picture (Anschuetz et al. 2001). Southwest archaeologists collaborated with Native Americans to identify cultural landscapes along the San Pedro River corridor, for example (e.g., Ferguson and Colwell-Chanthaphonh 2006). The concept of cultural landscapes weaves together oral histories, migrations and traditional land use (e.g., Ferguson and Colwell-

Chanthaphonh 2006). Prominent visual landmarks helped with wayfaring and contributed to the creation of a sense of community (Bernardini and Peeples 2015). Natural and archaeological places are inextricably connected to memories, histories, religious practices, and cosmologies. As Basso (1996) demonstrated for the Western Apache, storied places are woven into the social fabric, maintaining morality, conveying wisdom. Mountain peaks, buttes, mesas and canyons are more than locations in stories, or backdrops for historical events. They are integral to the identities of those who live within their viewsheds.

All indigenous groups in the Southwest inscribe landscape features with social, religious, and political meanings. For Pueblo people, mountains are home to katsinas—cloud beings or ancestral spirits—that bring rain. Mountains also are important directional markers in a complex cosmography defining the pueblo as the center of a bounded, nested, hierarchical world.

The Keres, who inhabit Acoma, Laguna, and five pueblos along the northern Rio Grande, conceive of the world as a series of nested, interrelated regions focused on the central village (White 1942, 1960). Sacred mountains topped with shrines mark the outermost level of the contemporary world. Similarly, four sacred mountains associated with cardinal directions delimit the Tewa world. Each is associated with an earth navel or opening between worlds, a lake, a color, and various supernatural beings. People go to these distant, high mountains to hunt, gather, or make pilgrimages. Concentric tetrads of shrines and natural features have counterparts in the horizontal and vertical divisions of Tewa society (Ortiz 1969, 1972).The Zuni world is also one of hierarchical, symmetrical divisions connected at a center place (Ferguson and Hart 1985; Ladd 1979). There are six cardinal directions (including up and down), each associated with colors, fetishes, and animals. These intersect at the center, the Zuni village itself, called Itiwanna or "Middle Place. Many ritual activities are carried out at particular sacred sites—archaeological sites, shrines, mountain peaks, springs, and other natural places. Shrines—which can be as simple as a single stone, or as complex as a coursed masonry enclosure—delineate boundaries and mark sacred places.

The Navajo homeland also traditionally is delineated by four sacred mountains: Tsis Naasjini (White Shell Mountain), or Sierra Blanca Peak in south-central Colorado; Tsoodzil (Turquoise Mt), or Mount Taylor in central New Mexico; Doko'oosliid (Abalone Shell Mt), or the San Francisco Peaks in northern Arizona; and Dibe Nitsaa (Big Mountain Sheep), or Mt Hesperus in the La Plata Mountains of southwest Colorado (McPherson 2001:5). Many other high or unusually shaped peaks across the Colorado Plateau are storied places for the Navajo. Hosta Butte, a flat-topped mesa framed through South Gap to the south of Chaco Canyon, is called 'Ak'iih Nást'áni (Mountain Sits On Top of Another Mountain); this is the mythic home of Mirage Boy and Mirage Girl. Huerfano Mountain is a distinctive, ripple-backed, isolated, sandstone mesa on the horizon north of Chaco Canyon. The Navajo call this hogan-shaped mesa Dzilth Ná'oodithlii. It is one of the homes of First Man and First Woman, and it figures prominently in oral history as the place where Changing Woman gave birth to the warrior twins. Shiprock—a dramatically shaped volcanic plug with great fin-like dikes—resembled a clipper ship in European eyes, but the Navajo consider Tsé Bit' a'í to represent a large bird. Cabezon Peak, a knoblike volcanic plug in the Middle Rio Puerco Valley, is the head of a slain giant in Navajo stories (Kelley and Francis 1994; Linford 2000; McPherson 1992,

Indigenous peoples in the Southwest each have an origin story that involves emergence from below followed by migrations to a center place where the people are destined to live (Parsons 1939:215, 230). Archaeological sites mark the path of migration from Zuni's place of emergence in the Grand Canyon to Itiwanna (Ferguson and Hart 1985:20-23). Hopi clans left

their footprints in the form of archaeological sites as they wandered the earth on their migrations (Colwell-Chanthaphonh and Ferguson 2006); at last they arrived at Tuuwanasavi, the center place (Dongoske et al. 1997:603).

Ethnographies and oral traditions provide a wealth of information about indigenous Southwest sacred geographies in the present and the recent past. However, sacred landscapes present challenges for archaeological study. People can interact with sacred places just by knowing about them, telling stories about them, or seeing them. Many storied places are not materially marked at all, or are marked by shrines that consist of one or two stones. Others are signified by formal shrines, rock art, votive deposits, or trails. Buildings and roads sometimes point toward topographic features that carry special meaning. It can be very important to visit sacred places, sometimes leaving offerings (such as turquoise or prayer sticks) or taking materials home (such as salt). Because of the materially subtle and often culturally sensitive nature of sacred geographies, archaeological research into ancient Southwest lansdscapes should be grounded by the direct historical approach.

Appendix III C. Phenomenology

The Chacoan landscape provides a case study that is of great value for scholars interested in theorizing the lived human experience within space and place. In this section we review some of the contemporary anthropological and archaeological literature to illustrate the depth and breadth of these inquiries across the discipline. Much of the potency of spatial experiences for enhancing or challenging power relationships comes from the fact that landscapes are also inherently sensual. Place-making – the construction of a meaningful landscape – involves sound, smell, taste, touch, sight, and emotion. Tuan's (1974) *Topophilia*, today a classic geography text, was the first book of its kind to deal with the aesthetic and sensual dimensions of landscape. Tuan (1974:27) pointed out that spatial experiences can elicit powerful emotions, particularly when multiple senses are involved. Archaeologists are at present working towards archaeologies of the senses, encompassing sights, smells sounds, and tastes (Day 2013; Hamilakis 2013; Houston et al. 2006; Skeates 2010).

Lefebvre (1991:38-46) proposes a useful organizational scheme for thinking about interrelated dimensions of landscape. For Lefebvre, space is a tri-partite concept that includes the material world, spatial representations, and spatial perceptions. Smith (2003:73-75) has helped translate these ideas into archaeological terms. The material world is the archaeologically familiar patterning of sites, features, topography, and resources. These physical landscapes are invested with meaning through representations and perceptions. Spatial representations refer to the ways people draw, describe, and imagine landscape, through art, texts, photographs, maps, or cosmographic schemes – this dimension may be accessible to Southwest archaeologists through rock art, pottery motifs, and Indigenous oral traditions and histories. Spatial perceptions encompass the sensual, emotional, aesthetic dimensions of landscape, involving such archaeological factors as visibility, memory, and iconic symbolism. Investigations into past perceptions pose no small challenge for archaeologists.

With theoretical roots in Bourdieu (1977), Merleau-Ponty (1962), and Heidegger (1962), archaeologists including Ashmore (1989; Ashmore and Knapp 1999) Bender (1993, 1998), Bradley (1998, 2000), Thomas (1996), Tilley (1994), and Van Dyke (2007) have followed the lead of geographers such as Harvey (1989) and Soja (1988, 1996), and anthropologists such as Low (1997; Lawrence and Low 1990) and Basso (1996) to recognize that humans construct meanings through our experiences in places.

Phenomenological archaeologists such as Tilley (1994, 2004, 2008) have used the commonalities in all human spatial perception as a starting point for exploring the ways in which ancient peoples might have experienced landscape and architecture. Phenomenological methods– walking where past peoples walked, experiencing the same sights – are one way to work towards an understanding of past spatial experiences (Brück 2005; Hamilton and Whitehouse 2006; Thomas 2004). Some aspects of the contemporary and the ancient Chacoan spatial experience are likely to be similar. All humans know the world through bodily experience, so all humans share body-relational perceptions such as directionality and scale. Phenomenologically-oriented archaeologists often focus on the visual dimensions of past places (e.g., Barrett and Ko 2009; Brück 2005; Cummings et al. 2002; Cummings and Whittle 2004; Day 2013; Hamilton and Whitehouse 2006; Scarre 2002; Tilley 1994, 2004, 2008, 2010; Van Dyke 2007). Of course, the contemporary archaeological landscape is but a distorted remnant of the ancient landscape, and interpretations of both are and were culturally situated. We can never replicate the perceptions and reactions of past peoples, and we cannot help but bring our own subjectivities to any experience. Nevertheless, phenomenology provides us with one route of ingress into the ideologically charged, complex social and physical landscapes of the past. The on-the-ground perspective afforded by phenomenology can be complemented by regional-scale GIS analyses (Hacigüzeller 2012).

Clearly, ancient Chacoans possessed their own senses of place and bodily experiences of dwelling in the world. For scholars interested in these philosophical and theoretical issues, the Chacoan landscape – where movement, vision, monumental architeture and the cyclical experience of time were of great importance -- offers an ideal laboratory.

Appendix IV: Defining the Chacoan Landscape

Across the greater San Juan Basin's buttes, dunes, and drainages, Chacoans built Bonito style architecture at over 200 outlier communities. The collapsed remains of some outlier great houses, like Red Willow and Whirlwind, form mounded silhouettes against the sky. At others, like Kin Bineola and Kin Ya'a, multistoried sandstone walls rise tenaciously from the basin floor. Often, outliers include great kivas, earthworks and road segments. There is usually (but not always) a surrounding community of 30-40 or more small, domestic sites.

Scholars have long recognized the existence of outliers (Gladwin 1945; Martin 1936; Morris 1939; Roberts 1932), but these extra-canyon communities and their relationships to Chaco remain poorly explored. In the late 1970's and early 1980's, several major survey projects systematically documented outliers across the San Juan Basin (Fowler et al. 1987; Marshall et al. 1979; Marshall and Sofaer 1988; Powers et al. 1983). Today, archaeologists have excavated a handful of outlier great houses, and research is ongoing in a number of communities (Cameron 2002; Irwin-Williams and Shelley 1980; Kantner 2003; Kantner and Mahoney 2000; Pippin 1987), but most outliers remain unexcavated. Outlier great houses and associated Bonito style features are generally well-described, but information for the surrounding communities often tends to be sketchy at best.

The most recent large-scale pedestrian survey of the central Chaco Canyon region was conducted in 1983-1984. This full-coverage survey was conducted in the Chaco Culture National Historical Park for management and research purposes, to inventory cultural resources on new lands added to the park in 1980. The areas surveyed included new lands around Kin Bineola, Kin Klizhin, Chacra Mesa, Upper Kin Klizhin, and the South Addition (Powers and Van Dyke

2015:Figure1.1). Under the direction of Robert Powers, the goal was also to cover any areas previously not surveyed within the 17,000 acres of the park boundaries. Approximately 956 archaeological sites were documented as part of this project. Forty percent of those sites (380 out of 956) were classified as explicitly Chacoan.

As part of the Chaco Culture National Historical Park Museum Collection, the Chaco Research Archive (chacoarchive.org) has digitized significant portions of data created by the Additional Lands Archaeological Survey (ALS). This process included the digitization and transcription of all original site survey forms. The data from the ALS is relevant to the current discussion for multiple reasons. Archaeologists on the ALS project identified 380 Chacoan sites (typically in the Culture/Tradition field on the form). The following site types from the survey were identified as "Chacoan:" Atalayas; Great Houses; Herraduras; Isolated Great Kivas; Petroglyphs; Quarries; Roads; Stone Circles; Shrines. This variety of site type classifications provide one method of identifying specific archaeological features of the Greater Chaco Landscape.

Classification of material features clearly poses a challenge in itself. In what follows, we sort the material traces of Chaco across the landscape to include great houses, great kivas, earthworks, roads, shrines, and rock art. In **Appendix IV**, we provide a brief review of what we know, and what we don't know, about these features. **Appendix IVA** consists of a list of known Chaco outliers, and illustrates how few of them have been intensively investigated. **Appendix IVB** provides examples of the range of outlier diversity. In **Appendix IVC** we discuss Chaco roads, in **Appendix IVD** shrines and in **Appendix IVE**, rock art.

Appendix IVA: An Outlier List and Map Example

The following list of 230 known Chaco outliers was compiled from Van Dyke et al.'s (2016) database, available from Van Dyke et al. in GIS and GoogleEarth formats. This list does not include great houses within "downtown" Chaco Canyon. Cursory maps exist of all of the great houses, but the range of additional work is highly variable. Most communities remain largely unexplored. To give some sense of just how much work remains to be done, we have noted where archaeologists have excavated some portion of outlier great houses (E), and/or where they have conducted intensive survey (S). Out of n=230, we have excavation data from 23 outlier great houses (10%) and intensive survey coverage of 32 communities (13%); both kinds of data are available for only 11 out of 230 outliers (5%). In quantitative terms, then, our lack of knowledge about the Chaco landscape far exceeds our knowledge.

Site Name	**Site Number(s)**	**Significant Research?** E = great house excav S = community survey	**Google Earth Visible?**
10-Acre Ruin	42SA7217		X
5-Acre Ruin			X
Albert Porter	5MT123		X
Allentown	NA 4119	E	X
Andrews	LA 17218	S	X
Ansell Hall			X
Antelope House			X

Arch Canyon	42SA5271		X
Atsee Nitsaa	LA 1507		X
AZ K:3:I3-2			X
AZ P:16:160	AZ P:16:160		X
Aztec	LA 45, LA 5603	E, S	X
Bad Dog Ridge	AZ P:36:44		X
Badger Springs			
Bean Patch	AZ Q:8:12		
Bee Burrow	LA 13163		X
Bent Knee Wash			X
Bis sa'ani		E	X
Black Creek Flats			
Black Mesa Ruin			X
Blackrock Gaddy			X
Blue J	LA 18795	E, S	X
Bluewater Spring			
Bluff	42SA22674		X
Bosson Wash	LA 61165		X
Burnt Corn	AZ J:58:62		
Canyon Butte			X
Carhart Ruin		E	X
Carvell Ruin			X
Casa Cielo	LA 17081		X
Casa del Rio	LA 17221	S	X
Casa Escondida	LA 5334		X
Casa Estrella			X
Casa Mosca	LA 1341		X
Casa Negra	5MT3925		X
Casa Patricio	LA 34208		
Casamero	LA 8779	E, S	X
Cerro Pomo	LA 31803		X
Cerro Prieto	LA 48656		X
Chaco East	29MC560	S	X
Chambers/Padre Mesa	AZ P:53:83		X
Chimney Rock	5AA83	E, S	X
Church Rock	LA 47123		X
Coalbed Village	42SA920		X
Comb Wash	42SA24756		
Coolidge	LA 17289		
Cottonwood Falls	42SA5222		X

Cottonwood Seep	LA 14762		X
Cove	AZ I:26:44	S	
Cox Ranch Pueblo	LA 13681	E, S	X
Coyotes Sing Here			X
Crumbled House			X
Cuatro Payasos	LA 25903		X
Dalton Pass			X
Dancing Rocks	AZ E:6:30		
Danson 202	LA 56160		
Decker Ruin	42SA16962		X
Deer Springs	LA 47858		X
Devil's Highway			
Dittert Ranch	LA 11723		X
Dye Brush/Dzil Nda Kai			
Eagle Crag			X
Eagle Nest	CGP 652		
Edge of the Cedars	42SA700	E	X
El Malpais	LA 685	E	
El Rito			X
Escalante	5MT2149	E, S	X
Escalon	LA 51152, LA 51153		X
Et Al. Site			X
Far View House	5MV808	E, S	X
Fenced-Up Horse Canyon	LA 16279		X
Figueredo	LA 2024		X
Fort Defiance			X
Fort Wingate	LA 2690		X
Ganado			
Garcia Ranch	AZ Q:8:5		X
Goesling Ranch	LA 4026		X
Gonzales Well	LA 49192		
Greasewood Flat	42SA18100		X
Greasy Hill	LA 42282		X
Great Bend	LA 6419		X
Great Bend West	LA 6420		X
Great Houselet	AZ P:61:186		
Greenlee	LA 35418		X
Grey Hill Spring	LA 18244		X

Grey Ridge			
Guadalupe	LA 2757	E, S	X
H-Spear			X
Halfway House			
Hammond Canyon	42SA23616		
Hartman Draw	5MT8888		
Haynie	5MT1905		X
Haystack	LA 6022, LA 12573A		X
Hedley Ruin	42SA22760		
Hinkson Ranch	LA 11439, NM M:1:6-32, Spier 169		X
Hogback			X
Holmes Group	LA 1916		X
Houck	LA 8440		X
Hubble Corner	LA 8112		
Hunter's Point	AZ P:25:1		X
Hurley Site	LA 10959		X
Ida Jean	5MT4126	E	X
Indian Creek: Casa Abajo	LA 17083		X
Indian Creek: Casa Chiquita	29SJ1167		X
Jackrabbit Ruin			X
Jackson Lake	LA 1921		X
Jacquez	LA 2609		X
JR's Entremetido	LA 78187		X
Kello Blancett	LA 59967		
Kin Bineola	LA 18705	S	X
Kin Cheops	LA 48030		X
Kin Henio	LA 51448		X
Kin Hocho'i	LA 6541	S	X
Kin Indian Ruin	29SJ402, LA 40402		X
Kin Klizhin	LA 4975	S	X
Kin Lichee	LA 8022		
Kin Niiyahk'eed			X
Kin Nizhoni (Lower)	LA 68896		X
Kin Nizhoni (Upper)		S	X
Kin Sani A			
Kin Tl'iish	LA 68896		X
Kin Trinklebert	AZ P:62:21		X

Kin Ya'a		S	X
LA 11670	LA 11670		
LA 17226	LA 17226; LA 10716		
LA 17257	LA 17257		
LA 2520	LA 2520		X
LA 38012	LA 38012		
LA 38113	LA 38113		X
LA 40081	29MC184, LA 40081		
LA 4030	LA 4030		
LA 59282	LA 59282		X
LA 72343	LA 72343		X
LA 8240	LA 8240		
LA 8620	LA 8620		X
La Plata	LA 39112		X
Lake Valley/Kin Lani	LA 18755		X
Lancaster	5MT4803; 5MT3805		X
Largo Gap	LA 3918		X
Las Ventanas/Candelaria	LA 1328	S	X
Los Gigantes	LA 56159	S	
Lower Greenlee	LA 35419		X
Lowry/Pigg	5MT1566, 5MT839	E, S	X
Lukachukai			X
Mac-Stod			X
McCarty's GH			X
McCreery	AZ K:13:41		X
Mesa Tierra	LA 17220		X
Mitten Rock			X
Moki Island Unit 8	42SA17347		X
Montezuma Bench	42SA5034		X
Montezuma Creek	42SA822		
Morefield Canyon	5MV1928, 5MV1927,5MV1067		X
Morris 20	Morris 20		
Morris 39			X
Morris 41			X
Morris' Old Fort	LA 61051		X

Mud Springs--Northern San Juan	5MT4466A		X
Mud Tank			
Muddy Water	LA 10716		
Nancy Patterson	42SA2110	E	X
Naschitti A & B	LA 14779, LA 14780		X
Navajo North	AZ P:52:32		
Navajo South	AZ P:61:224		
Navajo Springs	AZ P:53:43	S	X
Newcomb			X
North Pasture	LA 11651		
Oak Wash	LA 49800, NM 12:K3:101		
Owen Site	42SA24584		
Padilla Well	LA 40352	S	X
Parker Site			
Peach Springs		S	X
Pierre's A & B	LA 16508, LA 16509	S	X
Point Pueblo		E, S	X
Pueblo Cerrito	LA 11663		X
Pueblo Pintado	LA 574	S	X
Ram Mesa	LA 89484		X
Raton Well	LA 14354		
Red Knobs	42SA259		X
Red Pottery Mound	5MT2363		X
Red Willow		S	X
Redonda	LA 20520		
Reservoir Ruin	LA 15278, CM100		X
Reservoir--Northern San Juan	5MT4450		X
Rocky Point	AZ K:15:21		
Round Rock	AZ I:37:9		X
Salina Springs	AZ I:63:9		X
Sally's Site 17			
Salmon	LA 8846	E	X
San Mateo			X
Sanders	AZ K:15:16		
Sanostee	LA 7292		X
Skull Site	LA 11664		

Skunk Springs		S	X
Spier 81	ZAP-NM-12-J3-147		X
Squaw Springs/Morris 40			
Standing Rock	LA 18232		
Sterling		E, S	X
Sundown	LA 9093		
Sunrise Spring	LA 2358		X
Swamp Tank	AZ P:61:185-NN		
Teec Nos Pos	AZ I:8:23		X
The Twins NE & SW			X
This Isn't It			
Three Kiva Ruin	42SA863		X
Tocito	LA 7603		
Toh Lakai			X
Toms Rock			X
Toyee	AZ P:15:23		X
Tse Bee Kintso/Thoreau	LA 51382		X
Tse Chizzi			
Tse La Vie	LA 35623		
Tse Lichii	LA 35421		X
Tse Taak'a			
Tseyatoh			X
Tsintaa Yitilii			X
Twin Angels	LA 5642	E	X
Twin Lakes			X
Upper Kin Klizhin	LA 34245		X
Ute Gravel Pit			
Village of the Great Kivas		E	X
Wallace Ruin	5MT6970	E	X
Weber Canyon	MV155		
Whirlwind Lake	LA 18237	S	X
White House			X
Willow Canyon	LA 18235	S	X
Wolye Adin	LA 47505		X
Woosh Clo Dee Toh			
Yellow Jacket	5MT5	E	X
Yucca House	5MT4359	S	X

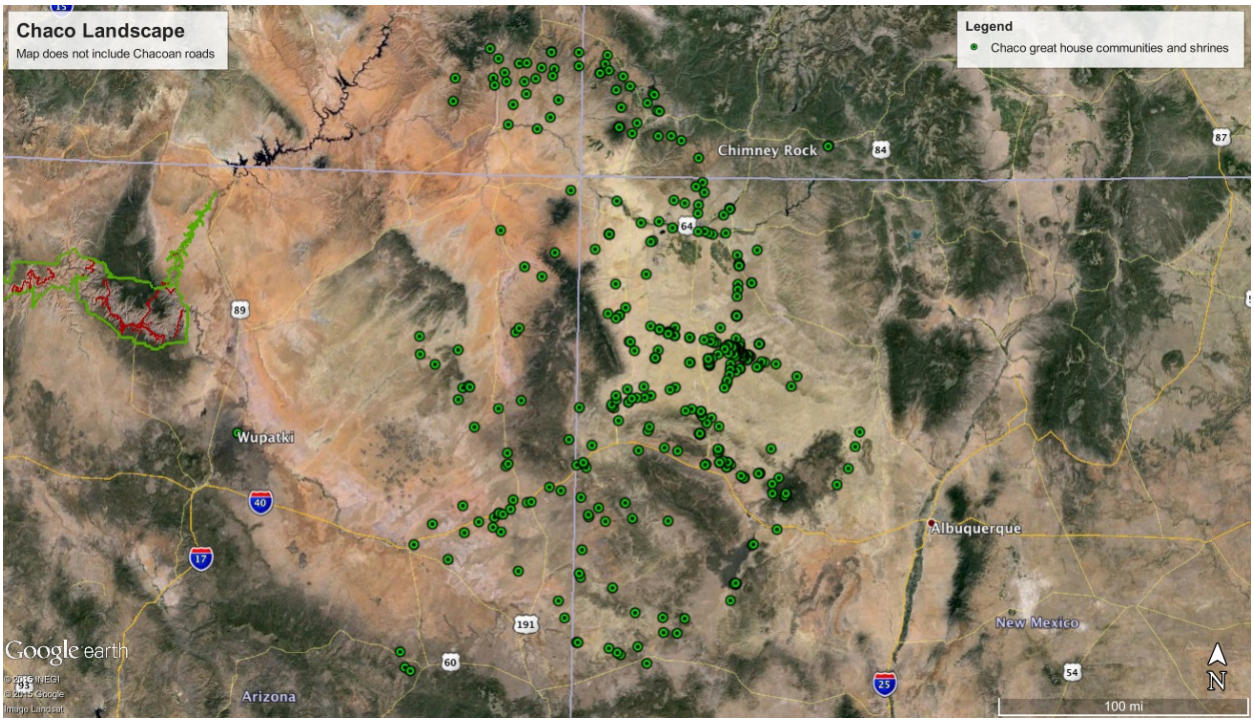

Figure IVA.1 Example of map generated by on-going GIS reconciliation, University of Nebraska, July 22-25, 2015

Appendix IVB: Examples of Outlier Diversity

Although all Classic Bonito outliers contain some kind of Bonito style architecture, they are tremendously variable in terms of such things as great house sizes, number of rooms, and locations, great kiva numbers and locations, and configurations of additional features such as roads or earthworks. Surface ceramics and architecture tell us that in some instances, eleventh century people constructed Bonito style architecture in a pre-existing community. In others, people erected new outlier great houses in previously unoccupied places. Some of these people were probably colonists from Chaco, some were locals emulating Chaco, and sometimes both colonists and locals were involved. Archaeologists have spilled much ink over the past decade in an attempt to understand these relationships (e.g., Hurst 2000; Kantner 2003a; Reed 2008; Van Dyke 1999b, 2003). Here, we demonstrate the range the variability amongst great house communities through the following examples: Peach Springs (a textbook outlier); Skunk Springs (a sprawling community with a deep history); Andrews & Casamero (ancestral and scion communities); Escalon (Bonito-style architecture without a community); and Section 8 (a black box). We believe this sample is representative of the overall variability evident in the greater Chaco landscape and argue against using a "one size fits all" approach to great house site protection buffer zones. Peach Springs is the only one of these for which one could draw a circle a mile in diameter around the great house and catch most of the associated significant Chacoan landscape.

Peach Springs is a good example of an outlier community with all the characteristic features contained within a relatively circular area 1 mile in diameter (Powers et al. 1983:55-93; Gilpin and Purcell 2000). Peach Springs is located on the South Chaco slope near a spring along the foothills of Lobo Mesa, on the Navajo Nation. On a sandstone ridge just south of the spring, eleventh century builders erected a formal, Classic Bonito great house with an adjacent great kiva, and an encircling berm. There is a surrounding community of 25 small sites, as well as an associated road segment. Although Peach Springs is unexcavated, looters have exposed Type 1 masonry walls at the rear of the great house, indicating the structure's tenth century origins.

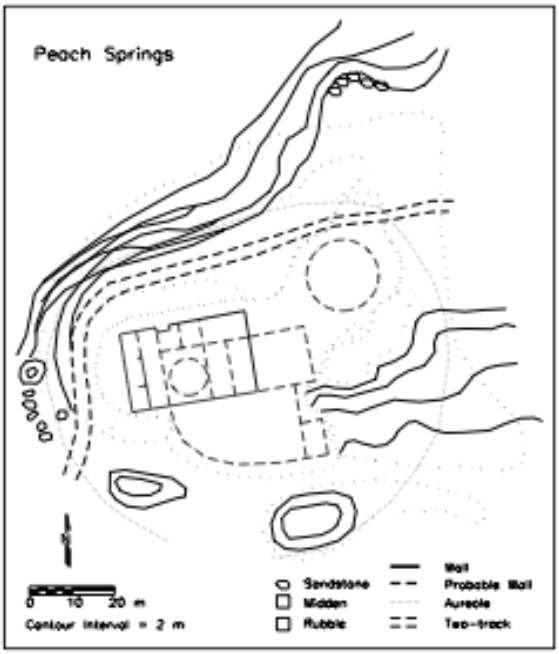

Figure IVB1. Peach Springs Great house, after Powers et al. (1983:70, Figure 23), drafted by Molly O'Halloran.

Powers et al. (1983) surveyed over an area 1 km in diameter surrounding the great house and found most of the community along the drainages to the north and west. Many of the community sites have occupations that extend back into the tenth century. Powers et al. also sampled the greater area for another kilometer beyond their survey radius, as shown in their map below. They were able to demonstrate that most of the associated community was "captured" within the 1 km area around the great house.

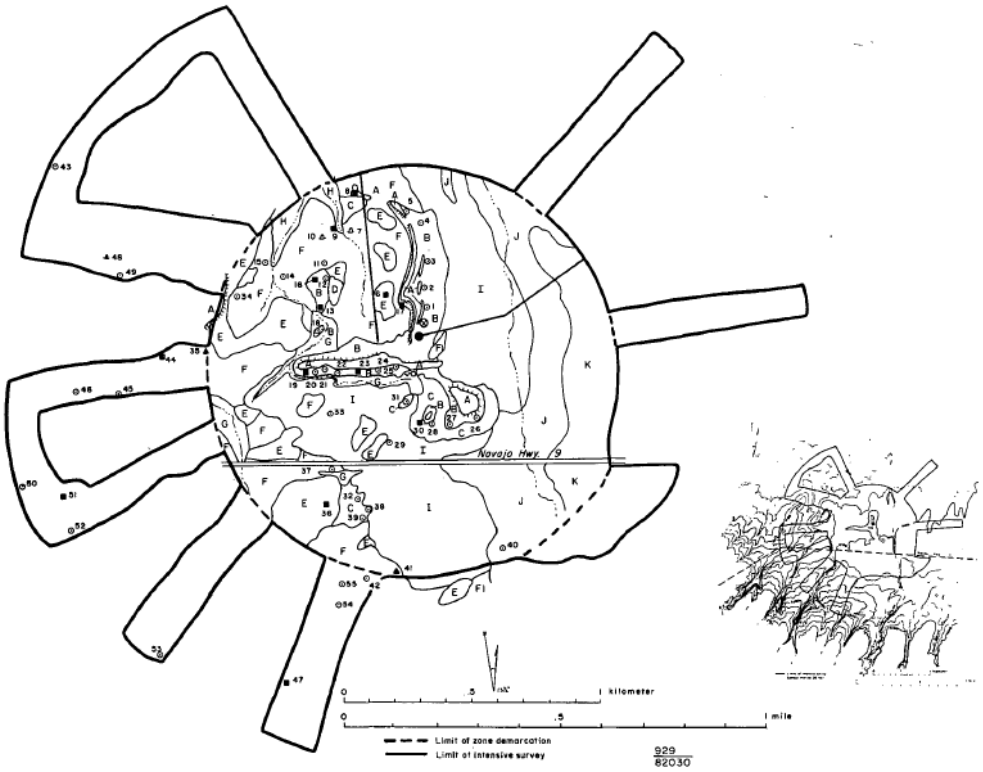

Figure IVB2. Powers et al.'s (1983:57, Figure 21) Peach Springs community survey area.

Skunk Springs is a good example of a sprawling outlier community with a large, multi-component great house and an occupation spanning at least three centuries. Skunk Springs is located on a broad mesa top along the eastern slopes of the Chuska Mountains approximately 75 km west/northwest of Chaco Canyon. Peckham (1969) initially mapped the community. It was revisited and the great house re-mapped by Marshall et al. (1979:109-113) and again by Stein and Friedman for the Chaco Protection Sites project (but we do not have access to these data). The great house is located on the mesa top near the eastern end of the community. The great house exhibits at least three construction phases; all three sections together cover an area of approximately 2670 m^2 but they are not contemporaneous.

The western, Early Bonito phase portion of the great house consists of a crescent shaped, 20-room block associated with a 16 m diameter great kiva in the center of an open plaza. The central and east portions date to the Pueblo II - Early Pueblo III periods. The central section of the house contains approximately 10 rooms and 2 enclosed kivas in a T or irregular shape. Some of the rooms may have been two stories in height. An enclosed plaza south of the central section has walls ranging in thickness from 60 cm to 2 m. The plaza contains a great kiva 17 m in diameter and has an entryway facing south. The east section of the house consists of a linear block 2-4 rooms wide with an associated enclosed plaza and a 11 m diameter great kiva. This area is estimated to contain 20 ground floor rooms and 12 second story rooms. The plaza is surrounded by a wall 1.5 m thick and has an entryway facing south.

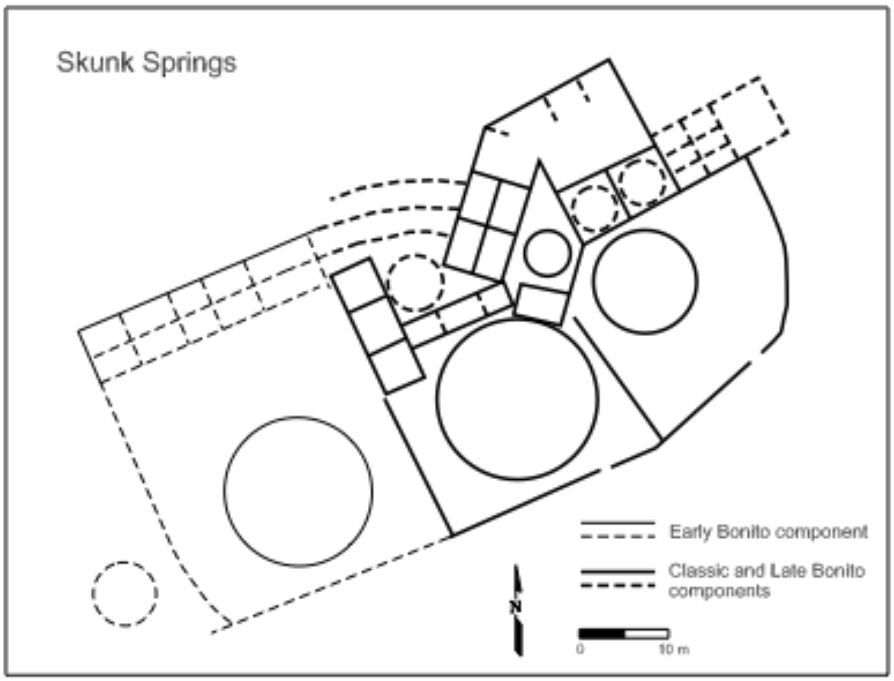

Figure IVB3. Skunk Springs great house, after Marshall et al. (1979:112); drafted by Molly O'Halloran.

The Skunk Springs great house is located near the east end of a community of at least 65 sites which extend southwest along the top of the mesa and cover a 1.3 km2 area. Sites in the community are ceramically dated between the Basketmaker III and the Pueblo III periods. Seventeen of the sites are assigned to a single temporal period, and 49 have date ranges that span more than one period. Among the 65 community sites, there are a total of 4 Basketmaker III components, 50 Pueblo I components, 53 Pueblo II components, and 12 Pueblo III components. Stein and Friedman have reportedly also documented road segments in and around the community.

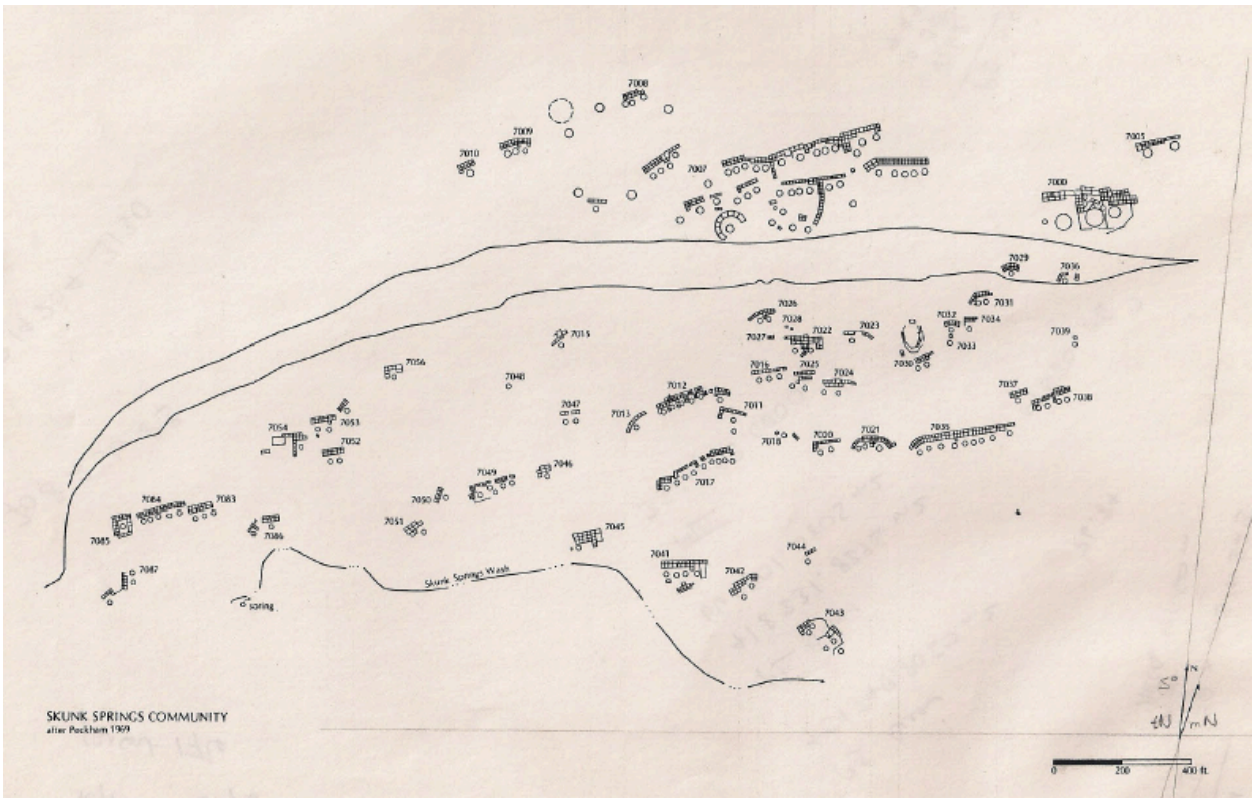

Figure IVB4. Skunk Springs community (Marshall et al. 1979:110).

Andrews & Casamero are good examples of a complicated outlier landscape that is not well-represented in either time or space by a circle around a great house. These two outliers are located in the Red Mesa Valley approximately 75 km south of Chaco Canyon. The Andrews and Casamero great houses are about 5 km apart, facing one another across the Casamero Draw. Both are situated on colluvial ridges near the base of escarpments with highly visible features. Both great houses are on lands owned by the BLM, but the land status of the surrounding communities is checkerboarded with state and private ownership. Intensive survey in both surrounding communities have yielded a complicated picture of the two communities' time depth, relationship to one another, and relationship to Chaco. A Late Basketmaker and Pueblo I settlement above Casamero gave rise to Early Bonito phase settlement at Andrews. The surrounding topography at Andrews dictated that the community spread south and west into the associated valley, rather than radiating outwards in a circle as at Peach Springs. Eleventh century people built Classic Bonito great houses at both Andrews and Casamero, with community sites and a road segment in the valley between them, and a reservoir on the mesa above Andrews.

The Casamero great house (LA 8779) was excavated by a group of avocational archaeologists in the early 1980s (Sigleo 1981). The great house and the surrounding community were investigated by Marshall et al. (1979:131-140) and were intensively surveyed by the Office of Contract Archeology (OCA) of the University of New Mexico (Harper et al. 1988). The L-shaped great house is located on a southeast-facing slope below a reddish sandstone escarpment on the west side of the broad valley drained by Casamero Draw. Two

large wind-carved depressions in the reddish sandstone escarpment – resembling owl eyes – have lent the name Tecolote Mesa (Owl Mesa) to the landform above the great house. The great house ground floor contains at least 20 rooms and a single kiva; an additional nine rooms may have been present in a second story. Both core-and-veneer and compound masonry construction techniques were employed. Walls were constructed using local limestone and sandstone and exhibit banded facing (Sigleo 1981:2-3). A great kiva with a diameter of 21 m is located 65 m south of the great house (Marshall et al. 1979:134). A second great kiva (LA 67158) with a diameter of 18 m was identified 75 m north of the great house (Harper et al. 1988). The Casamero great house and the great kivas date to the eleventh century (Neller 1978:24, cited in Marshall et al. 1979:133; Harper et al. 1988). Harper et al. (1988) recorded 36 sites, including 23 roomblocks, 12 artifact scatters, and 1 rockshelter in the surrounding community, ranging in age from the Basketmaker III to the Early Pueblo III periods.

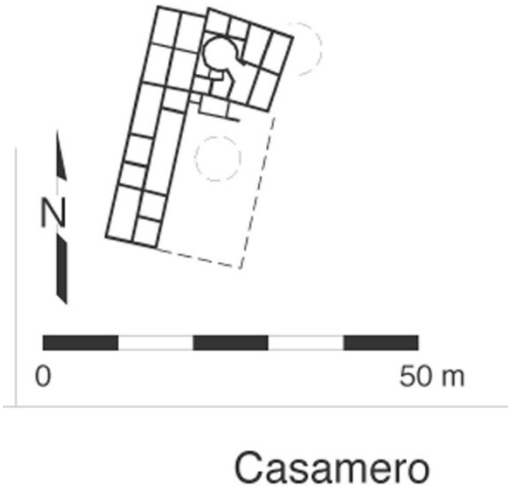

Figure IVB5. Casamero great house.

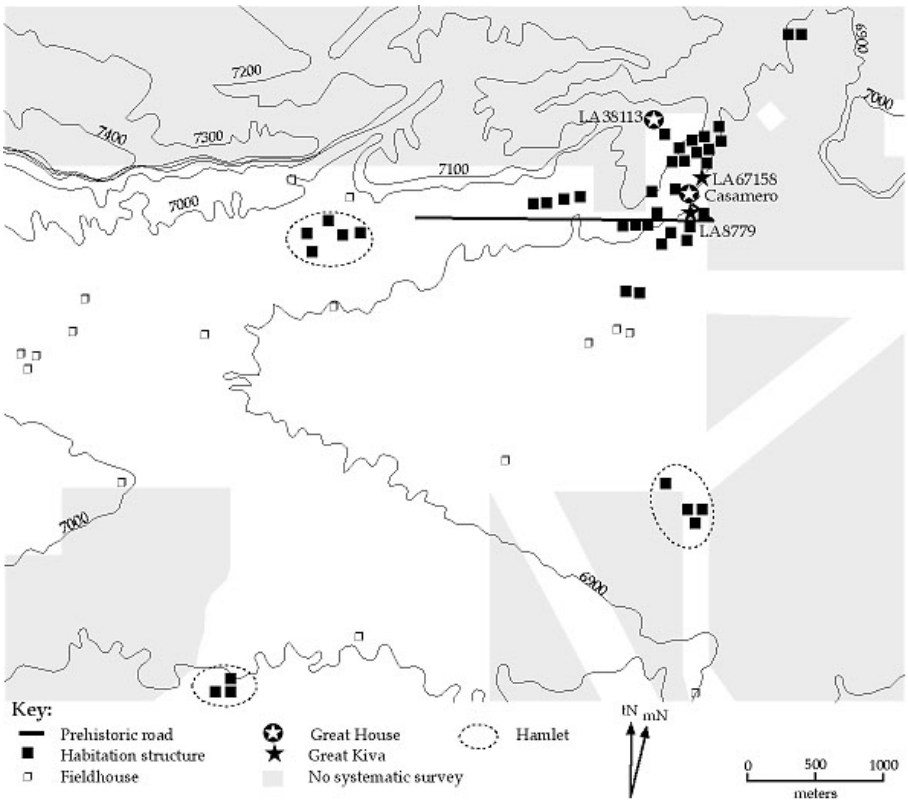

Figure IVB6. Casamero community map

The Andrews community was initially recorded by Marshall et al. (1979) and then by Van Dyke (1999, 2000). During the tenth century, Andrews was an insular community clustered around two great kivas along a series of finger ridges at the base of an unnamed mesa. In the early 1000s, inhabitants erected a great house and a new, Bonito style great kiva on a colluvial ridge northwest of the tenth century great kivas (Van Dyke 1999a). Like the Casamero great house, the Andrews great house was positioned directly below a highly visible geologic juncture in the mesa behind it. Here, smooth red Wingate sandstone meets the blocky brown sandstone of the Entrada formation, and this disjuncture enhances the local visibility of the great house. The Andrews great house, with two stories and 20 rooms, is not particularly large compared to canyon great houses, yet it dwarfs the local small sites. Some 40 community sites, dating from the late ninth through the late eleventh century, are dispersed across 2-3 km of valley floor to the southwest of the great house. The average small site at Andrews is one story high with 4-6 rooms. There are no small habitation sites on the mesa above Andrews, but there are artifact scatters and architectural features indicating Chaco-era occupation. A stone circle (LA 13801) is positioned directly above one of the great kivas. From this spot, a "floating" road segment in the valley below is on a direct line between the stone circle and Hosta Butte (Nials et al. 1987). Ancient inhabitants modified a bedrock fault to create a large rectangular reservoir on the mesa top that is littered with whiteware jar sherds. Rock art and pot drops in the vicinity attest to historic use of the community by Acoma and Navajo peoples.

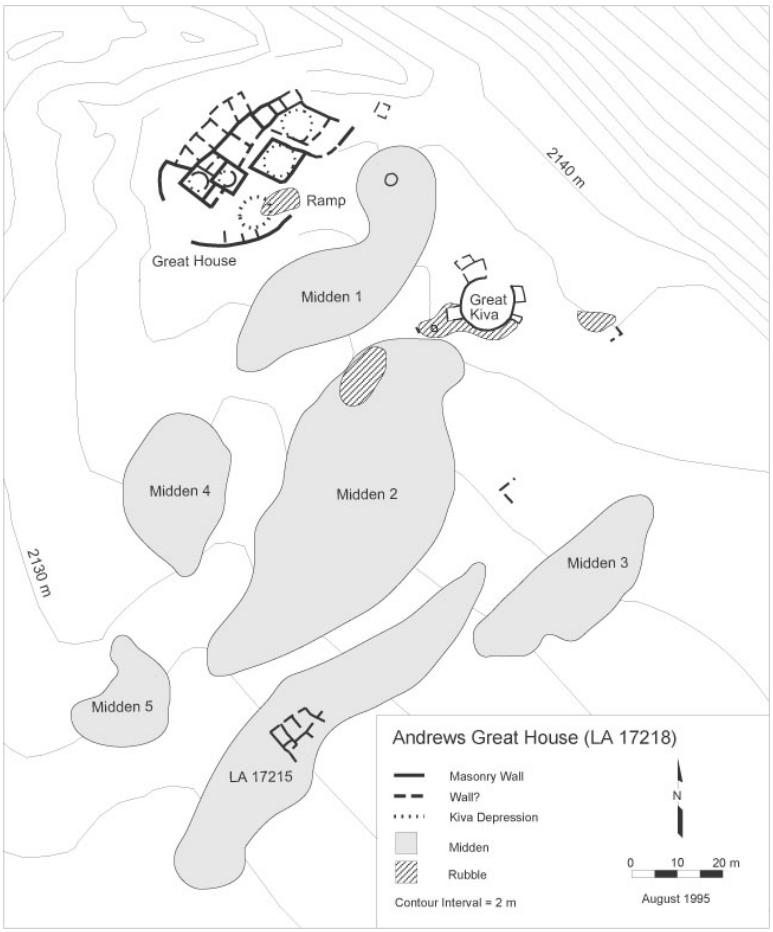

Figure IVB7. Andrews Classic Bonito phase great house and associated great kiva (Van Dyke 1999).

Escalon is an example of an eccentric outlier. Located in the badlands of the Indian Creek drainage, 35 km west of Chaco, Escalon was first documented in 1984 (Marshall and Sofaer 1988:46-70). An associated Chacoan road segment, the Escalon West Road, was recorded by the Division of Conservation Archaeology (Hancock 1990). Escalon and a nearby, earlier community of El Llano was investigated as part of the Transwestern Pipeline Extension project in 1992 (Marshall 1994). The focus of Escalon is a tall, mushroom-shaped butte. Atop the butte, there is an "atalaya" – a series of 14 compound or core-and-veneer masonry enclosures. Rather than using a ladder or hand-and-toe holds to access the top, builders constructed a massive platform and stairway complex 8-10 m high against the south face of the butte. This massive stairway lends the outlier its name. Platform and stairway complexes are known from other Chacoan locations (Marshall and Sofaer 1988), but Escalon offers the best-preserved example found to date. Marshall believes processions may have been staged to proceed up the stairway. However, any activities taking place atop the butte would have been hidden from the view of spectators immediately below by the steep angle of the butte's edge.

< Figure IVBX. Escalon Atalaya, with person standing on lower reach of massive collapsed staircase. Photo by Ruth Van Dyke.

On the valley floor, a small, single-storied core-and-veneer great house consists of 6 large rooms and an attached great kiva. An additional four to six rooms may have been present on the east side of the roomblock, but the stone appears to have been removed in the past, possibly for use in historic Navajo buildings in the area. The great house and the atalaya are ceramically dated by Marshall to ca. A.D. 1000-1050. The El Llano community, 2 km southeast of Escalon, dates to the Basketmaker III and Pueblo I periods Marshall (1994:323-324, Table 44). By the Early Pueblo II period, the focus of settlement had shifted to the Escalon community, with 13 small house sites dating between A.D. 1000-1050. A relatively low average midden volume at Escalon is interpreted by Marshall (1994:347) to indicate a short occupation span for the sites in the community. Occupation ceased at Escalon by A.D. 1075, although three Pueblo III sites in the neighborhood post-date A.D. 1175.

The Escalon community is associated with a Chacoan road segment extending 4 km west from Escalon to the Willow Canyon community (Hancock 1990). The Escalon atalaya and stairway complex may be the eastern end or a station along this road. Ceramics found along the road date to the Late Pueblo I and Early Pueblo II periods. The road's presence suggests that "the summit of Escalon Butte can be considered to be an important location in the sacred geography of Chacoan Anasazi" (Marshall 1994:347). Research into these kinds of odd, highly visible Chacoan structures along the west road corridor is ongoing (Tuwaletstiwa and Marshall, personal communication, August 2014).

Section 8 is a good example of a “black box” outlier – we know it exists, but there is a great deal that we do not know about it, thus requiring further research. Marshall et al. (1979:227-229) documented Section 8 on Navajo Nation land. They described and mapped this outlier as a small great house with two roughly symmetrical roomblocks with enclosed kivas, connected by something they termed an “elevated passageway.” They ceramically dated the site to 1050-1125. They did not identify an associated community, but they did note a possible road segment. Marshall et al. also noted that Section 8 might be the same site that Fewkes (1917) had described as Ruin B near Crown Point; the topographic description roughly matches Section 8, but Fewkes’ map does not. Marshall et al. conclude that there are issues here that cannot be resolved “until an adequate reconnaissance of the Crownpoint region is conducted” (Marshall et al. 1979:229).

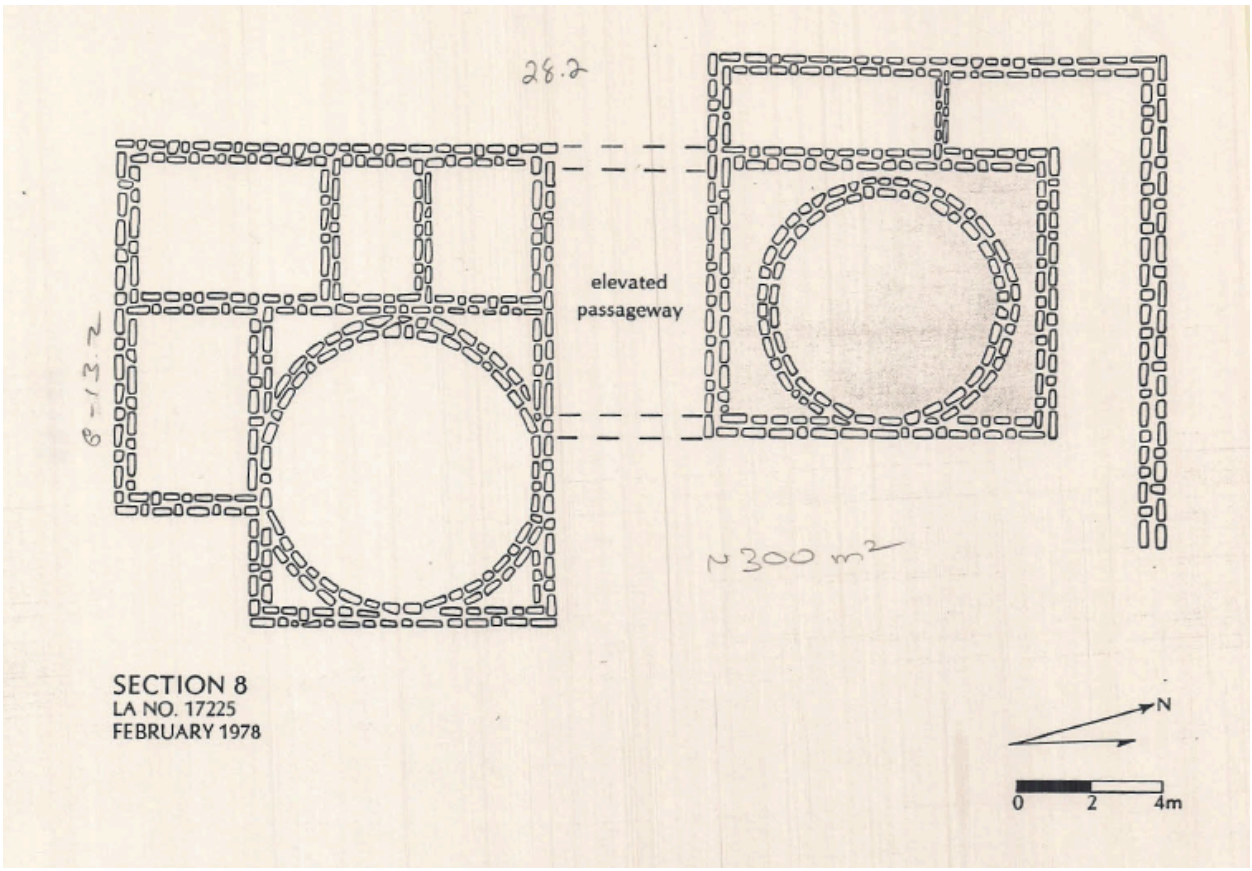

Figure IVBX. Section 8 great house (Marshall et al. 1979: 228).

Appendix IVC: Roads

Chaco roads consist of cleared, linear alignments radiating out from great houses or landscape features, sometimes but not always connecting sites and/or prominent landforms. Road construction minimally involved the clearing of stones and earth out of the roadbeds. Much of what we currently know about Chaco roads is the result of ground-verification efforts by the BLM (Kincaid 1983; Nials et al. 1987). Chacoan engineers sometimes created staircases, causeways, ramps, and grooves. Formal surfacing is rare, and road depressions may be as shallow as 30 cm. Roads usually average about 9 m wide, but width can range from 3 to 12 m. Wide, major segments sometimes split into narrow "spur roads." Major directional changes are angular and occur at points of topographic change, intersections, or sites. Alignments could have been maintained with simple survey techniques such as backsighting (Lekson 1999:117-118; Nials 1983:6-27). Road-related features include herraduras and shrines. Herraduras are a road-related feature often found atop major topographic breaks with good visibility. These horseshoe shaped, low-walled masonry structures range from 5-7 m in diameter and open to the east (Lekson 1999:117-118; Nials et al. 1987). J-shaped "Windes' shrines" also are often found along Chacoan roads (Kincaid et al. 1983:20; Windes 1991:118).

Roads are notoriously difficult to date – the best methods involve absolute dates gleaned from articulated endpoints such as great houses (Vivian 1997b:14). Although some scholars believe Chacoans were experimenting with roads during the Pueblo I period (e.g., Windes 2006), most indications are that road construction began in earnest in the Classic Bonito phase. In the canyon, despite the effects of ranching, erosion, and other recent disturbances, road segments are associated with all Classic Bonito phase canyon great houses (Vivian 1983, 1997b). Windes (1987:529-555) determined that 14 segments in Chaco Canyon date between 1050 and 1140. At least eight road segments extend outward from Chaco Canyon (Vivian 1997b). The two major road segments – the North Road, and the South Road – meet at Chaco Canyon as center place. Roney (1992) confirmed approximately 305 km of ground-verifiable Chacoan roads and road segments at 41 locations across the San Juan Basin. The four longest segments verified by Roney are the North Road (50.5 km), the South Road (51.0 km), the Ah-Shi-Sle-Pah Road (11.5 km), and the Coyote Canyon Road (11.5 km). The first three radiate out from Chaco Canyon, and the latter connects the Peach Springs outlier to the Grey Ridge community (Figure 6.3). Many road segments originate or terminate at great houses or great kivas, then disappear into difficult terrain.

The idea of transportation is embedded in the very term "road." Many archaeologists assume that the roads functioned to facilitate travel for economic, ritual, or political purposes (e.g., Judge 1979; Judge et al. 1981; Powers et al. 1983:262; Schelberg 1984; Vivian 1983; Wilcox 1993). The roads' relatively compacted surfaces provide easier walking than the stabilized dunes that comprise much of the basin floor. We often think of Chaco roads as extending outward, connecting Chaco Canyon to surrounding outlier communities. However, it is equally likely that the roads were important connections moving inward, prescribing formal routes of access for visitors and pilgrims into Chaco Canyon. The tracks may have been used for ceremonial races or ritual processions (Judd 1954:350; Judge 1989). Roads were particularly likely to have been used as routes of travel at the final stage of approach to Chaco and to outlying great houses, where they are best elaborated. The roads condition approaches to Chaco Canyon and to specific buildings both within and outside of the canyon (Ware and Gumerman

1977). Roads may have been yet another way Chacoan leaders manipulated the landscape, prescribing access routes that directed visitors towards specific spatial experiences.

The North Road constitutes the best evidence for a Chacoan concern with cardinal directions (Lekson 1999; Marshall 1997; Marshall and Sofaer 1988; Sofaer et al. 1989; Sofaer 1999). The North Road bears north from Chaco for 50.5 km, extending from Pueblo Alto past the outliers of Pierre's and Halfway House to the badlands at the edge of Kutz Canyon, where there is an earth and juniper log stairway (Stein 1983; Sofaer et al. 1989:367-368). En route, there are a number of jogs, gaps, and parallel segments. Upper Twin Angels mound, a prominent, symmetrically shaped pinnacle topped with a shrine, is nearby (Sofaer et al. 1989), and the Late Bonito phase Twin Angels outlier is on the canyon rim 6.5 km to the northwest (Carlson 1966).

From this point, the North Road probably continued down Kutz Canyon to the outlier of Salmon Ruin on the San Juan River, then headed north from Salmon Ruin to the Aztec outlier on the Animas River (Lekson 1999; Stein and McKenna 1988). The North Road as a link from Chaco Canyon to Aztec is a major lynchpin of Lekson's (1999) argument in *Chaco Meridian*. Sadly, energy development in the 20th century has destroyed virtually any traces of the North Road between Kutz Canyon and Aztec. And, the areas around Salmon and Aztec have been heavily farmed and otherwise modified over the past century, potentially obliterating road evidence there.

The North Road is also considered a symbolic statement of the importance of the direction north for Chacoans. Keresan emergence stories describe a sipapu to the north, where the people came forth into this world. The people then migrated south to find the center place (White 1942:177, 1960:89). For Hopi, a road to the sipapu represents life's journey. Infant souls travel along this path from the sipapu to the center place at birth, and souls return along this path to the sipapu at death (Parsons 1939:310). At Acoma, offerings that represent the soul of a deceased person are deposited in a canyon or crevice in the north (White 1973 [1932]:137). Building upon these ideas, Marshall (1997) and Sofaer et al. (1989) have interpreted the North Road as a symbolic pathway linking Chaco Canyon, and more specifically Pueblo Alto, with a place of emergence represented by or near Kutz Canyon or the San Juan Mountains beyond.

In dualistic balance with the North Road, the South Road extends for 51 km from Chaco Canyon south-southwest toward the Dutton Plateau. The BLM Roads project traced a total of 39 km along the South Road, beginning just south of the park service boundary and extending past Bee Burrow and Kin Ya'a. The South Road stops 5 km short of Hosta Butte, a prominent landmark on the southern horizon rising 300 m above the Dutton Plateau (Marshall 1997:71; Nials et al. 1987:18). More important than creating a true southerly orientation may have been the desire to symbolically connect the canyon with Hosta Butte.

Many scholars, especially Marshall (1997), Sofaer (Sofaer 1999; Sofaer et al. 1989), and Lekson (1999) have recognized that the North and South Roads not only express a Chacoan concern with directionality but also fix Chaco Canyon as a center place. The Great North and the South Road counterpose not only north and south, but also the subterranean and the vertical (Marshall 1997:71). The North Road begins at a high place – Pueblo Alto, on the north rim of Chaco Canyon – and leads to a low place – Kutz Canyon. By contrast, the South Road begins at a low place – Pueblo del Arroyo, on the floor of Chaco Canyon – and leads to a high place – Hosta Butte. Not only do the two roads form opposing pairs of north/south and down/up, they are of equal length, balancing the canyon like a fulcrum between them, intersecting at Chaco Canyon – the center place.

Some evidence exists for East and West roads. An East Road may have run down the length of the canyon for approximately 25 km from Fajada Butte to Pueblo Pintado (Windes et al. 2000:42-43). A West Road is represented by short segments near Peñasco Blanco and the outliers of Lake Valley and Escalon (Hancock 1990; Nials et al. 1987; Windes (1987:97); research into the West Road is ongoing (Tuwaletstiwa, personal communication).

Other road segments connect Chaco Canyon to unusual landforms or springs (Sofaer et al. 1989). The 11.5 km-long Ah-shi-sle-pah Road originates at Peñasco Blanco (Stein 1983; Nials et al. 1987:120-126). A stairway leads north into the Chaco/Escavada Wash confluence below Peñasco Blanco, and a matching modified path known as Vivian's Staircase climbs up the north side of the confluence. From the north rim of the wash, a road extends to a series of bedrock tanks (Los Aguages), then can be traced through sherd scatters over slickrock to a masonry ramp descending into Ah-shi-sle-pah Wash. An additional 2 km are visible past this point, and the northern terminus of the road is thought to be a shrine-like site at Black Lake (Marshall and Sofaer 1988; Roney 1992).

For the past several years, a team of researchers led by John Roney and Anna Sofaer have been investigating and documenting road segments across the San Juan Basin using a combination of LiDAR and other photogrammetry techniques. Sofaer is working on a new film focused on the roads. Initial, unpublished results from the work of Richard Friedman indicate that Chacoan roads can be located using LiDAR data. There is clearly great potential for using this method and to identify additional roadways and segments that have been previously undocumented.

We do not currently have a GIS database for known Chacoan roads. The data exist largely in piecemeal fashion or on paper maps. Spurred by imminent land management decisions in the San Juan Basin, an effort is underway to aggregate existing Chacoan roads data into a GIS. This project, based at the University of Nebraska-Lincoln, has gathered some of the few existing digital datasets and a graduate student is in the process of plotting known road segments from topographic maps into a GIS. For now, we have no single GIS of known Chacoan roads which means land managers in the region are also operating without this critical dataset.

Appendix IVD: Shrines and Related Features

Shrines exist in a wide range of forms and purposes across the Southwest landscape. In the Pueblo world, shrines may take the form of small piles of stones denoting meaningful places or directions. Chaco scholars have described the following shrines or shrine-like features: J or box-shaped "communication" shrines (Hayes and Windes 1975); stone crescents (Marshall and Sofaer 1988); stone circles (Windes 1978); herraduras, or horseshoe-shaped features associated with Chacoan roads (Kincaid 1983; Nials et al. 1987); and cairns, or simple piles of stacked rock. These features are notoriously difficult to date, because they frequently lack associated artifacts, and some remain in active use. To further complicate the picture, scholars have been less than systematic with these labels and categories, often conflating shapes, locations, and assumed functions. For example, on the Chaco Additions survey, Powers defined shrines as "ceremonial or other apparently esoteric sites including Anasazi (sic) C or fishhook shaped enclosures formed by a masonry wall, stone circles, and possible signaling sites at locations of high topographic prominence or visibility (Powers and Van Dyke 2015: 31, Table 1.1). A comparative study would be useful to assess similarities and differences in shrine configurations. Meanwhile, we offer the following brief review.

Box or J-shaped Chacoan shrines are low, masonry-walled enclosures that sometimes contain turquoise beads, turquoise chips, or other offerings. The first shrine discovered in Chaco Canyon was a Classic Bonito phase J-shaped feature erected atop 29SJ 423, the Basketmaker III village above Peñasco Blanco (Hayes and Windes 1975; Windes 2015:95–100, 692). Similar J-shaped "Windes' shrines" are often found along Chacoan roads (Kincaid 1983:20; Windes 1991:118). Hayes and Windes (1975) argued that these "Windes' shrines" functioned primarily for communication. These and other shrines might also be marking places of cosmographic, mythic, or ritual importance. Since the 1970s, Windes (e.g., Windes 1978, 2015:692; Windes et al. 2000:43) and others have documented over 40 shrines on high places across the greater Chacoan world (Van Dyke et al. 2016)

Across the greater San Juan Basin, shrines are documented in association with many outlier great houses. Many of these create line-of-sight connections with Chaco Canyon (Hayes and Windes 1975; Van Dyke et al. 2016). Places marked by Chacoan shrines are often significant in terms of visibility. For example, two shrines on Chacra Mesa and South Mesa bracket Fajada Butte, iconic symbol of central Chaco, and home of the Sun Dagger petroglyph. Hayes and Windes (1975) demonstrated that builders strategically placed shrines to facilitate intervisible links among fifteen great houses. The Kin Ya'a tower kiva is visible from shrine 29SJ706 on South Mesa, 43 km to the northeast, through a small notch in the broad ridge north of Crown Point. The intervisibility is contingent on the tower kiva's precise positioning in front of the notch. Hayes and Windes (1975:154–155) suggest that this "impressive bit of engineering" indicated that signaling and communication between the two areas was one of the functions of shrines and tower kivas.

Stone circles are an enigmatic Chacoan landscape feature consisting of compound, core-and-veneer, or upright slab masonry. They are nearly always constructed on slickrock, on high points or benches that provide good vantage points, and they range in size from 9–32 m along a long axis to 7–20 m along a short axis. Most stone circles contain one or more circular or rectangular basins pecked or ground into the interior slickrock. Although associated ceramics are scarce, sandstone abraders are common. During the Chaco Project, Windes (1978) identified 16 stone circles on the north rim and four on the south mesas of Chaco Canyon. Windes and other

researchers have located additional circles at outliers across the San Juan Basin, including Andrews, Kin Bineola, and Twin Angels (Marshall and Sofaer 1988; Van Dyke 2001; Windes 1978). Ancient builders seemed concerned with visibility when they positioned these enigmatic features. For example, from a stone circle on the north rim of Chaco Canyon (29SJ1572), a viewer sees Pueblo del Arroyo, South Gap, and Hosta Butte in perfect alignment along the trajectory of the South Road (Van Dyke 2007:Figure 6.6). Viewsheds from stone circles always include one or more great kivas, but the closest great houses are usually hidden beneath the canyon rim. If the circles were moved only a few meters, these dual attributes of visibility and invisibility would be lost. Windes (1978) suggests the dual visible/invisible quality of circles might have made them ideal places for the manufacture of ritual items, or preparation for ceremonies.

Herraduras are horseshoe shaped structures defined by their association with Chacoan roads (Kincaid 1983:9–14; Lekson 1999:117–118; Marshall and Sofaer 1988; Nials et al. 1987). These features are often found atop major topographic breaks with good visibility. The horseshoe shaped, low-walled masonry structures range from 5–7 m in diameter and usually open to the east.

Cairns also dot the high places across the San Juan Basin. For example, the Chacoans marked the southern and western tip of West Mesa with a dozen barrel-shaped cairns and a circular masonry enclosure (29SJ1088, hereafter Site 1088; first recorded in about 1901 by Wetherill and the Tozzer Expedition; Hovey 1902) (see Windes 2015:692). From Site 1088, it is possible to see most of the western half of the San Juan Basin — a region that contained nearly 60 Classic Bonito phase outlier communities (Figure 4). If someone standing at Site 1088 can see most of the Chacoan world, it follows that many inhabitants living in outlier communities could also see West Mesa (and therefore Chaco). Other cairns, associated with Navajo homesteads, were built in the recent past by Navajo shepherds. Many cairns lack associated artifacts or datable wood. Thus, archaeologists must base temporal and cultural affiliation on masonry style, the presence of fill, or associations with nearby features.

Appendix V: Chaco Landscapes - Some Suggestions from the Old World

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The Chaco Culture National Historical Park is a World Heritage Site, inscribed in 1987 as "Chaco Culture World Heritage Site." While many such sites are composed of single buildings (Aachen and Chartres cathedrals, Rohtas fort, Tugendhat villa, Hal Saflieni hypogeum), townscapes (Dubrovnik, Valetta, New Lanark) or areas of natural beauty and scientific interest (the Everglades, the Blue Mountains, the Galápagos Islands), a smaller number are composed of sets of archaeological sites dispersed in a wider landscape. In this respect, the comparison between Chaco and the Stonehenge and Avebury World Heritage Site in the United Kingdom, which was inscribed in 1986, may prove instructive.

Stonehenge and Avebury are both located in the modern county and Wiltshire, and in each case a single important monument lies at the core of the World Heritage Site. In the case of Stonehenge, the monument concerned has an internationally iconic status, which has positioned it as a focus of cultural struggles between a number of different constituencies (archaeologists, national and local government, druids, pagans, new age travelers, the military and conservation bodies) (Bender 1999; Worthington 2004). The situation is complicated by the patchwork of land ownership in the immediate vicinity of Stonehenge, split between English Heritage, the National Trust, the Ministry of Defence and numerous private landholders. While the majority of visitors to the Stonehenge and Avebury WHS are only motivated to see the two eponymous sites, each area contains a very large number of prehistoric structures, including Neolithic long barrows, causewayed enclosures, cursus monuments and henge monuments, and cemeteries of Bronze Age round barrows. Although Stonehenge is instantly recognisable from its arrangement of sarsen trilithons, the enclosure in which it stands is dwarfed by the nearby Great Stonehenge Cursus (three kilometres long) and the Durrington Walls henge (half a kilometre in diameter) (Thomas et al. 2009).

Stonehenge can be seen as one element of an integrated monumental landscape that developed over a period of several millennia, beginning with a series of massive postholes of Mesolithic date (c. 8000 BC). These may have been positioned in relation to a series of periglacial subsoil fissures that are fortuitously aligned on the midsummer sunrise and midwinter sunset, and would have been visible as variations in the surface vegetation (Parker Pearson 2013). In this way, natural topographic features established the conditions for the location of Stonehenge itself, centuries later (Richards and Thomas 2012). Similarly, Stonehenge and Durrington Walls are connected to each other by their respective avenues and by the River Avon, linking them into a single pattern of movement (Thomas 2007). Phenomenological landscape analysis conducted by Chris Tilley has demonstrated that many of the Neolithic and Bronze Age monuments of the Stonehenge are located so as to have a view of Beacon Hill, the tallest eminence in the area, which has none the less no prehistoric structures on top of it (Parker Pearson et al. 2008). So in the Stonehenge landscape, natural and cultural features are tightly integrated, and it would be unhelpful to isolate and protect the latter without reference to the former.

The Stonehenge and Avebury WHS is composed of two bounded areas, making up a total of 12,850 acres (Darvill 2005). For some while there has been a recognition that during the Neolithic and Early Bronze Age (4000-2000 BC) a series of discrete monumental landscapes developed on the chalk uplands of Wessex (Renfrew 1973). While Stonehenge and Avebury have been granted WHS status, it is arguable that Cranborne Chase in north Dorset and the Dorchester area in south Dorset are equally important: the former contains the massive Dorset Cursus and the cluster of henge enclosures at Knowlton, while the latter has the Maiden Castle causewayed enclosure and the Mount Pleasant henge. Each of these areas is thus distinguished by a series of monumental structures that are readily visible on the surface, and each has a history of antiquarian and archaeological investigation that stretches back for centuries. Yet the work of the Stonehenge Riverside Project has demonstrated that even in what amount to the most intensively studied archaeological landscapes in Britain, new work can bring entirely unexpected sites and structures to light, often in the areas between the monuments (Parker Pearson et al. 2008).

The Stonehenge and Avebury landscapes are appreciably smaller than the Chacoan cultural area. None the less, it seems likely that like each of the Wessex monumental complexes, the Chaco landscape represented an integrated social entity, distinguished by reciprocal relationships between the Chaco Canyon Downtown 'core' and the many outlier communities. One definition of landscape is that it represents a 'life-world', the culturally integrated dwelling space of a particular extended community. Chaco is an extended landscape, as demonstrated by roads, signalling systems, the circulation of particular artefact types and materials, and shared architectural styles. As such it represents an important case study for the investigation of the *scale* of past social entities. The Wessex landscapes were small and tightly integrated units, but they can be contrasted with enormous entities such as the European Neolithic *Bandkeramik* (spreading from the Ukraine to the Paris Basin, but composed of a series of much smaller 'settlement cells'), or the Pacific Lapita Culture. The question of the scale of archaeological entities is one that is still poorly understood, and while Chaco represents an outstanding case in which these issues can be addressed, preserving the integrity of the whole is essential to understanding how it operated. It is the very fact that Chacoan communities were scattered and dispersed over a relatively large area that makes the phenomenon so fascinating, prompting questions of how relationships of various kinds were maintained over both time and space.

In terms of management, the history of the Stonehenge landscape in particular represents almost a mirror image of the Chaco WHS: threats are receding rather than encroaching. Stonehenge is located close to a number of modern settlements of various sizes: Amesbury, Larkhill, Durrington and Bulford. A major arterial road, the A303 runs immediately to the south of the monument. In addition, during the earlier part of the twentieth century a clutter of huts and other buildings, mostly associated with military activity, was concentrated in the immediate area. In 1966, somewhat brutalist concrete visitor facilities were constructed, including an underpass connecting Stonehenge with a nearby car park. Recent alterations to the visitor experience have been addressing many of the concerns raised in this white paper: removing intrusive structures, enabling people to walk across the landscape, emphasising the relationship between Stonehenge and the other monuments, moving visitor facilities to a respectful distance, considering both the visual envelope of the site and its soundscape. The recognition that the Sarsen arrangement at Stonehenge has quite unusual auditory characteristics, in particular, provides an imperative to reduce the traffic noise at the site (Watson and Keating 1999). Particularly significant has been the removal of the A344, a small road that ran immediately to the north of Stonehenge, effectively placing the monument within a 'traffic island'. The debate over the much larger A303 continues, with general recognition that the road should be put into a tunnel, but disputes arising over the probable expense. Most archaeologists prefer the option of a long, bored tunnel. A shorter, cut-and-cover tunnel would be much cheaper, but would undoubtedly result in the destruction of much as-yet undiscovered archaeology.

The management of the Stonehenge and Avebury WHS has two distinct elements: a management plan (Simmonds and Thomas 2015) and an archaeological research framework (Darvill 2005). Both are recognised as iterative phenomena, and both have gone through a number of revisions, and in the more recent versions Stonehenge and Avebury have been treated separately, with distinct management and research communities. In both cases, there is an explicit recognition that what is being designated, preserved and investigated is an integrated landscape, rather than an assembly of separate sites. The management plan addresses the educational and research

value of this landscape, and stresses the need for stringent control over development, as well as the management of potentially damaging activities that are not normally subject to planning control. The archaeological research framework, by contrast, identifies a series of outstanding research issues and priorities, with the aim of channelling investigation toward particular lacunae of knowledge.

It is possible that some of the developments in the Stonehenge and Avebury WHS might prove of interest to professionals engaged in research and management at Chaco. However, what is more likely is that a dialogue between archaeologists working in on the Chacoan phenomenon in the US and the Neolithic in the UK would prove mutually enriching. There are very many themes that are common to both: viewsheds and soundscapes; collective acts of construction; linear monuments and human movement; the role of group ancestors; feasting and collective consumption; the night sky and the movement of the heavenly bodies; the circulation of exotica and the role of heirlooms; the creation of collective history and identity.

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Appendix VI: Defining the Chacoan Landscape: Part II - Experiences

The Chaco landscape includes nonmaterial dimensions that archaeologists are only beginning to study. These experiential aspects of landscape include viewsheds, night skies, soundscapes, and oral histories.

Appendix VIA: Viewsheds

On the Colorado Plateau, high places are visible and intervisible by virtue of the elevated topography and the clear and cloudless skies. As discussed in **Appendix III**, contemporary indigenous peoples structure cosmologies and oral traditions around highly visible, uniquely shaped landforms. Past inhabitants similarly would have valued visibility over broad areas of landscape for reasons that could have included surveillance, communication, symbolism, and a shared sense of identity or history. Intervisibility — when visibility extends in both directions – connotes some kind of exchange. This exchange could be symbolic, as when inhabitants construct an iconic building to project a particular identity to viewers who in turn feel some sense of connection or alienation when viewing the building (Carr and Neitzel 1995), or it could be functional, as in signaling for purposes of communication.

Chacoans had the means as well as the motive to create a communication or signaling network involving great houses and shrines that drew together the greater Chacoan world. They clearly possessed the technology. Fire at night is particularly visible over long distances, and the Chaco Project used flares at night to demonstrate that signaling among shrines and great houses in high places is possible. Archaeologists have identified the presence of large hearths or fire pits at the canyon great houses of Tsin Kletzin and Pueblo Alto, and the outlier great houses of Chimney Rock, Pierre's, Bis sa'ani, the Poco Site, and Guadalupe (Breternitz et al. 1982; Drager and Lyons 1976; Eddy 1977; Harper et al. 1988; Pippin 1987; Powers et al. 1983). Gwinn Vivian and Doug Palmer have used mirrors to establish line-of-sight connections between the outlier of Pierre's and the canyon great houses of Pueblo Alto and Tsin Kletsin. Vivian suggests Chacoans may have used selenite for signaling between high places (Gwinn Vivian, personal communication, November 2006). Anthropologists have documented the use of selenite for signaling among the Eastern Pueblos, and they have successfully employed selenite in signaling experiments (A. Ellis 1991; Haas and Creamer 1993). Selenite is widespread in the Menefee formation across the San Juan Basin and has been found in association with some outlier great houses (Mathien and Windes 1989:27).

We have long known anecdotally that such a signaling system was possible. A communication system using thirty heliograph stations on high peaks was employed by the U.S. Army across southern Arizona and New Mexico during the Apache Wars in the 1880s and 1890s (Basso 1971:314 fn 110). Hayes and Windes (1975) established the role of shrines in visually linking great houses (see **Appendix IV – Shrines**). Shrine-topped prominent landforms are

visible from many outliers: for example, Cabezon Peak, above the outlier of Guadalupe, is topped by a prehispanic shrine and is within sight of shrines adjacent to and east of Fajada Butte. A local high school student (Freeman et al. 1996, 1997) used mirrors for a science fair project to demonstrate that Huerfano Mesa links the Pueblo Alto to the outlier great house of Chimney Rock, 130 km to the northeast. In the 1980s, Windes noted that a person standing atop Huerfano Mesa can see the top of the Knickerbacker Peaks, east of Aztec Ruins, thereby connecting Chaco Canyon with the Aztec outlier settlement.

We are only beginning to have the technology to systematically chart the existence of a Chacoan signaling system across the greater landscape. GIS databases and software are proving to be excellent tools for examining and modeling visible connections over large areas (Bernardini et al. 2013; Bernardini and Peeples 2015; Connolly and Lake 2006; Exon et al. 2000; Fisher et al. 1997; Johnson 2003; Kay and Sly 2001; Kay and Witcher 2005; Lake 2007; Llobera 1996, 2003, 2007; Waldron and Abrams 1999; Wheatley 1995; Wheatley and Gillings 2002). Visibility studies based in GIS generally focus on determining lines-of-sight (the reciprocal ability of people at two locations to see one another), viewsheds (the surrounding terrain and features that can be seen from a single location), and viewnets (networks of locations connected by lines-of-sight). GIS-based analyses are an ideal way investigate whether Chacoans intentionally established a network that tied together the Chacoan world through intervisibility. Van Dyke et al. (2016) have recently completed a GIS-based viewshed and line-of-sight study involving 87 shrines and related features, and 258 great houses or related features over a 60,000 sq mi area centered on the greater Chacoan world. We determined that shrines do, in fact, facilitate intervisible connections.

Cumulative viewshed analysis or CVS (Wheatley 1995) allowed us to identify places on a landscape that are covisible to one or more Chacoan great houses, shrines, or great houses plus shrines. The figure below illustrates the results of the CVS analysis, with colors that show how many great houses or shrines can see each pixel in the GIS-generated topography. In this image, at least one great house can see the yellow locations, and many great houses can see the red locations (the darkest red areas can be seen by 64 great houses). At least one shrine can see the yellow locations, and multiple shrines can see the blue locations (the darkest areas can be seen by 49 shrines). The central map combines these two CVS analyses to show areas that are covisible to both great houses and shrines — red areas can be seen only by great houses; blue areas can be seen only by shrines; and yellow areas can be seen by both. Places that are exceptionally covisible from great houses and/or shrines include those on the Chuska rim, the Carrizo Mountains, Hosta Butte, Shiprock, Huerfano Mountain, Fajada Butte, the north and west flanks of Mount Taylor, the rims of Chaco Canyon, the La Plata Mountains, Ute Mountain, and an uplift south of Black Mesa (northeastern Arizona) and west of El Malpais. Many San Juan Basin viewsheds intersect and overlap at well-acknowledged high places such as Huerfano Mountain, White Rock, and Hosta Butte — prominent, shrine-topped peaks that are visible from many locations. Other prominent places that are likely locations for shrines have not been systematically surveyed and recorded, including Shiprock, points along the Chuska Mountains, and Sleeping Ute Mountain.

Despite the incomplete nature of the shrine data, the visual coverage from recorded shrines clearly enhances intervisibility across the Chaco World. Shrine viewsheds are extensive in the Chaco basin and in the eastern portion of our study area, while coverage of great houses extends far to the west and north, beyond the locations of recorded shrine sites. About 14,000 sq mi of the landscape shown in Figure VIA1 is visible from one or more Chacoan great houses,

and about 7,700 sq mi are visible from one or more shrine. Visibility from shrines and great houses complement one another to cover over 21,000 sq mi of Van Dyke et al.'s (2016) 60,000 sq mi study area.

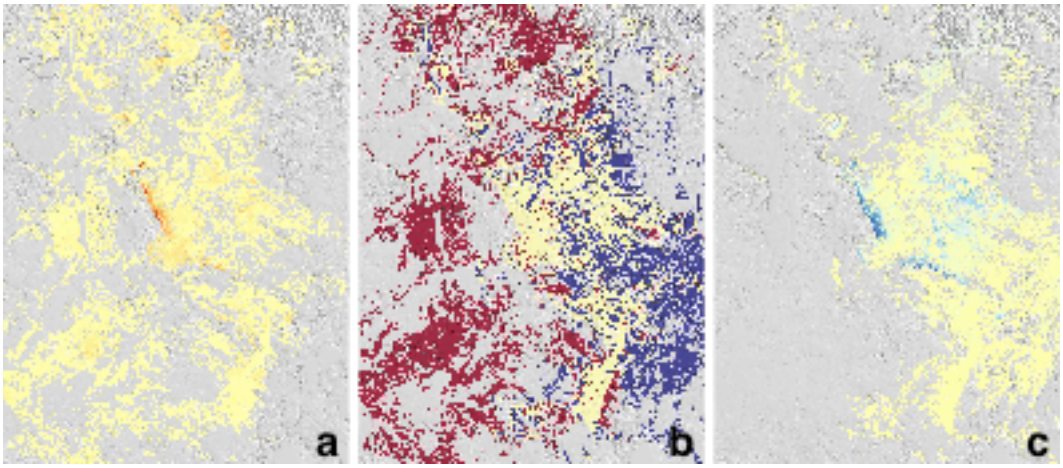

Figure VIA1: Cumulative viewsheds from great houses (a), shrines (c), and both combined (b), from Van Dyke et al. (2016:Figure 5).

The Van Dyke et al. (2016) study also demonstrates how valuable it would be for us to systematically look for shrines in specific areas of the Chaco landscape. High places where viewsheds intersect have not yet been examined to see whether shrines are present. Shrines can be difficult to recognize, and it is very likely that there are many shrines on the Chacoan landscape that have not been recorded. If we knew the location of every shrine in the San Juan Basin, we would be able to take this study to the next level – we would potentially be able to see "holes" in the viewshed, where some outlier communities perhaps were not linked in to the system. This information would enable us to address our major research issues re: Chaco's boundaries in time and space, Chaco's sociopolitical organization, and exchange and interaction.

Viewsheds within outlier communities similarly are of great importance. As noted in the discussion of great houses (Appendix IV), many outlying great houses are situated in highly visible locations. The great houses may have been intended *to see* (as in surveillance) and/or *to be seen* (as in signaling group membership or political authority) by the surrounding community. In four communities where fine-grained small site data are present, scholars have employed GIS line-of-sight and viewshed analyses in attempts to address these issues, with variable and contradictory results. In the Kin Bineola outlier community, Dungan (2009) found that the massive great house was positioned to be seen within the surrounding community but did not facilitate long-distance visibility. This contrasts with the situation at Whirlwind Lake, where a great house is perched on a high mesa overlooking a valley containing some 20 contemporaneous small sites (Kearns 1996; Marshall et al. 1979:87–89). The Whirlwind Lake great house cannot be seen from most of the community small sites, but it does have line-of-sight connections to many distant prominent peaks, suggesting builders were interested in regional rather than local visual relationships (Robinson et al. 2007). Long before the days of GIS analyses, Hayes and Windes (1975:154–155) noted that the Kin Ya'a tower kiva was built at the right spot and at the right height to allow it to be seen over the ridge from a point atop South Mesa at Chaco Canyon, marked by a shrine (29SJ706). Hayes and Windes concluded that

communication with Chaco Canyon was a primary function of tower kivas, However, Kantner and Hobgood (2003) recently revisited this idea using GIS analysis and found that the Kin Ya'a tower kiva's extra height did not increase its long-distance visibility (in other words, it was not necessary to build a tower kiva to see Chaco). Because the tower kiva's height did increase visibility within the immediate Kin Ya'a community, Kantner and Hobgood concluded that Kin Ya'a tower kiva's primary viewing audience was local. At Kin Klizhin, another well-known outlier tower kiva, Ellenberger's (2012) viewshed analysis similarly determined that the Kin Klizhin tower kiva neither enhanced nor detracted from intervisibility with Chaco Canyon. However, by contrast with Kantner and Hobgood, Ellenberger (2012) found that the Kin Klizhin tower kiva did *not* facilitate intervisibility with the surrounding community sites, which already could see one another quite well. Clearly, if we had better and more comprehensive data on the positions of small sites across the Chaco landscape, it would be very informative to conduct some large-scale comparative studies of the viewsheds of different kinds of outlier communities. However, we lack such data at present.

While GIS and photogrammetry are powerful tools, they cannot replace the eyes people on the ground. Photogrammetric techniques are good at finding roads and buildings, but as of yet they lack the resolution to allow us to see small features such as shrines. GIS analyses can identify visual connections, but the software cannot tell us whether visibility was meaningful. Just because high places can be seen from an archaeological location does not mean that ancient inhabitants valued the visual stature of those places (Frieman and Gillings 2007; Llobera 2007); Fitzjohn (2007), for example, found that although a major geological formation dominated the viewshed of an Italian valley, local residents did not "see" it as important. Thus, it is important to have eyes on the ground to assess the importance of viewsheds identified through technological means.

And, viewsheds cannot be studied where air quality is poor. The air pollution contributed by coal-burning power plants near Farmington over the past 30 years has resulted in a noticeable decrease in visibility across the Chacoan landscape. In 1985, people standing at Pueblo Alto could clearly see the snow-topped peaks of the San Juan and La Plata Mountains some 150 km to the north. Today, on most days, visitors to Pueblo Alto merely see a band of haze on the horizion. Any energy development that negatively impacts air quality will directly affect our ability to see, study, and understand viewsheds on the Chaco landscape.

Appendix VIB: Day and Night Skies

It is not simply visibility that is an important component of the Chaco landscape experience – it is the sky itself. All Pueblo agriculturalists follow with interest the peregrinations of the sun and moon (McCluskey 1977; Parsons 1939, 212, 493-497, 554-589; Stevenson 1894, 29; Tedlock 1983). In Tewa pueblos, a sunwatcher is appointed to keep track of the sun's position on the horizon (Harrington 1916:47; Parsons 1939:555). The winter solstice – when the sun turns back from its southerly course – is an important turning point in the ceremonial cycle (Parsons 1939:554). Solstice ceremonies such as the Zuni Shalako are held to ask the sun to return to the north. Solstice ceremonies usually begin before the actual solstice date, and this is, in part, to coordinate this solar event with an important moment in the lunar cycle – the full moon (White 1962, 227; Zeilik 1986). The moon is also associated with women, with the womb, and with the circular subterranean ritual chamber called a kiva (Young 1988:114).

The directions and alignments so important to Pueblo cosmography derive some of their significance from the movements of celestial bodies. Cardinal directions are also solar

alignments – on equinoxes, when the sun has traveled halfway between its northern and southern extremes on the horizon, it rises directly to the east and sets directly to the west. Cardinal, solar alignments at Classic Bonito great houses suggest that periodic gatherings at Chaco followed the movements of the sun. The North Star represents a fixed point around which the stars appear to revolve. North is the "heart of the sky" (Lekson 1999:86), bisecting the daily movements of the sun. At midday, when the sun is halfway across the sky, any shadow will be cast directly along a north-south meridian. North has particular symbolic significance for Tewa and Keresan speakers as the mythic location of the sipapu, the connection to previous worlds, through which ancestors emerged long ago (Benedict 1931:249; White 1960:85). The Sun Dagger petroglyph atop Fajada Butte indicates Chacoans marked solstices, equinoxes, and possibly lunar standstills (Sinclair et al. 1987; Sofaer 1997; Sofaer et al. 1979; Sofaer et al. 1982). The winter solstice – when the sun appears to pause on its southward journey and to turn back on the horizon – was likely the ceremonial high point at Chaco. The winter solstice corresponds to critical events in many Pueblo ceremonial cycles (Parsons 1939:554). In Zuni cosmography, the winter solstice is associated with the middle place, and the Zuni village itself (Young 1988:103-104).

Like solar orientations, lunar orientations would have emphasised the great houses of Chaco as center places around which celestial bodies seemed to revolve. Recent work by Sofaer (1997, 1999, 2007) and others suggest that Chacoans observed phenomena known as lunar standstills. Moonrise on the horizon shifts gradually from a northern to a southern extreme each month, and the width of this envelope expands and contracts over an 18.6 year cycle. At the major lunar standstill, moonrise positions are at their maximum width – the moon swings exuberantly between its northernmost and southernmost positions on the horizon. At the minor lunar standstill, moonrise positions are at their minimum width, shifting only within a narrow envelope. Chacoans could have obtained knowledge of major and minor lunar standstills by watching the moon rise and set on the horizon over 18.6 years. Lunar standstill knowledge would have been of little practical utility, but it might have constituted esoteric ceremonial lore seen as the exclusive property of particular groups or individuals. A fixed landmark is required in order to appreciate the importance of a lunar standstill moonrise. As Chacoan ritual and political hegemony expanded across the San Juan Basin during the eleventh century, Chacoans could have imported this information from the outlier of Chimney Rock.

Chimney Rock, along the Piedra River approximately 130 km (80 miles) northeast of Chaco Canyon, serendipitously provides an ideal location from which to view, and mark, the major lunar standstill (Malville 2004; Malville et al. 1991). Twin vertical stone pillars – Chimney Rock, and Companion Rock – reach over 400 m above the surrounding terrain, and a narrow ridge to the southwest of the pillars gives a view of the full moonrise during the major lunar standstill. In the late eleventh century, Chacoans built an outlier great house on the prime lunar standstill viewing location, atop the ridge southwest of the twin pillars. Clusters of tree-ring dates for the great house in the 1070s and 1090s correspond with major lunar standstills in 1076 and 1093.

Chacoans may have incorporated this lunar knowledge into the orientations of great houses in Chaco Canyon. Sofaer (1997, 1999, 2007) argues that the orientations of non-cardinal canyon great houses, including Chetro Ketl, Pueblo del Arroyo, Una Vida, and Peñasco Blanco, relate to major or minor lunar standstills. The rear wall of Chetro Ketl is one of the most convincing examples, as it aligns precisely with the rising full moon at the minor lunar standstill. If Chacoans did orient some great houses to embody lunar standstill knowledge, this would have

been one more way to construct an experience of the canyon as centre place – the location around which the moon, as well as the sun, revolves.

Chaco has long been considered by night sky enthusiasts to be one of the best places in America to stargaze. Located far from modern urban light pollution, the night skies at Chaco are alive with galaxies, stars, comets and meteors. The park has made a commitment to keep light pollution at a minimum and to educate the public about night skies. As a result, Chaco Culture NHP recently was certified as an International Dark Sky Park by the International Dark-Sky Association (IDA). Chaco is the fourth unit in the National Park System to earn this distinction.

We know that the ancient Chacoans watched the night skies as well – not only the moon, but also the stars. Researchers have long hypothesized that the "Supernova" petroglyph on the south canyon wall near Penasco Blanco may represent the appearance of the Crab Nebula in the night skies over Chaco in A.D. 1054. At present there has been virtually no research into celestial meanings, alignments, and associations at outliers on the Chaco landscape other than Chimney Rock. Energy development creates a great deal of light pollution and thus would be potentially very harmful to Chaco's night skies, as well as daytime air quality. This less tangible "resource" is not well-protected by Section 106.

Appendix VIC: Soundscapes

Sound is an understudied experiential aspect of the Chacoan landscape that begs for further attention. In Pueblo and Navajo ritual, sound is very important. Ritual practices involve songs, chants, drums, bells, flutes, and shell trumpets (Parsons 1966; Mills and Ferguson 2008). It is difficult to study sound in the ancient past, but we have many clues. Archaeologists have recovered shell trumpets, flutes, and copper bells from great houses (Pepper 1920; Neitzel 2003). The shallow trenches in great kiva floors may have been plank-covered foot drums.

Cutting-edge and experimental archaeological work is in its infancy with regard to the study of ancient sounds (e.g., Day 2013; Skeates 2010). Archaeologists have undertaken experiments to evaluate the acoustic properties of enclosed architectural spaces such as kivas. In the reconstructed Great Kiva at Aztec, Loose (2002, 2009) measured the sound waves produced by flutes, trumpets, computer-generated sounds and contemporary music – he found that the space has ideal acoustics for public performances. The north cliff face between Pueblo Bonito and Chetro Ketl shelters an area described as a natural amphitheatre. Navajo ritual practitioners use shell trumpets, bone flutes, and reed whistles in this space to communicate with spirits (Blackhorse and Williams 2002). Loose (2009) and Stein et al. (2007) have conducted experiments in this space and have again determined that acoustics there are ideal for large public performances. Pueblo drums resonate particularly well against the cliff walls. Van Dyke (2015) has noted another striking natural sound in Chaco Canyon. When it rains in the summer, spadefoot toads emerge from the mud and fill the canyon for about 48 hours with strident, rasping mating sounds. These sounds resemble the sound of corn grinding, and in fact the rasps used by Hopi katsinas to emulate women grinding corn are decorated with carvings of toads or frogs. Van Dyke suggests that it is not just images of toads or frogs that represent water and fertility, but also the sounds they make.

This brief review encompasses all the published work done to date on acoustics on the Chaco landscape. It would be extremely important and interesting to conduct similar experiments and make similar observations in outlier communities. Unfortunately, soundscapes – as less tangible than architecture or artifacts – are not well-protected by Section 106. The Chaco soundscape is one of the most fragile aspects of this landscape to be threatened by energy

development. Trucks, wells, and fracking could forever destroy our ability to study and understand the relevance of acoustic properties to Chacoan ritual and identity.

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